

# GETTYSBURG NATIONAL MILITARY PARK GETTYSBURG, PA

REHABILITATE THE HISTORIC JOSIAH BENNER HOUSE, SPRING HOUSE  
AND SUMMER KITCHEN

GETT  
PMIS NO. 257363

**ISSUED FOR BID**



NATIONAL PARK SERVICE  
By GWWO, Inc.  
February 28, 2022

## **TABLE OF CONTENTS**

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

01 11 00	Summary of Work.....
01 26 01	Contract Modification Procedures.....
01 27 00	Definition of Contract Line Procedures.....
01 31 00	Project Management and Coordination .....
01 32 16	Construction Schedule .....
01 32 33	Photo Documentation for Historic Preservation projects.....
01 33 23	Submittal Procedures .....
01 35 13.22	Archeological Protection.....
01 35 91	Historic Preservation Treatment Procedures .....
01 40 00	Quality Requirements .....
01 50 00	Temporary Facilities and Controls .....
01 57 19.11	Indoor Air Quality.....
01 57 23	Under-An-Acre Pollution Prevention.....
01 67 00	Product Requirements .....
01 73 29	Cutting and Patching .....
01 73 40	Execution.....
01 74 19	Construction Waste Management and Disposal.....
01 77 00	Closeout Procedures.....
01 78 23	Operation and Maintenance Data .....
01 79 00	Demonstration and Training .....

### **DIVISION 02 – EXISTING CONDITIONS**

02 41 19	Selective Demolition.....
----------	---------------------------

### **DIVISION 21 – FIRE SUPPRESSION**

21 13 00	Fire Suppression.....
----------	-----------------------

### **DIVISION 22 – PLUMBING**

22 34 00	Domestic Water Heaters .....
22 44 00	Plumbing Fixtures and Equipment .....

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

23 05 00	Basic Mechanical Materials and Methods.....
23 05 48	Mech Sd & Vib Controls .....
23 05 93	Testing, Adjusting, and Balancing.....
23 07 00	Mechanical Insulation.....
23 08 16	Comm of HVAC Systems.....
23 20 00	Building Services Piping.....
23 31 13	Duct and Duct Accessories .....
23 34 16	Fans.....
23 37 13	Air Outlets and Inlets .....
23 70 00	Heating, Ventilation and Air Conditioning .....

### **DIVISION 26: ELECTRICAL**

26 05 00	Common Work Results for Electrical .....
26 05 19	Low Voltage Power Conductors and Cables.....
26 05 26	Grounding and Bonding for Electrical Systems.....
26 05 29	Hangers and Supports for Electrical systems .....
26 05 33	Raceways and Boxes for Electrical systems .....
26 05 43	Underground Ducts and Raceways for Electrical Systems.....
26 05 44	Sleeves and Sleeve seals for Electrical Raceways and Cabling .....
26 05 53	Identification for Electrical Systems .....
26 09 23	Lighting Control Devices.....
26 24 16	Panelboards .....
26 27 26	Wiring Devices.....
26 28 13	Fuses .....
26 28 16	Enclosed Switches and Circuit Breakers .....
26 43 13	Surge Protection for Low-Voltage Electrical Power Circuits.....
26 51 19	LED Interior Lighting .....

## **DIVISION 28: ELECTRONICS SAFETY AND SECURITY**

28 31 11	Digital, Addressable Fire Alarm Systems .....
----------	-----------------------------------------------

## **DIVISION 31: EARTHWORK**

31 00 00	Earthwork .....
31 11 00	Clearing and Grubbing.....
31 23 33	Trenching Backfilling and Compacting .....
31 25 00	Erosion and Sediment Controls .....

## **DIVISION 32: EXTERIOR IMPROVEMENTS**

32 12 16	Minor Asphalt Paving.....
32 14 16	Brick Paver Sidewalk.....
32 17 23	Pavement Markings.....
32 92 19	Finish Grading & Seeding .....

## **DIVISION 33: UTILITIES**

33 12 13	Water Service Connections.....
33 41 00	Storm Drainpipe .....
33 44 00	Storm Inlets .....

## 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. Contractor use of premises.
3. Public use of site.
4. Occupancy requirements for buildings.
5. Work Restrictions.
6. Special Construction Requirements.

#### 1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Location: Within the Gettysburg National Military Park located at 920 Old Harrisburg Road, Gettysburg PA, 17325.

The Josiah Benner House was present during the Battle of Gettysburg and saw extensive battle action during the first day of battle on July 1, 1863. NPS took possession of the House, Barn and Spring House in the 2000s and although extensive work has been completed on the Barn and Spring House, the House has undergone significant repairs to masonry walls, roof, and foundation to stabilize the building.

B. The Work consists of the following:

This Work includes installation of all interior and exterior mechanical, electrical, plumbing as well as the installation of parking and drive for the Josiah Benner House. Work will include fire suppression, plumbing, HVAC, electrical, safety and security system, all utilities, earthwork, and exterior improvements to better suit the NPS goal of using the property for housing or offices. Outdated Systems throughout the home will be replaced. Replacement of all building utility service connections with conversion to municipal water, sewer, and gas service as available; electrical work including replacement of wiring and devices, replacement of lighting, and replacement of the existing electrical service to meet current and potential future needs; HVAC replacement to provide natural gas heating and central air conditioning; installation of fire suppression and alarm systems; complete replacement of interior plumbing including installation of new water-efficient bathroom and kitchen fixtures, replacement of water supply pipes with PEX, installation of new supply and drain piping; and hardscape work including replacement of existing hardscape features. The house may become either housing for seasonal employees or office space for park or regional staff.

C. Project will be constructed under a single prime contract.

#### 1.3 CONTRACTOR USE OF SITE

A. General: Contractor shall have full use of the site for construction operations during the construction  
GETT - 257363

period. Contractor's use of the site is limited only by the Government's right to perform work or to retain other contractors on portions of Project.

- B. Storage of Materials: Confine storage of materials to area of former garage. This area can be used as a staging area.
- C. Preservation of Natural Features:
  - 1. Prevent damage to natural surroundings. Restore damaged areas, repairing or replacing damaged trees and plants, at no additional expense to the Government.
  - 2. Provide temporary barriers to protect existing trees and plants and root zones.
  - 3. Do not remove, injure, or destroy trees or other plants without prior approval. Consult with Contracting Officer and remove agreed-on roots and branches that interfere with construction.
  - 4. Do not fasten ropes, cables, or guys to existing trees.
  - 5. Carefully supervise excavating, grading, filling, and other construction operations near trees to prevent damage.
- D. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Government, Government's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
  - 1. Schedule deliveries to minimize use of driveways and entrances.
  - 2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- E. Construction Camp: Establishment of a camp within the park will not be permitted.
- F. Hauling Restrictions: Comply with all legal load restrictions in the hauling of materials. Load restrictions on park roads are identical to the state load restrictions with such additional regulations as may be imposed by the Park Superintendent. Information regarding rules and regulations for vehicular traffic on park roads may be obtained from the Office of the Park Superintendent. A special permit will not relieve Contractor of liability for damage which may result from moving of equipment.

#### 1.4 PUBLIC USE OF SITE

- A. Contractor shall at all times conduct operations to endure the least inconvenience to the public. Other public visitation areas adjacent to the site will remain open to the public during construction.

#### 1.5 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 7:00 a.m. to 4:30 p.m., Monday through Friday, No Federal Holidays, except when otherwise indicated.
- B. Existing Utilities
  - 1. Existing Utilities: Notify Contracting Officer and utility companies of proposed locations and times for excavation.

2. Contractor shall be responsible for locating and preventing damage to known utilities. If damage occurs, repair utility at no additional expense to the Government.
3. If damage occurs to an unknown utility, repair utility. An equitable adjustment will be made in accordance with the Changes clause of the contract.

C. Nonsmoking Building: Smoking is not permitted within Park Structures

#### 1.6 CONSTRUCTION COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
  1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  1. Preparation of Contractor's Construction Schedule.
  2. Preparation of the Schedule of Values.
  3. Delivery and processing of submittals.
  4. Progress meetings.
  5. Project closeout activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 11 00

## SECTION 01 26 01 – CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. The work of this section consists of administrative and procedural requirements for contract modifications.

#### 1.2 DEFINITIONS AND ALLOWANCES

- A. Home Office Overhead: Those costs incurred in support of all of a contractor's projects and not attributable to a specific job. The cost for home office overhead is only allowed as a percentage of all direct work excluding profit. The following items represent allowable home office overhead costs identified in Part 31 of the Federal Acquisition Regulation (FAR):

1. Rent
2. Utilities
3. Furnishings
4. Office equipment
5. Executive and management staff not exclusively assigned to the project
6. Support, accounting, and administrative staff
7. Preparation of cost proposals, estimating, and schedule analyses connected with Modifications
8. Estimating and preconstruction services
9. Mortgage costs
10. Real estate and corporate taxes
11. Automobile maintenance and travel costs for home office personnel
12. Home office insurances i.e. structure, automotive, umbrella, flood, etc.
13. Depreciation of equipment and other assets
14. Home office supplies (paper, staples, etc.)
15. Legal services
16. Accounting and data processing
17. Professional fees/registration

- B. General Conditions (Field Office Overhead): Management and administrative costs incurred on site for the designated project. Costs associated with the preparation of modifications will not be allowed. The costs for these items are to be included only in the general conditions of the modification estimate. Only in the case of a contract time extension are additional general conditions included in modifications. The following items, if applicable, are considered allowable costs for calculating General Conditions:

1. Project Manager, Assistant Project Manager
2. Superintendent, Assistant Superintendent
3. Quality Control, Safety Officer, Environmental Manager, etc.
4. Engineers
5. Travel, lodging, and per diem (as established by Federal Travel Regulations)

6. Scheduling
7. Field Office Trailers and associated temporary utilities
8. Field office supplies
  - a. Mailing and couriers
  - b. Reproduction costs
  - c. Storage
  - d. Phones
  - e. Computers
  - f. Copiers
9. Personal vehicles i.e. Superintendent Pickup trucks

C. General Requirements: These are costs directly associated with the project and are necessary to perform the actual work of the modification. These costs shall be shown as direct costs in the estimate. The following items, if applicable, are considered allowable costs for calculating General Requirements:

1. Hoisting
2. Material handling
3. Temporary fencing
4. Port-a-lets
5. Trash removal, dumpsters
6. Barricades
7. Small tools
8. Safety supplies
9. Scaffolding
10. Daily cleaning
11. Traffic control
12. Temporary signage
13. Temporary heating and power

D. Personnel Costs: Costs included in the modification must only be for General Conditions staff and workers actually present and working on the project site. Modification costs for salaried workers are only allowed within the structure of a 40-hour week and no overtime or holiday pay will be allowed.

1. Worker Hourly Rates are costs directly associated with the individual worker and consist of the following:
  - a. Base Rate: This is the hourly rate paid directly to the worker
  - b. Labor Burden: Employer payments of all applicable burdens, this includes insurance and taxes that the business must pay on behalf of the worker to government entities and educational forums, such as:
    - 1) Social Security
    - 2) Medicare
    - 3) Workers Compensation– Policy and company calculation to be made available.
    - 4) FUTA– Cap Rate and percentage to be proportionally allocated over one year.
    - 5) SUTA– Cap Rate and percentage to be proportionally allocated over one year.



- 6) Union agreement costs – Other costs required under an enforceable collective bargaining agreement.
- c. Fringe Benefits: Various non-wage compensations provided to employees such as:
  - 1) Health Care Insurance Premiums
  - 2) Cell Phone
  - 3) Clothing
  - 4) 401K and Pensions
  - 5) Vehicle allowances
  - 6) Gas allowance
  - 7) Life insurance premiums
  - 8) Disability insurance
  - 9) Other Fringe Benefits required under an enforceable collective bargaining agreement
- E. Bonuses or Deferred Compensation: No Bonus or Deferred Compensation will be allowed within any components of pricing including Home Office Overhead, General Conditions, General Requirements, Hourly Worker Rates, or the direct costs of work.
- F. General Liability Insurance: An insurance policy that protects the contractor from claims resulting from bodily injury or property damage to a third party. Include this as a separate line item within all modification proposals and provide a current insurance quote upon request.
- G. Performance and Payment Bonds: A performance bond is a surety bond issued by an insurance company or bank to guarantee satisfactory completion of a project. The Payment Bond guarantees that the contractor will pay the labor and material costs they have incurred. Banks and Insurance companies charge a premium for each individual project based on a sliding scale which relates to the size of the project. Include this as a separate line item in modification proposals and provide current company bonding rates upon request.
- H. Builder's Risk Insurance: This covers the contractor's loss due to fire, high winds, or other natural forces. This is not reimbursed by the National Park Service (NPS) and shall not be included in modification proposals.

### 1.3 MODIFICATION PROPOSAL PRICING REQUIREMENTS

#### A. General:

- 1. Your proposal must be received in the format and within the time frame specified in the Request for Proposal letter. Costs or delays resulting from failure of contractor to submit within the time frame specified will not be compensable.
- 2. The proposal must be detailed with itemized lists of equipment, materials, labor, production rates, overhead, profit, and bond markup for each item. Labor costs must be itemized by craft and hourly rate, including Fringe Benefits and Labor Burden. If the costs of Fringe Benefits and Labor Burden are not itemized, it is assumed that they are included in the hourly rate shown, or contractor is not requesting reimbursement. Contractor may utilize the government provided [Contractor Estimate Form](#), or their

own form, provided that it contains the same information and level of detail as the Gov't provided form.

3. Requests for extensions of contract time as a result of this change must be justified with a Time Impact Analysis (TIA). Refer to Division 01 Specification, "Construction Schedule", for time impact analysis requirements. TIA and associated costs must be received with the proposal by the date shown within the Request for Proposal letter. Contractor's failure to submit within the specified time frame will be construed as the Contractor waiving the right for additional time and no time extension will be allowed.
4. All supporting documentation used to justify the proposed modification will be made available to the Contracting Officer upon request.
5. Contractor must review and approve all subcontractor/supplier pricing in detail for proper format, scope, production rates, and pricing prior to submission to the NPS. All delay costs associated with not reviewing and approving subcontractor/supplier pricing will be borne by the Contractor.
6. All pricing and production rates within the estimate must be based on fair and reasonable pricing and cannot include built-in contingency.

B. Labor:

1. Contractor shall estimate the cost of labor by itemizing each craft involved, indicating worker hourly rate (base rate + labor burden + fringe benefits) for each and itemizing the hours required for each craft that will be directly engaged in modification work. Any work proposed that will require overtime work or premium pay shall be itemized separately. All rates shall be in accordance with the Davis-Bacon Act as incorporated herein. Labor Burden may include payroll taxes, Social Security, unemployment insurances, workers compensation insurance, FICA, FUTA, and other direct costs resulting from Federal, State or local laws.
2. Itemize labor costs for equipment operators separate from equipment costs.
3. The labor cost for foremen shall only be costs for related work required for the modification.

C. Materials:

1. The estimated cost for materials shall include quotes from multiple sources. Material prices must include all applicable fees and credits, including but not limited to, sales tax, freight and delivery charges, and tax rebates.
2. No markup shall be applied to any material provided by the NPS.

D. Equipment:

1. Equipment used for the project must be appropriately sized for the work being performed.
2. Do not include costs for "miscellaneous tools and equipment", in your proposal for a replacement value of \$500 or less. Costs shown in excess of \$500 must be broken out separately.
3. Regardless of ownership, the rates to be used in determining equipment rental costs shall be the lowest cost from one of the following sources:
  - a. U.S. Army Corps of Engineers , Ownership and Operating Expense Schedule (use latest edition and applicable region)
  - b. Construction Blue Book

- c. Local equipment rental rates, documented by actual invoice charges, or itemized vendor quotes.
4. The estimated equipment rates shall include the operating costs of all fuel, oil, lubrication, supplies, small tools, necessary attachments, ground engaging components, tires & tracks, routine repairs and maintenance (cost of major repair and overhaul is not allowed per FAR 31.105(d)(2)), depreciation, storage, insurance, and all incidentals. Mobilization, if applicable, may be included for equipment solely used on the modification work but must be listed separately.
5. Estimate the full rate for equipment only for the duration that the equipment will be utilized to accomplish the work of the modification.
6. Standby unit rates used are to be in accordance with paragraph 1.3, D, 2, above. If the US Army Corp of Engineers is utilized then their standby rates prevail. If Bluebook or local equipment pricing is accepted, then ½ of the equipment costs minus any operating costs, major repair and overhaul will be accepted.
7. If equipment is in standby mode due solely to a documented NPS delay, the established standby rate shall apply from the first day of the delay.
8. Equipment that is not used and on the jobsite for up to five consecutive days may be classified at standby rates, provided that the equipment is or has been used solely to perform work on the modification and will be necessary to complete additional modification work. Equipment that is still on the jobsite but not in use after five consecutive days will not be considered in the modification pricing.
9. Requests for compensation for equipment stand by time must be justified, documented and itemized separately.
10. The estimated timeframe (daily, weekly, monthly) for use of the equipment must reflect the lowest cost to the Government.

E. Establishment and Application of Overhead and Profit Percentages:

Utilize the [Profit Calculator](#) to generate the allowable maximum rate for Profit on self-performed work. Insert the result below where indicated by the red X.XX%. Work collaboratively with the COR to produce the draft Profit Calculator for Design Development (DD) submission. Denver Service Center Contracting Services division will approve the final number. Submit completed Profit Calculator with the DD submission.

1. Home Office Overhead and Profit (OH&P) shall be applied to direct costs only. Profit shall not be applied to overhead amounts; and overhead shall not be applied to profit. Home office overhead shall contain only allowable, allocable, and reasonable costs per the contract documents and FAR Part 31. Profit percentages are based on risk factors found in FAR Part 31 which have been applied to the specific type of work included in this project. Negotiated rates shall not exceed the following percentages for OH&P for contractor self-performed work:
 

Overhead .....	10%
Profit .....	X.XX%
2. Total aggregate limit of markup (OH&P) for contractor and subcontractors on modification work shall not exceed 25%. The NPS will not be responsible for allocation of percentages between contractor and subcontractors at any tier.
3. If contractors form a partnership, than the partnership may only receive home office overhead and profit in the same amount as an individual contractor (refer to par 1.3,E,1 above). It is the responsibility of the partners to decide on the division of revenue.

4. Combined Increases and Decreases: On proposals involving both increases and decreases in the Contract Price, the overhead and profit mark-ups are required on the net increases and deducted on net decreases.
5. At no time can profit be calculated on Overhead or itself, it must be calculated on direct costs of work only.

## PART 2 - PRODUCTS

## PART 3 - EXECUTION

END OF SECTION 012601

## **SECTION 01 27 00 – DEFINITION OF CONTRACT LINE ITEMS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. The intent of this section is to explain, in general, what is and what is not included in a contract line item, and the limits or cut-off points where one item ends and another begins.
- B. If no contract line item exists for a portion of the work, include the costs in a related item.

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

### **PART 3 - EXECUTION**

#### **3.1 LIST OF CONTRACT LINE ITEMS**

- A. Contract Line Item No. 01 Removal of all non-historic elements, including a frame addition at the rear and multiple twentieth century interior finishes; structural repair to stabilize the home. Repair and repaint all existing conditions. Installation of new appliances.
  - 1. This item consists of demolition and construction of all non-historic elements, and all new appliances. Repainting and repairing existing conditions.
  - 2. Measurement for payment will be based on the percentage complete.
  - 3. Payment will be made at the contract lump sum price.

END OF SECTION 01 27 00

## SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Definitions
  - 2. Construction Coordination.
  - 3. Submittals
  - 4. Coordination Drawings.
  - 5. Requests for Information (RFIs).
  - 6. NPS/DSC SharePoint Project Website.
  - 7. Project meetings.
  - 8. Environmental Coordination.
  - 9. Permits
- B. Related Requirements:
  - 1. Section 01 32 16 "Construction Schedule" for preparing and submitting Contractor's construction schedule.
  - 2. Section 01 73 40 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.
  - 4. Section 01 91 14 "Total Building Commissioning" for coordinating the work with Owner's Commissioning Authority.

#### 1.2 DEFINITIONS

- A. Agency with Jurisdiction
- B. Construction Permits – Contractor Provided
- C. Government Furnished Permits

#### 1.3 CONSTRUCTION COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
  4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
  5. Properly plan construction operations to include permit requirements. Allow enough time to execute permit provisions to maintain work schedule, site visits, inspections, and reporting deadlines.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
  2. Preparation of the Schedule of Values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Permit requirements.
  7. Pre-installation conferences.
  8. Project closeout activities.
  9. Commissioning activities.

#### 1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
    - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - b. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to the Contracting Officer (CO) for resolution of such conflicts.
    - c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    - e. Indicate required installation sequences.

2. Sheet Size: At least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
3. Number of Copies: Submit a digital copy of each submittal
4. Refer to individual Sections for Coordination Drawing requirements for Work in those Section

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
  - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
  - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
  - c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
  - a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
  - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
  - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
  - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
  - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Contracting Officer (CO) will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If CO determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, CO will so inform Contractor, who shall make changes as directed and resubmit.



10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 23 "Submittal Procedures."

C. Division 01 documents: The following items shall be submitted a minimum of one week prior to the Preconstruction Conference. Contracting Officer will notify Contractor of tentative date for the Pre-Construction Conference.

1. Letter designating Project Superintendent.
2. Construction Schedule.
3. A comprehensive breakdown of the Schedule of Values.
4. Accident Prevention Plan.
5. A list of Subcontractors for this project.
6. Written statements from subcontractors certifying compliance with applicable labor standard clauses.
7. Satisfactory evidence of liability insurance coverage and workman's compensation for the Contractor and all subcontractors.
8. Waste Management Plan.
9. Quality Control Plan.
10. Temporary Storm Water Pollution Prevention Plan (SWPP or UPPP).
11. Indoor Air Quality (IAQ) Management Plan.
12. Contractors Commissioning Plan.
13. Historic Preservation Treatment Plan.
14. List of Required Construction Permits. Include the following information for each permit:
  - a. Name of Permit.
  - b. The Agency(ies) with Jurisdiction issuing the permit.
  - c. Information required from the Government to complete the permit application.

D. All items listed must be provided to the Contracting Officer before the Pre-Construction Conference is held. If all of these documents have not been received one week prior to the scheduled Pre-Construction Conference date, the conference will be cancelled, Notice to Proceed will not be issued, and the Contracting Officer will consider other contractual remedies. Work shall not commence until written Notice to Proceed has been issued.

## 1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI utilizing the form created on the NPS/DSC SharePoint Project website.

1. CO will not respond to RFIs submitted by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in the work.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. RFI number, numbered sequentially.
2. Date.
3. RFI subject.
4. Specification Section number and title and related paragraphs, as appropriate.

5. Drawing number and detail references, as appropriate.
6. Field dimensions and conditions, as appropriate.
7. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
8. Contractor's signature.
9. Requested date for response.
10. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
  - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Form: Complete the RFI Form on the NPS/DSC SharePoint website as follows:

1. Enter the general information at the top of the form.
2. Under the "Action" section at the bottom of the form, select "Question" then select "CMR" in the drop-down of the "Send to" box.
3. Enter the details of the question and attach related documents.
4. Select "Submit Form" at the bottom of the page.

D. Contracting Officer's Action: CO will review each RFI, determine action required, and respond. CO will determine the critical nature of each RFI and issue a response accordingly.

1. The following are not considered to be RFIs and will receive no action:
  - a. Requests for approval of submittals.
  - b. Requests for approval of substitutions.
  - c. Requests for approval of Contractor's means and methods.
  - d. Requests for coordination information already indicated in the Contract Documents.
  - e. Requests for adjustments in the Contract Time or the Contract Sum.
  - f. Requests for interpretation of Architect's actions on submittals.
  - g. Incomplete RFIs or inaccurately prepared RFIs.
2. CO's action may include a request for additional information, in which case time for response will date from time of receipt of additional information.
3. CO's action on RFIs may result in the need for a change to the Contract Time or the Contract Sum. All contract changes will be processed following the terms and conditions of the contract.

## 1.6 PROJECT MEETINGS

- A. Preconstruction Conference: Before start of construction, Contracting Officer will arrange an on-site meeting with Contractor. The meeting agenda will include the following as a minimum:
1. Roles & Responsibilities/ Lines of Authority.
  2. Park rules and regulations.
  3. Jobsite Safety.
  4. Resolution of comments on required Division 01 documents.
  5. Coordination of Subcontractors.
  6. Labor law application.

7. Modifications.
8. Payments to Contractor.
9. Payroll reports.
10. Contract time.
11. Liquidated damages.
12. Contractor Performance Evaluation.
13. Display of Hotline posters.
14. Notice to proceed.
15. Correspondence procedures.
16. NPS/DSC SharePoint Project website.
17. Acceptance/rejection of work.
18. Progress meetings.
19. Submittal procedures.
20. NPS Final Accessibility Inspection.
21. Environmental requirements.
22. Permit requirements.
23. As-constructed drawings/operation and maintenance (O&M) manuals.
24. Saturday, Sunday, holiday and night work.
25. Reference materials.
26. Value engineering.

B. Progress Meetings: The Contracting Officer will schedule weekly meetings with the Contractor.

1. Attendees: In addition to Government Representatives, each Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. The meeting agenda will include the following:
  - a. Approval of minutes of previous meetings.
  - b. Submittal status.
  - c. Review of off-site fabrication and delivery schedules.
  - d. Requests for information (RFI) and other issues.
  - e. Modifications.
  - f. Work in progress and projected.
    - 1) Status of required inspections (Special Inspections, Accessibility, etc.)
  - g. Inspections of work in progress and projected (Special inspections,
  - h. Construction Schedule update (provide updated CPM).
  - i. Status of Project Record Drawings and O&M manuals.
  - j. Other business relating to work.
  - k. Permit requirements.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise CO of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
  - a. Contract Documents.
  - b. Options.
  - c. Related RFIs.
  - d. Related Change Orders.
  - e. Purchases.
  - f. Deliveries.
  - g. Submittals.
  - h. Review of mockups.
  - i. Possible conflicts.
  - j. Compatibility requirements.
  - k. Time schedules.
  - l. Weather limitations.
  - m. Manufacturer's written instructions.
  - n. Warranty requirements.
  - o. Compatibility of materials.
  - p. Acceptability of substrates.
  - q. Temporary facilities and controls.
  - r. Space and access limitations.
  - s. Regulations of agency(ies) with jurisdiction.
  - t. Testing and inspecting requirements.
  - u. Installation procedures.
  - v. Coordination with other work.
  - w. Required performance results.
  - x. Protection of adjacent work.
  - y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

## 1.7 PERMITS

### A. General:

1. Permits and Responsibilities: The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the work.
2. For the purpose of this contract the Contractor will not be considered an agent of the Government. Therefore the Contractor will comply with the appropriate Federal, State and local laws.

- B. Potential Permits: The permits listed below were identified during the design process as likely to be required based on typical means and methods of construction. The list is provided to assist the contractor in determining which permits will be required for the contract's chosen means and methods. The list shall not be considered complete, as it is the responsibility of the contractor to determine means and methods, and obtain the required permits. It is the responsibility of the Contractor to obtain all permits required to legally conduct the work.
- C. Coordination with Agency(ies) with Jurisdiction Issuing Permits
  - 1. Coordination: Contact the Agency(ies) with Jurisdiction as needed and sufficiently in advance to avoid delaying the work: Coordinate meetings, reporting requirements, inspections, or any other requirements.
- D. Administrative Procedures:
  - 1. Coordinate scheduling and timing of required administrative provisions of project permits with Agency(ies) with Jurisdiction, Construction Manager, and Park to avoid conflicts and to ensure orderly execution of the Work.
  - 2. Supply all needed information to Agency(ies) with Jurisdiction issuing permits, pay any fees required and provide all material needed to comply with the permit's conditions and provisions.
  - 3. Upload permits to the NPS/DSC SharePoint project website when the permits are obtained.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

## SECTION 01 32 16 – CONSTRUCTION SCHEDULE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section consists of Construction Schedule requirements including but not limited to the following:
  - 1. Schedule of Values
  - 2. Construction Schedule Requirements.
  - 3. Construction Schedule Updates.
  - 4. Time Impact Analysis.
- B. Purpose: The purpose of the Construction Schedule is to ensure adequate planning, coordination, scheduling, and reporting during execution of the work by the Contractor. The Construction Schedule will assist the Contractor and Contracting Officer in monitoring the progress of the work, evaluating proposed changes, and processing the Contractor's monthly progress payment.

#### 1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by the Contracting Officer.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Float: The measure of leeway in starting and completing an activity.
  - 1. Float: Float is not for the exclusive use or benefit of either the Government or the Contractor but is jointly owned.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- E. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

- F. Fragment: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

### 1.3 SUBMITTALS

- A. Electronic Copies: All schedules and reports submitted shall be posted on the NPS DSC SharePoint project website, provided in the native electronic file format. It is the intent of the Government to limit the number of printed reports to only those reports determined by the project team to be essential.
- B. Construction Schedule Updates: On or before the 7th day preceding the progress payment request date, submit estimates of the percent completion of each schedule activity and necessary supporting data. Provide two paper copies.
- C. Construction Schedule Revisions and Time Impact Analysis: For each Construction Schedule revision submit hard paper copies of a Time Impact Analysis. Each Time Impact Analysis shall include a Fragmentary Network (Fragnet), incorporated into the currently accepted Construction Schedule, demonstrating how the Contractor proposes to incorporate a modification, change, delay, or Contractor request.

### 1.4 QUALITY ASSURANCE

- A. The Contractor shall meet with the Contracting Officer on the day of the preconstruction conference to go over the following:
  - 1. Review software limitations, content and format for reports.
  - 2. Verify availability of qualified personnel needed to develop and update schedule.
  - 3. Review delivery dates for Government-furnished products.
  - 4. Review schedule for work of separate Government contracts.
  - 5. Review time required for review of submittals and re-submittals.
  - 6. Review requirements for tests and inspections by independent testing and inspecting agencies.
  - 7. Review time required for completion and startup procedures.
  - 8. Review time required for obtaining and activating permits.
  - 9. Review and finalize list of construction activities to be included in schedule.
  - 10. Review baseline schedule comments, resolve issues and progress on incorporating them
  - 11. Review procedures for updating schedule.
  - 12. Discuss reporting requirements and establish a protocol for naming and transmitting electronic schedules.
- B. Contractor's Schedule Representative: Before or at the preconstruction conference, designate an authorized representative to be responsible for the preparation and maintenance of the Construction Schedule. A resume outlining the qualifications of the Scheduler shall be submitted to the Contracting Officer for acceptance. The Scheduler shall have prepared and maintained at least 5 previous schedules of similar size and complexity similar to this Contract, demonstrating proficiency in the use of scheduling software. The authorized representative will be responsible for preparing the Baseline Schedule, all required updates, revisions, Time Impact Analyses, and preparation of reports.

## 1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate Contractors.
- B. Coordinate Construction Baseline Schedule with the list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. In developing the Construction Baseline Schedule, ensure that the Subcontractor's work at all tiers, as well as the prime Contractor's work, is included and coordinated.
  - 2. Secure time commitments for performing critical elements of the Work from parties involved.
  - 3. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## PART 2 - PRODUCTS

### 2.1 CONSTRUCTION SCHEDULE REQUIREMENTS

- A. Construction Baseline Schedule: Prepare a chart project schedule.
  - 1. Develop and finalize Construction Baseline Schedule so it can be accepted for use no later than 30 days after date established for the Notice of Award.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Governments acceptance of the schedule.
  - 2. Establish procedures for monitoring and updating Construction Baseline Schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
- B. Construction Baseline Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary CPM network diagram, prepare a skeleton network to identify probable critical paths.
  - 1. Activities: Indicate the estimated duration, sequence requirements, and relationship of each activity in relation to other activities.
  - 2. The Construction Baseline Schedule as developed shall show the sequence and interdependence of activities required for complete performance of the work. Ensure all work sequences are logical and the Construction Baseline Schedule shows a coordinated plan of the work.
  - 3. Time Frame: Proposed duration assigned to each activity shall be the Contractor's best estimate of time required to complete the activity considering the scope and resources planned for the activity.
    - a. An early finish date may be shown but the late finish date must be the same date as the last day of the contract period. An early completion schedule must contain the following:



- b. Contract completion date shall not be changed by submission of a schedule that shows an early completion date.
- c. Activity Duration: Define activities so no activity is longer than 15 days, except for non-construction activities including mobilization, shop drawings and submittals, fabrication and delivery of materials and equipment.
- d. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 calendar days, as separate activities in the schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
- e. Submittal Review Time: Include review and re-submittal times indicated.
- f. Substantial Completion: Allow time for Government administrative procedures necessary for certification of Substantial Completion.

C. Joint Review, Revision, and Acceptance:

- 1. Within seven calendar days of receipt of the Contractor's proposed Construction Baseline Schedule, the Contracting Officer and Contractor shall meet for joint review, correction, or adjustment of the initial Construction Baseline Schedule. Any areas which, in the opinion of the Contracting Officer, conflict with timely completion of the project shall be subject to revision by the Contractor.
- 2. Within seven calendar days after the joint review between the Contractor and Contracting Officer, the Contractor shall revise and resubmit the Construction Baseline Schedule in accordance with agreements reached during the joint review.
- 3. In the event the Contractor fails to define any element of work, activity, or logic, and the Contracting Officer review does not detect this omission or error, such omission or error, when discovered by the Contractor or Contracting Officer, shall be corrected by the Contractor within seven calendar days and shall not affect the contract period.
- 4. Upon acceptance of the Construction Baseline Schedule by the Contracting Officer, save the schedule as a baseline and update on a monthly basis. The construction schedule update will be used to evaluate the Contractor's monthly applications for payment based upon information developed at the monthly Construction Schedule update meeting.

D. Cost Correlation: In the heading of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

- 1. Contractor shall assign cost to construction activities on the Construction Baseline Schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Contracting Officer's approval, be assigned to fabrication and delivery activities. Costs shall be included for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable).
- 2. Each activity cost shall reflect an accurate value based on the Contract Price Schedule.
- 3. Total cost assigned to activities shall equal the total Contract Price.

E. Recovery Schedule: When periodic schedule update indicates the Work is 14 or more calendar days behind the current accepted schedule, a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule must also be submitted. Indicate

changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

- F. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

## PART 3 - EXECUTION

### 3.1 CONSTRUCTION SCHEDULE UPDATES

- A. Progress Meeting Updates: Provide updated schedule information before each weekly progress meeting.
- B. Monthly Schedule Updates:
  - 1. General: Update the Construction Schedule on a monthly basis to reflect actual construction progress and activities throughout the entire contract period and until project substantial completion. The status date of each schedule update shall be the 7th day preceding the progress payment request date.
  - 2. Progress Payments: The monthly updating of the currently accepted Construction Schedule shall be an integral part of the process upon which progress payments will be made under this contract. If the Contractor fails to provide schedule updates or revisions, then a portion of the monthly payment may be retained until such corrections have been made.
- C. Distribution: Distribute copies of accepted schedule to Contracting Officer, Contracting Officers Representative, Construction Management Representative, Subcontractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  - 1. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.
- D. Construction Schedule Revisions:
  - 1. Required Revisions: If, as a result of the monthly schedule update, it appears the currently accepted Construction Schedule no longer represents the actual prosecution and progress of the work, the Contracting Officer will request, and the Contractor shall submit, a revision to the Construction Schedule. The Contractor may also request reasonable revisions to the currently accepted Construction Schedule in the event the Contractor's planning for the work is revised. If the Contractor desires to make changes, the Contractor shall notify the Contracting Officer in writing, stating the reason for the proposed revision. Accepted revisions will be incorporated into the currently accepted Construction Schedule for the next monthly schedule update.
  - 2. Procedure: If revision to the currently accepted Construction Schedule is contemplated, the Contractor or Contracting Officer shall so advise the other in writing at least seven calendar days prior to the next monthly schedule update meeting, describing the revision

and reasons for the revision. Government-requested revisions will be presented in writing to the Contractor, who shall respond in writing within seven calendar days.

END OF SECTION 01 32 16

## SECTION 01 32 33 – PHOTO DOCUMENTATION FOR HISTORIC PRESERVATION PROJECTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
  - 1. Existing Condition images.
  - 2. Periodic construction images.
- B. See Division 01 Section "Closeout Procedures" for a complete listing of closeout documents.
- C. See Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of NPS personnel.

#### 1.2 SUBMITTALS

- A. Construction Images: Submit images electronically within seven days of taking the image. Include the following for each:
  - 1. Include Date, time and number (sequentially number all images) in filename.
  - 2. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
  - 3. Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- B. Closeout: Submit a complete set of digital image electronic files as a Project Record Document. Submit flash drive media.
  - 1. List each image as a file name with number, date, and time. Include description and or vantage point image was taken. (avoid long excessive names)
  - 2. Submit images that have the same aspect ratio as the sensor, un-cropped.

### PART 2 - PRODUCTS

#### 2.1 FORMAT REQUIREMENTS

- A. Media: CD-R Archival Gold or DVD-R Archival Gold
- B. Media Labels: Archival CD/DVD labeling markers, archival labels, or direct print CD
- C. Images: Provide sRGB color images in JPEG format. Minimum sensor size of 12 mega pixels, and at an image resolution of not less than 3200 by 2400 pixels.

## PART 3 - EXECUTION

### 3.1 CONSTRUCTION IMAGES

- A. General: Take digital images using the maximum range of depth of field, and that are in focus, to clearly show the Work. Images with blurry or out-of-focus areas will not be accepted.
  - 1. Maintain index with each set of Construction images that identifies the number, date, time, and description for each.
  - 2. Maintain one set of images accessible in the field office at the Project site, available at all times for reference.
- B. Existing Condition Images: Before commencement of excavation or demolition take color digital images of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Contracting Officer.
  - 1. Flag excavation areas and construction limits before recording construction images.
  - 2. Take eight separate images to show existing conditions adjacent to property before starting the Work.
  - 3. Take eight separate images of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
- C. Periodic Construction Images: Take 12 color, digital images weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last images were taken.
- D. Additional Images: Contracting Officer may issue requests for additional images, in addition to periodic Construction images specified.
  - 1. Three days notice will be given, where feasible.
  - 2. In emergency situations, take additional images within 24 hours of request.
  - 3. Circumstances that could require additional images include, but are not limited to, the following:
    - a. Immediate follow-up when on-site events result in construction damage or losses.
    - b. Images to be taken at fabrication locations away from Project site.
    - c. Substantial Completion of a major phase or component of the Work.
    - d. Extra record images at time of final acceptance.

END OF SECTION 01 32 33

## SECTION 01 33 23 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

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

#### 1.2 DEFINITIONS

- A. Action Submittals: Written, graphic information, and physical samples that require Government's responsive action.
- B. Informational Submittals: Written information that does not require Government's responsive action. Submittals may be rejected for not complying with the requirements.
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

#### 1.3 GENERAL SUBMITTAL PROCEDURES

- A. General: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual specific sections.
  - 1. Contracting Officer reserves the right to require submittals in addition to those called for in individual sections.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Review them for legibility, accuracy, completeness, and compliance with Contract Documents.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Contracting Officer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- C. Submittal List: A submittal list has been attached to the end of this Specification Section. The intent is to provide an overall summary of submittal requirements and not a comprehensive list. The requirements of the individual Specification Sections, terms and conditions of the Contract still apply regardless of what is shown on the submittal list.
- D. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence when an e-mail notification is received by the Contracting Officer (or designee) indicating the submittal has been posted on the NPS SharePoint website and is ready for review. When the Contracting Officer has completed their review, an e-mail notification will be sent to the Contractor indicating the submittal has been processed. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.
  - 1. Action Submittals
    - a. Initial Review: Allow 30 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.
    - b. Re-submittal Review: Allow 30 days for review of each re-submittal.
  - 2. Informational submittals
    - a. Review: Allow 10 days for review of each submittal.
- E. Approved Equals:
  - 1. For each item proposed as an “approved equal,” submit supporting data, including:
    - a. Drawings and samples as appropriate.
    - b. Comparison of the characteristics of the proposed item with that specified.
    - c. Changes required in other elements of the work because of the substitution.
    - d. Name, address, and telephone number of vendor.
    - e. Manufacturer’s literature regarding installation, operation, and maintenance, including schematics for electrical and hydraulic systems, lubrication requirements, and parts lists. Describe availability of maintenance service, and state source of replacement materials.
  - 2. A request for approval constitutes a representation that Contractor:
    - a. Has investigated the proposed item and determined that it is equal or superior in all respects to that specified.
    - b. Will provide the same warranties for the proposed item as for the item specified.
    - c. Has determined that the proposed item is compatible with interfacing items.
    - d. Will coordinate the installation of an approved item and make all changes required in other elements of the work because of the substitution.
    - e. Waives all claims for additional expenses that may be incurred as a result of the substitution.
- F. **Electronic Submittals:** Identify and incorporate information in each electronic submittal file as follows:

1. CM-SPE Transmittal Form: All submittals shall be transmitted using National Park Service form CM-SPE form. The form is accessed and completed on the NPS/DSC SharePoint Project website. No action will be taken on a submittal item unless accompanied by the CM-SPE transmittal form.
    - a. Complete the general information at the top of the form.
    - b. Provide all required information based on the submittal type
    - c. Attach all related documents.
    - d. Sign the CM-SPE form in the contractor section at the bottom of the form, and select “submit” when complete.
  2. Physical samples: Complete the CM-SPE on the NPS/DSC SharePoint Project website as described above. Deliver the physical sample to the CO (or designee) on site for processing. All comments and actions will be documented on the CM-SPE form on the NPS/DSC SharePoint Project website.
- G. Identification: Submittal number or other unique identifier, including revision identifier.
1. Submittal number shall use a sequential number (e.g., .001). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., .001.A).
- H. Re-submittals: Make re-submittals using the same process used with the initial submittal.
1. Note date and content of previous submittal.
  2. Note date and content of revision in the title block on the CM-SPE and clearly indicate the extent of revision.
  3. Re-submit submittals until they are marked “Approved” or “Approved with notations”.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and others as necessary for performance of construction activities.
- J. Use for Construction: Use only final submittals with mark indicating “Approved” or “Approved with notations”. Ensure all notations have been incorporated and, at a minimum, keep one copy of the final approved submittal on site for use during construction.
- 1.4 CONTRACTOR’S USE OF CAD FILES
- A. General: At Contractor’s written request, copies of CAD files will be provided to Contractor for Contractor’s use in connection with Project, subject to the following conditions:
1. Files will be provided as is; no format or other changes to files or changes to the objects in the drawing will be done by the Government.



## PART 2 - PRODUCTS

### 2.1 ACTION SUBMITTALS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's product specifications.
    - b. Manufacturer's installation instructions: When Contract Documents require compliance with manufacturer's printed instructions, provide one complete set of instructions to Contracting Officer and keep another complete set of instructions at the project site until substantial completion.
    - c. Manufacturer's catalog cuts: Submit only pertinent pages; mark each page of standard printed data to identify specific products proposed for use.
    - d. Wiring diagrams showing factory-installed wiring.
    - e. Printed performance curves.
    - f. Operational range diagrams.
    - g. Compliance with specified referenced standards.
    - h. Testing by recognized testing agency.
  - 4. Submit product data in PDF file format before or concurrent with samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
  - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - f. Shopwork manufacturing instructions.
    - g. Templates and patterns.
    - h. Schedules.
    - i. Notation of coordination requirements.
    - j. Notation of dimensions established by field measurement.
    - k. Relationship to adjoining construction clearly indicated.
    - l. Seal and signature of professional engineer if specified.
    - m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
  - 2. Submit shop drawings as a PDF electronic file.

- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Complete and post the CM-SPE on the NPS SharePoint website for processing and documentation of action on submitted samples.
  3. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Submittal Number and title of appropriate Specification Section.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
  5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit 2 set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Contracting Officer will return submittal with options selected.
  6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
- D. Construction Materials: The Contractor is encouraged to submit for approval products made out of recycled or environmentally responsible material. Every effort will be made by the National Park Service to approve these materials.

## 2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by individual Specification Sections.
1. Post informational submittals as PDF electronic files directly to the NPS SharePoint website.
  2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  3. Informational submittals that do not comply with the requirements specified in the Contract Documents will be rejected and one copy will be returned.

- B. Coordination Drawings: Comply with the requirements specified in Section 01 31 00 "Project Management and Coordination."
- C. Contractors Construction Schedule: Comply with the requirements specified in Section 01 32 16 "Construction Schedule."
- D. Accident Prevention Plan: Comply with the requirements specified in Section 01 35 23 "Safety Requirements."
- E. Schedule of Values: Comply with the requirements specified in Section 01 32 16 "Construction Schedule."
- F. Waste Recycling Plan: Comply with the requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."
- G. Quality Control Plan: Comply with the requirements specified in Section 01 40 00 "Quality Requirements."
- H. Storm Water Pollution Prevention Plan: Comply with the requirements specified in Section 01 57 23 "Temporary Storm Water Pollution Prevention" and any storm water permit requirements identified in Section 01 31 00.
- I. Indoor Air Quality Management Plan: Comply with the requirements specified in Section 01 57 19.11 "Indoor Air Quality Management."
- J. LEED™ Submittals: Comply with the requirements specified in Section 01 81 13.13 "Sustainable Design Requirements - LEED™ for New Construction and Major Renovations," Section 01 81 13.16 "Sustainable Design Requirements - LEED™ for Commercial Interiors," Section 01 81 13.19 "Sustainable Design Requirements - LEED™ for Core and Shell Development," and Section 01 81 13.23 "Sustainable Design Requirements - LEED™ for Schools."
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with the requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- M. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with the requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- N. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with the requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with the requirements in the Contract Documents.

- P. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with the requirements in the Contract Documents.
- Q. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with the requirements in the Contract Documents.
- R. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with the requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- S. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- T. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- U. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- V. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with the requirements in the Contract Documents.
- W. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with the requirements specified in Section 01 78 23 "Operation and Maintenance Data."
- X. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- Y. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.
- Z. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
  - 1. Statement on condition of substrates and their acceptability for installation of product.
  - 2. Summary of installation procedures being followed, whether they comply with the requirements and, if not, what corrective action was taken.

3. Results of operational and other tests and a statement of whether observed performance complies with the requirements.
- AA. Permit Compliance Products: Prepare required information for compliance with permit provisions. Products include written notification of project startup, suspension, and completion of work; photo documentation of site conditions; reports; and drawings.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions.

### 3.2 CONTRACTING OFFICER'S ACTION

- A. General: Submittals will be disapproved without technical review if identification information is missing, not filled in, or if placed on the back of the submittal; an incorrect format of submittals is provided; the transmittal form is incorrectly filled out; submittals are not coordinated; or submittals do not show evidence of Contractor's approval.
  1. Any work done or orders for materials or services placed before approval shall be at the Contractor's own risk.
- B. Action Submittals: Contracting Officer will review each submittal, generate comments on corrections or modifications required, and indicate the appropriate action on the CM-SPE Transmittal Form. The submittal will be marked in one of three ways as defined below:
  1. APPROVED: Acceptable with no corrections.
  2. APPROVED WITH NOTATIONS: Minor corrections or clarifications required. All comments are clear and no further review is required. The Contractor shall address all review comments when proceeding with the work.
  3. DISAPPROVED - RESUBMIT: Rejected as not in accordance with the contract or as requiring major corrections or clarifications. The Contracting Officer will identify the reasons for disapproval. The Contractor shall revise and resubmit with changes clearly identified.
- C. Informational Submittals: Contracting Officer will review each submittal and will either accept or reject it.
- D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

END OF SECTION 01 33 23

## SECTION 01 35 13.22 – ARCHEOLOGICAL PROTECTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. The work of this section consists of protecting archeological resources contained in soil deposits.

#### 1.2 DEFINITIONS

- A. Archeological Resources: Archeological resources are the physical evidences of past human activity, including evidences of the effects of that activity on the environment. Archeological resources represent both prehistoric and historic time periods. They are found above and below ground and under water.
- B. Archeologically Sensitive Areas: Areas that have the potential to contain significant (National Register eligible) archeological resources. If National Register eligible or listed archeological resources could not be avoided, an appropriate mitigation strategy would be developed in consultation with the state historic preservation officer and, if necessary, associated American Indian tribes.
- C. Non-sensitive Areas: Areas with little, if any, potential of containing significant (National Register eligible) archeological resources.
- D. Archeological Monitor: A representative from the Park is designated to oversee construction activities that could disturb archeological resources. All Archaeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken. The Park is responsible for any objects uncovered as part of the project work and must be contacted if there are any findings.
- E. Archeological Resources Protection Act (ARPA) of 1979 (P.L. 96-95; 93 Stat. 712): defines archeological resources as any material remains of past human life or activities that are of archeological interest and at least 100 years old; Section 4 of the statute describes the requirements that must be met before Federal authorities can issue a permit to excavate or remove any archeological resource on Federal or Indian lands; the curatorial requirements of artifacts, and other materials excavated or removed.

#### 1.3 SUBMITTALS

- A. Daily Work Schedule; Submit a Daily work Schedule detailing construction work in archeologically sensitive areas. Submit to Contracting Officer 30 days before start of ground disturbing site work.

## 1.4 QUALITY ASSURANCE

- A. At least one week before on-site work begins, Contractor shall meet with Contracting Officer and Archeological Monitor to discuss Daily Work Schedule and equipment and special methods to be used in archeologically sensitive areas. Contractor shall ensure that approved Daily Work Schedule is followed throughout construction.

## PART 2 - PRODUCTS

### 2.1 DAILY WORK SCHEDULE

- A. A Daily Work Schedule is required for all work occurring within archeologically sensitive areas. Include all work that is to occur within the area and key the schedule to the drawings to include the following:
  - 1. Starting and ending dates of ground-disturbing construction.
  - 2. Locations of temporary facilities, such as barriers, field offices, staging areas, sanitary facilities, borrow pits, and haul and access roads.
  - 3. Types of construction, such as clearing, topsoil stripping, structure or trench excavation, landscaping, and post construction clean-up.
  - 4. Methods and equipment used for each type of construction.
  - 5. Plan for relocating work in the event of temporary work stoppages at each archeologically sensitive area

## PART 3 - EXECUTION

### 3.1 BARRICADES

- A. Comply with requirements specified in Division 01 Section "Temporary Facilities And Controls."

### 3.2 ARCHEOLOGICAL INVESTIGATION BY NON-NPS PERSONNEL

- A. A permit is required for any archeological investigations (e.g. excavation, shovel testing, coring, pedestrian survey, underwater archeology, rock art documentation, or other types of reconnaissance including the archaeological monitoring of construction) carried out on parklands by non-NPS personnel, unless carried out under a contract or a cooperative agreement specifically written for archeological investigations. Permits are issued under the Archaeological Resources Protection Act of 1979 (ARPA). The NPS does not issue a permit for archeological investigations carried out by NPS archeologists, or to archeologists working on NPS archeological projects under a contract or cooperative agreement.
- B. Applicants should submit a Permit Application (DI Form 1926 (Rev Sept 2004) OMB No. 1024-0037, approved through 1/31/2008 – the Permit Application form is available in pdf format) to the manager of the park in which they propose to work; or to the regional director, with a copy to the park manager.

### 3.3 OBSERVATION

- A. Archeological Monitor will observe all ground-disturbing site work, including construction of temporary facilities, at all archeologically sensitive areas, from a safe location mutually agreed on by Contractor and Monitor. As new ground is broken, Monitor will examine excavated materials, using construction layout centerline and perimeter staking as a reference point to record locations of findings.

### 3.4 DISCOVERY OF RESOURCES

- A. If Archeological Monitor discovers resources, immediate relocation of the work to a non-sensitive area may be required to allow Monitor to identify and document resources and, if necessary, develop an appropriate mitigation plan. While Archeological Monitor is documenting resources in sensitive areas, Contractor shall relocate work to non-sensitive areas where monitoring is not normally required.
- B. If resources are discovered while Archeological Monitor is absent, stop work immediately and report the discovery to the Contracting Officer.

### 3.5 WORK STOPPAGE

- A. The Contractor shall plan, schedule, and execute the work to prevent stoppages at one area from stopping all work at the construction site

END OF SECTION 01 35 13.22



## SECTION 01 35 91 - HISTORIC PRESERVATION TREATMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes special procedures for historic treatment on the Project including, but not limited to, the following:
  - 1. Definitions.
  - 2. Submittals.
  - 3. Quality Assurance.
  - 4. Storage and protection of existing historic materials.
  - 5. Project site conditions.
  - 6. Historic Preservation Treatment Plan
  - 7. Protection, General.
  - 8. Protection during application of chemicals.
  - 9. Protection during use of heat-generating equipment.
  - 10. Historic preservation treatment procedures.

#### 1.2 DEFINITIONS

- A. Preservation": To apply measures necessary to sustain the existing form, integrity, and materials of a historic property. Work may include preliminary measures to protect and stabilize the property.
- B. Rehabilitation": To make possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features that convey its historical, cultural, or architectural values.
- C. Restoration": To accurately return the form, features, and character of a property to its appearance at a particular period of time by means of the removal of features from other periods in its history and the repair and reconstruction of missing and deteriorated features from the restoration period.
- D. Reconstruction": To reproduce in the exact form and detail a building, structure, or artifact as it appeared at a specific period in time. Reconstructed elements do not possess historic integrity in their own right since it is not original fabric.
- E. Stabilize": To apply measures designed to reestablish a weather-resistant enclosure and the structural reinforcement of an item or portion of the building while maintaining the essential form as it exists at present. This level of intervention is aimed at retarding or arresting adverse impacts to structures.
- F. Protect and Maintain": To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.

- G. Repair": To stabilize, consolidate, or conserve; to retain existing materials and features while employing as little new material as possible. Repair includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials. Within restoration, repair also includes limited replacement in kind, rehabilitation, and reconstruction, with compatible substitute materials for deteriorated or missing parts of features when there are surviving prototypes.
- H. Replace": To duplicate in its entirety a historic element or feature by matching its historic pattern, detail and appearance. . Replacement is justified when original or historic elements are damaged beyond repair or are missing. Replacement methods includes the following conditions:
1. Replacement with Original or Historic Fabric: Includes fabric salvaged from other locations or projects having identical architectural qualities. It means duplication of appearance using identical material possessing historical significance.
  2. Replacement with New Materials: Includes replacement with new material of like kind (custom fabricated or manufactured) that is currently in production. It means duplication of appearance using like material.
  3. Replacement with Substitute Materials: Includes replacement with a compatible substitute that is frequently contemporary and unlike the historic fabric. It means duplication of appearance using modern (non-traditional) material Use of substitute materials is not approved unless matching materials are not available.
- I. Remove": To demolish or detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- J. Remove and Salvage": To detach items from existing construction and deliver them to the NPS reuse.
- K. Remove and Reinstall": To detach items from existing construction, repair and prepare them for reuse, and reinstall them where indicated.
- L. Existing to Remain" or "Retain": Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled.
- M. Material in Kind": Material that closely matches existing materials, through comparison of architectural qualities and salient characteristic such as species, cut, color, grain, , dimension, profile, thickness, and finish.

### 1.3 SUBMITTALS

- A. Historic Preservation Treatment Plan:
1. After the contract award and before the Pre-Construction conference, submit for approval a written Historic Preservation Treatment Plan (HPTP).
  2. If the plan requires any revisions or corrections, the contractor shall resubmit the plan within 10 days.
  3. No change in the approved plan may be made without written concurrence by the Contracting Officer.
  4. Unforeseen Conditions: During demolition activity. Any original fabric that is discovered due to the demolition must be protected from any damages.

- B. Alternative Methods and Materials: If alternative methods and materials to those indicated are proposed for any phase of work, provide a written description including evidence of successful use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this Project.
- C. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by historic treatment operations. Submit before work begins.
- D. Report all unforeseen conditions to the COR for review of potential Character Defining Features by Park Preservationist. Refer to Historic Structures Report for full list of Character Defining Features.

#### 1.4 QUALITY ASSURANCE

- A. Historic Preservation Treatment Specialist Qualifications: An experienced firm with the required certifications and training that can demonstrate through past performance that they are qualified to perform this work.

#### 1.5 STORAGE AND PROTECTION OF HISTORIC MATERIALS

- A. Removed and Salvaged Historic Materials:
  - 1. Clean salvaged historic items.
  - 2. Protect items from damage during transport and storage.
  - 3. Do not dispose of items removed from existing construction without prior written consent of Contracting Officer.
- B. Removed and Reinstalled Historic Materials:
  - 1. Clean and repair historic items to functional condition adequate for intended reuse.
  - 2. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- C. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling during historic treatment. When permitted by Contracting Officer, items may be removed to a suitable, protected storage location during historic treatment cleaned, and reinstalled in their original locations after historic treatment operations are complete.
- D. Storage and Protection: When removed from their existing location, store historic materials within a weather-tight enclosure where they are protected from wetting by rain, snow, or ground water, and temperature variations. Secure stored materials to protect from theft.
  - 1. Identify removed items with an inconspicuous mark indicating their original location.
  - 2. Develop a key plan when many similar items are scheduled for removal and reinstallation.

## 1.6 PROJECT-SITE CONDITIONS

### A. Exterior Cleaning and Repairing:

1. Proceed with the work only when forecasted weather conditions are favorable.
  - a. Wet Weather: Do not attempt repairs during rainy or foggy weather. Do not apply primer, paint, putty, or epoxy when the relative humidity is above 80 percent. Do not remove exterior elements of structures when rain is forecast or in progress.
  - b. Do not perform exterior wet work when the air temperature is below 40 deg F (5 deg C).
  - c. Do not begin cleaning, patching, or repairing when there is any likelihood of frost or freezing.
  - d. Do not begin cleaning when either the air or the surface temperature is below 45 deg F (7 deg C) unless approved means are provided for maintaining a 45 deg F (7 deg C) temperature of the air and materials during, and for 48 hours subsequent to, cleaning.
2. Perform cleaning and rinsing of the exterior only during daylight hours.

- B. National Park Service will occupy portions of building immediately adjacent to historic treatment area. Conduct historic treatment so National Park Service operations will not be disrupted. Provide not less than seventy two hour notice to Contracting Officer of activities that will affect National Park Service operations.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 HISTORIC PRESERVATION TREATMENT PLAN

- A. Prepare a written technical plan for preservation work covering all preservation components of the project. The plan must verify that the construction strategy and the intent is compatible with the Department Of Interior's standards for the Treatment of Historic Properties, guidelines for the Treatment of Cultural Landscapes, and National Park Service management policies for cultural resources. The plan must satisfy both the project scope and resource protection requirements. The plan shall include the following:
1. Organized list of preservation components of the project, systems, and tasks.
  2. Staging and sequence of the work.
  3. Disassembly and reassembly techniques and steps.
  4. Equipment and tools required.
  5. Supplies and materials with manufacturer or supplier identified.
  6. Skilled trades and crafts required.
  7. Anticipated testing and analysis of fabric.
  8. Additional investigations for the extents or magnitude of treatments needed.
  9. Protective measures.
  10. Seasonal limitations on the work.

11. Alternative means if primary treatment method is unfeasible.
12. Work conducted off-site (Approval from CO required prior to taking resources off-site).
13. **List of individuals to be contacted should there be a need to change the Historic Preservation Treatment Plan.**
  - a. **Historical Architect**
  - b. **Historian**

### 3.2 PROTECTION, GENERAL

- A. Comply with manufacturer's written instructions for precautions and effects of products and procedures on adjacent building materials, components, and vegetation.
- B. Ensure that supervisory personnel are present when work begins and during its progress.
- C. Temporary Protection of Historic Materials during Construction:
  1. Protect existing materials during installation of temporary protections and construction. Do not deface or remove existing materials.
  2. Attachments of temporary protection to existing construction shall be approved by Contracting Officer prior to installation.
- D. Protect landscape work adjacent to or within work areas as follows:
  1. Provide barriers to protect tree trunks.
  2. Bind spreading shrubs.
  3. Use coverings that allow plants to breathe and remove coverings at the end of each day. Do not cover plant material with a waterproof membrane for more than 8 hours at a time.
  4. Set scaffolding and ladder legs away from plants.
  5. Avoid rutting in landscapes adjacent to neighboring buildings. Contractor should not cause rutting or other damages to subsurface resources.
- E. Existing Drains: Prior to the start of work or any cleaning operations, test drains and other water removal systems to ensure that drains and systems are functioning properly. Notify Contracting Officer immediately of drains or systems that are stopped or blocked. Do not begin Work of this Section until the drains are in working order.
  1. Provide a method to prevent solids including stone or mortar residue from entering the drains or drain lines. Clean out drains and drain lines that become blocked or filled by sand or any other solids because of work performed under this Contract.
  2. Protect storm drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- F. Character Defining Features: Main House
  1. Location
  2. Mass, Scale and Shape
  3. Doorway openings
  4. Window openings
  5. Roof and roof related features

6. Projecting features
7. Exterior materials and craftsmanship
8. Special features
9. Exterior finishes
10. Spatial organization
11. Interior materials and craftsmanship

### 3.3 PROTECTION DURING APPLICATION OF CHEMICALS

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm or damage resulting from applications of chemical cleaners and paint removers.
- B. Comply with requirements in Division 01 Section "Temporary Facilities and Controls."
- C. Cover adjacent surfaces with materials that are proven to resist chemical cleaners selected for Project unless chemicals being used will not damage adjacent surfaces. Use covering materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
- D. Do not clean surfaces during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
- E. Neutralize and collect alkaline and acid wastes and dispose of outside park boundaries.
- F. Dispose of runoff from chemical operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors. Chemical applications need to be mindful of water sources in the immediate area; the spring inside the springhouse and Rock Creek.

### 3.4 PROTECTION DURING USE OF HEAT-GENERATING EQUIPMENT

- A. Comply with the following procedures while performing work with heat-generating equipment, including welding, cutting, soldering, brazing, paint removal with heat, and other operations where open flames or implements utilizing heat are used:
  1. Obtain Contracting Officer's approval for operations involving use of open-flame or welding equipment.
    - a. Notification shall be given for each occurrence and location of work with heat-generating equipment.
    - b. Obtain the appropriate permit from the park as required.
  2. As far as practical, use heat-generating equipment in shop areas or outside the building.
  3. Before work with heat-generating equipment commences, furnish personnel to serve as a fire watch (or watches) for location(s) where work is to be performed.

4. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
  5. Remove and keep the area free of combustibles, including, rubbish, paper, waste, etc., within area of operations.
    - a. If combustible material cannot be removed, provide fireproof blankets to cover such materials.
  6. Where possible, furnish and use baffles of metal or gypsum board to prevent the spraying of sparks or hot slag into surrounding combustible material.
  7. Prevent the extension of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
  8. Inspect each location of the day's work not sooner than 30 minutes after completion of operations to detect hidden or smoldering fires and to ensure that proper housekeeping is maintained.
- B. Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to automatic sprinkler heads, shield the individual heads temporarily with guards.

### 3.5 HISTORIC PRESERVATION TREATMENT PROCEDURES

The principal aim of preservation work is to halt the process of deterioration and stabilize the item's condition, to sustain the integrity of the historic element, feature or structure being preserved. Cyclic maintenance is often required as well as repair work. Repair is required where specifically indicated. The following procedures shall be followed:

1. Retain as much existing material as possible; repair and consolidate rather than replace.
  2. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.
  3. Use reversible processes wherever possible.
  4. Use traditional replacement materials and techniques if possible. New work shall be distinguishable from old work and original materials and techniques.
  5. Record the existing condition before commencing with repair work; document with preconstruction photos, sketches and field notes. Record repair work during construction with periodic construction photos and daily inspection reporting. Photo documentation is specified in Division 01 Section "Photo Documentation For Historic Preservation Projects".
- B. Prohibit smoking by personnel performing work on or near historic structures.
- C. Notify Contracting Officer of visible changes in the integrity of material or components whether due to environmental causes including biological attack, UV degradation, freezing, or thawing; or due to structural defects including cracks, movement, or distortion.
1. Do not proceed with the work in question until directed by Contracting Officer.

- D. Where Work requires existing features to be removed, cleaned, and reinstalled, perform these operations without damage to the material itself, to adjacent materials, or to the substrate.
- E. Identify new or replacement materials and features with inconspicuous, permanent marks to distinguish them from original materials. Record the legend of identification marks and the locations of these marks on Record Drawings.
- F. When cleaning, match samples of existing materials that have been cleaned and identified for acceptable cleaning levels. Avoid over-cleaning to prevent damage to existing materials during cleaning. Only the gentlest methods available should be attempted. Initiate cleaning using hand cleaning methods before introducing power cleaning methods and equipment.

END OF SECTION 01 35 91



## SECTION 01 40 00 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements. The quality of all work shall be the responsibility of the Contractor.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with the Contract Document requirements.
- C. See Divisions 02 through 49 Sections for specific test and inspection requirements.

#### 1.2 DEFINITIONS

- A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the work to evaluate that actual products incorporated into the work and completed construction comply with requirements.
- C. Preconstruction Testing: Tests and inspections that are performed specifically for the project before products and materials are incorporated into the work to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by a Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or a testing agency qualified to conduct product testing, to establish product performance and compliance with industry standards.
- E. Source Quality Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- F. Field Quality Control Testing: Tests and inspections that are performed on-site for installation of the work and for completed work.
- G. Testing Agency or Laboratory: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Using a term such as “carpentry” does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as “carpenter.” It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.

### 1.3 SUBMITTALS

A. Quality Control Plan:

1. After contract award and before the Pre-Construction conference, submit for approval a written Contractor Quality Control (CQC) plan.
2. If the plan requires any revisions or corrections, the Contractor shall resubmit the plan within 10 days.
3. The Government reserves the right to require changes in the plan during the contract period as necessary to obtain the quality specified.
4. No change in the approved plan may be made without written concurrence by the Contracting Officer.

B. Qualification Data: For testing agencies specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Contractor's Quality Control Daily Reports: Submit showing all inspections and tests on the first workday following the date covered by the report. Quality Control Supervisor shall utilize the DSC forms available by accessing the DSC Workflows website, <http://www.nps.gov/dscw/publicforms.htm>.

1. Review CMR Dailies and reconcile any differences prior to posting CQC Dailies on the SharePoint Project Website.

D. Test Reports

1. Test reports shall be completed by the person performing the test.
2. Submit Daily Test Information Sheets with Quality Control Daily Reports.
3. Submit failing test results and proposed remedial actions within four hours of noted deficiency.
4. Submit three copies of complete test results no later than one calendar day after the test was performed.

E. Accessibility Inspection Report:

1. Fill out the applicable sections of the Accessibility Inspection Report and attach to the Quality Control Daily Report.
2. Utilize the attached Accessibility Inspection form to document compliance with the Architectural Barriers Act Accessibility Standards (ABAAS).
3. Inspect at various stages of construction as needed to insure the finished product meets the standards.
4. Submit report not later than one calendar day after the inspection was performed.

- F. Off-Site Inspection Reports: Submit prior to shipment.
- G. If the CQC plan and Quality Control Daily Reports are not submitted as specified, the Contracting Officer may retain all payments until such time a plan is accepted and implemented, or may retain payments for work completed on days there are no Quality Control Daily Reports.
- H. Permits, Licenses, and Certificates: For NPS records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the work.

#### 1.4 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated (including Structural Tests and Special Inspections (STSI). Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
- F. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

#### 1.5 QUALITY CONTROL

- A. The Contractor is responsible for all testing and inspections, including Structural Tests and Special Inspections (STSI), as identified in the attached STSI. Inspect and test work as needed to ensure that the quality of materials, workmanship, construction, finish, and functional performance are in compliance with applicable specifications, drawings, and those required by the Building Code.
  - 1. Engage a qualified testing agency to perform these quality-control services.
  - 2. Submit the appropriate report, for each quality-control service.
  - 3. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 4. The Contracting Officer may designate test locations.

- B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- C. Re-testing/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with NPS and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Contracting Officer and Contractor promptly of irregularities or deficiencies observed in the work during performance of its services.
  - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  - 4. Submit 3 copies of the certified written report of each test, inspection, and similar quality-control service through Contractor.
  - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the work.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  - 1. Access to the work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Delivery of samples to testing agencies.
  - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## PART 2 - PRODUCTS

### 2.1 QUALITY CONTROL PLAN

- A. The Quality Control Plan shall include:
  - 1. A list of personnel responsible for quality control and assigned duties. Include each person's qualifications.

2. A copy of a letter of direction to the Contractor's Quality Control Supervisor outlining assigned duties.
3. Names, qualifications, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms.
4. Methods of performing, documenting, and enforcing quality control of all work.
5. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.

## PART 3 - EXECUTION

### 3.1 OFF-SITE CONTROL

- A. Items that are fabricated or assembled off-site shall be inspected for quality control at the place of fabrication.

### 3.2 ON-SITE CONTROL

#### A. Notification:

1. Notify the Contracting Officer at least 48 hours in advance of the preparatory phase meeting.
2. Notify the Contracting Officer at least 24 hours in advance of the initial and follow-up phases.

#### B. Preparatory Phase: Perform before beginning each feature of work.

1. Review control submittal requirements with personnel directly responsible for quality assurance and quantity control of the work. As a minimum, the Contractor's Quality Control Supervisor and the foreman responsible for the feature of work shall be in attendance.
2. Review all applicable specifications sections and drawings related to the feature of work.
3. Ensure that copies of all referenced standards related to sampling, testing, and execution for the feature of work are available on site.
4. Ensure that provisions have been made for field control testing.
5. Examine the work area to ensure that all preliminary work has been completed.
6. Verify all field dimensions and advise the Contracting Officer of discrepancies with contract documents.
7. Ensure that necessary equipment and materials are at the project site and that they comply with approved shop drawings and submittals.
8. Document all preparatory phase activities and discussions on the Contractor's Quality Control Daily Report.

#### C. Initial Phase:

1. As soon as work begins, inspect and test a representative portion of a particular feature of work for quality of workmanship.
2. Review control testing procedures to ensure compliance with contract requirements.
3. Document all initial phase activities and discussions on the Contractor's Quality Control Daily Report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

- D. Follow-Up Phase: Inspect and test as work progresses to ensure compliance with contract requirements until completion of work.
- E. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be required on the same feature of work for the following reasons:
  - 1. Quality of on-going work is unacceptable.
  - 2. Changes occur in the applicable quality control staff, on-site production supervision, or work crew.
  - 3. Work on a particular feature of work is resumed after a substantial period of inactivity.

### 3.3 DOCUMENTATION

- A. Maintain Quality Control Daily Reports, Daily Test Report Information Sheets, and Accessibility Inspection Reports (Forms may be downloaded from the DSC Workflows website, <http://www.nps.gov/dscw/publicforms.htm>.) of quality control activities and tests.
- B. Quality Control Daily Reports may not be substituted for other written reports required under clauses of the contract, such as Disputes, Differing Site Conditions, or Changes.

### 3.4 ENFORCEMENT

- A. The Contractor shall stop work on any item or feature pending satisfactory correction of any deficiency noted by the quality control staff or the Contracting Officer.

### 3.5 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Comply with the Contract Document requirements for Division 01 Section “Cutting and Patching.”
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

## SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 SUMMARY

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

#### 1.2 DEFINITIONS

- A. Permanent Enclosure: As determined by Contracting Officer, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

#### 1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum as required.
- B. Water Service: Water from existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations without any additional permit costs.
- C. Electric Power Service: Electric power from existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations without any additional permit costs.

#### 1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Environmental Protection: Provide environmental protection as required by agency(ies) with jurisdiction and as indicated in the Contract Documents. Coordinate with requirements of the following:
  - 1. Regulatory Requirements.
  - 2. Indoor Air Quality (IAQ) Management.
  - 3. Noise & Acoustics Management.
  - 4. Environmental Management.
  - 5. Construction Waste Management.

## 1.5 PROJECT CONDITIONS

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Temporary materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.
- B. Pavement: Comply with Division 32 [Section "Asphalt Paving."] [Section "Concrete Paving."] [pavement Sections.]
- C. Barrier Tape: Yellow tape Imprinted with "CAUTION: CONSTRUCTION AREA", manufactured by Reef Industries, Inc., Houston, Texas, or approved equal.
- D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

### 2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, NPS, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services. Acquire all necessary permits.
- B. Storm Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.



- C. Sanitary Facilities: Provide temporary toilets, and wash facilities for use by construction personnel.
  - 1. Place in approved locations secluded from public observation and convenient to work stations. Relocate as work progress requires.
  - 2. Maintain and clean toilet facilities at least weekly.
  - 3. Completely remove sanitary facilities on completion of work.
- D. Electric Power Service: Use of existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to the NPS.
  - 1. When temporary connections are removed, restore existing utility services to their original condition.
- E. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
  - 1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 50 feet of building lines. Comply with NFPA 241.
  - 2. Maintain support facilities until near Substantial Completion. Remove structures, equipment, and furnishings, and terminate services after punch list is 100 percent completed or when directed by Contracting Officer. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Contracting Officer.
- B. Traffic Controls: Erect and maintain barricades, lights, danger signals, and warning signs in accordance with Manual on Uniform Traffic Control Devices (MUTCD), Part IV, latest edition.
  - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
  - 3. Illuminate barricades and obstructions at night; keep safety lights burning from sunset to sunrise.
  - 4. Adequately barricade and post open cuts in or adjacent to thoroughfares.
  - 5. Protect pedestrian traffic by guardrails or fences.
  - 6. When pedestrian traffic is detoured onto a roadway, provide temporary walkways with protection as required at ends and overhead. For walkways, use lumber running parallel to direction of traffic movement and provide ramps at changes of elevation.
  - 7. Cover pipes, hoses, and power lines crossing sidewalks and walkways with troughs using beveled edge boards.
  - 8. Install Barrier Tape where directed by Contracting Officer. Keep a minimum of two rolls on site at all times
- C. Parking: Use designated areas of existing parking areas for construction personnel.

- D. Dewatering Facilities and Drains: Comply with requirements of the agency(ies) with jurisdiction. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
  - 2. Remove snow and ice as required to minimize accumulations.
- E. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings. Fence, barricade, or otherwise block off the immediate work area to prevent unauthorized entry.
  - 1. Provide temporary, directional signs for construction personnel and visitors.
  - 2. Maintain and touchup signs so they are legible at all times.
  - 3. Erect and maintain sufficient detour signs at road closures and along detour routes.
- F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of agency(ies) with jurisdiction.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Cleaning of Equipment: The Contractor shall ensure that prior to moving on to the Project Area, all equipment, is free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. Ensure that all equipment has been pressure washed and is free of exotic species prior to start-up of operations and moving of equipment to Project Area. Equipment shall be considered free of soil, seeds, and other debris when a visual inspection does not disclose such material. Disassembly of equipment components or specialized inspection tools are not required.
- C. Temporary Erosion and Sedimentation Control: Refer to Section 01 57 23 "Temporary Storm Water Pollution Prevention".
- D. Tree and Plant Protection: Refer to Section 01 11 00 "Summary of Work".
- E. Pest Control: Follow NPS requirements and practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

### 3.5 OPERATION, TERMINATION, AND REMOVAL

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

END OF SECTION 01 50 00

## SECTION 01 57 19.11 – INDOOR AIR QUALITY MANAGEMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes:

1. Special requirements for Indoor Air Quality (IAQ) management during construction operations.
  - a. Control of emissions during construction.
  - b. Moisture control during construction.
2. Procedures for testing baseline IAQ. Baseline IAQ requirements specify maximum indoor pollutant concentrations for acceptance of the facility.

#### 1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- B. Adequate ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.
- C. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation, or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Throughout this specification, hazardous material includes hazardous chemicals.
1. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).
- D. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.
- E. Interior final finishes: Materials and products that will be exposed to interior occupied spaces; including flooring, wall covering, finish carpentry, and ceilings.
- F. Packaged dry products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.

- G. Wet products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

### 1.3 QUALITY ASSURANCE

- A. Inspection and Testing Lab Qualifications: Minimum of 5 years experience in performing the types of testing specified herein.

### 1.4 SUBMITTALS

- A. Indoor Air Quality (IAQ) Management Plan: After award and before the Pre-construction conference, prepare and submit an IAQ Management Plan including, but not limited to, the following:

- 1. Procedures for control of emissions during construction.

- a. Identify schedule for application of interior finishes: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.
- b. Identify potential sources of odor and dust.
- c. Identify construction activities likely to produce odor or dust.
- d. Identify areas of project potentially affected, especially occupied areas.
- e. Evaluate potential problems by severity and describe methods of control.
- f. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
- g. Describe cleaning and dust control procedures.
- h. Describe coordination with commissioning procedures.

- 2. Procedures for moisture control during construction.

- a. Identify porous materials and absorptive materials.
- b. Identify schedule for inspection of stored and installed porous and absorptive materials.

- 3. Revise and resubmit Plan as required by Contracting Officer.

- a. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

- B. Product Data:

- 1. Submit product data for filtration media used during construction and during operation. Include Minimum Efficiency Reporting Value (MERV).
- 2. Material Safety Data Sheets: Submit MSDSs for inclusion in Operation and Maintenance Manual for the following products.
  - a. Adhesives.

- b. Floor and wall patching/leveling materials.
- c. Caulking and sealants.
- d. Insulating materials.
- e. Fireproofing and firestopping.
- f. Carpet.
- g. Paint.
- h. Clear finish for wood surfaces.
- i. Lubricants.
- j. Cleaning products.

C. Inspection and Test Reports:

- 1. Moisture control inspections.
- 2. Moisture content testing.
- 3. Moisture penetration testing.
- 4. Microbial Growth testing.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 IAQ MANAGEMENT - EMISSIONS CONTROL

- A. During construction operations, follow the recommendations in SMACNA IAQ Guidelines for Occupied Buildings under Construction.
- B. HVAC Protection:
  - 1. Seal return registers during construction operations.
  - 2. Provide temporary exhaust during construction operations
  - 3. To the greatest extent possible, isolate and/or shut down the return side of the HVAC system during construction. When ventilation system must be operational during construction activities, provide temporary filters at all air inlets (returns) and at all locations for filters prescribed in the design.
  - 4. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
- C. Source Control: Provide low and zero VOC materials as specified.
- D. Pathway Interruption: Isolate areas of work as necessary to prevent contamination of clean or occupied spaces. Provide pressure differentials and/or physical barriers to protect clean or occupied spaces.
- E. Housekeeping: During construction, maintain project and building products and systems to prevent contamination of building spaces.
- F. Temporary Ventilation: For materials/products that generally require ventilation for off gassing, provide an ACH (air changes per hour) of 1.5 or more and as follows:

1. Provide minimum 48 hour pre-ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degree F maximum continuously during the ventilation period. Do not ventilate within limits of Work unless otherwise approved by Contracting Officer.
  2. Provide adequate ventilation during and after installation of interior wet products and interior final finishes.
  3. Provide filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 during construction and a MERV as described in the construction documents during NPS occupancy. Coordinate with work of Division 23 (15), Heating Ventilating and Air Conditioning (HVAC).
- G. Scheduling: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.
- H. Flush-Out: After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.
1. Obtain Contracting Officers concurrence that construction is complete enough before beginning flush-out.
  2. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during or after flush-out then the flush-out process must be restarted.
  3. Install new HVAC filtration media in all locations identified to have permanent filtration in the contract documents after completion of flush-out and before occupancy or further testing.

### 3.2 IAQ MANAGEMENT - MOISTURE CONTROL

- A. Housekeeping:
1. Keep materials dry. Protect stored on-site and installed absorptive materials from moisture damage.
  2. Verify that installed materials and products are dry prior to sealing and weatherproofing the building envelope.
  3. Store interior absorptive materials only after building envelope is sealed and weatherproofed.
- B. Inspections: Document and report results of inspections; state whether or not inspections indicate satisfactory conditions.
1. Examine materials for dampness as they arrive. If acceptable to Contracting Officer, dry damp materials completely prior to installation; otherwise, reject materials that arrive damp.
  2. Examine materials for mold as they arrive and reject materials that arrive contaminated with mold.
  3. Inspect stored and installed absorptive materials regularly for dampness and mold growth. Inspect weekly, after each rain event.

- a. Where stored on-site or installed absorptive materials become wet, notify Contracting Officer. Inspect for damage. If acceptable to the Contracting Officer, dry completely prior to closing in assemblies; otherwise, remove (in accordance with the Waste Management Plan) and replace with new materials.
4. Basement: Monitor basement and crawlspace humidity, and dehumidify when relative humidity is greater than 70 percent for more than 2 weeks or at the first sign of mold growth.
5. Site drainage: Verify that final grades of site work and landscaping drain surface water and ground water away from the building.
6. Weather-proofing: Inspect moisture control materials as they are being installed. Include the following:
  - a. Air barrier: Verify air barrier is installed without punctures and/or other damage. Verify air barrier is sealed completely.
  - b. Flashing: Verify correct shingling of the flashing for roof, walls, windows, doors, and other penetrations.
  - c. Vapor Barrier: Verify that vapor barrier is installed in accordance with the Contract documents.
  - d. Insulation layer: Verify insulation is installed without voids.
  - e. Roofing: In accordance with ASTM D7186 Standard Practice for Quality Assurance Observation of Roof Construction and Repair
7. Plumbing: Verify satisfactory pressure test of pipes and drains is performed before closing in and insulating lines.
8. HVAC: Inspect HVAC system as specified in Section on Commissioning. And inspect HVAC to verify:
  - a. condensate pans are sloped and plumbed correctly.
  - b. access panels are installed to allow for inspection and cleaning of coils and ductwork downstream of coils;
  - c. ductwork and return plenums are air sealed;
  - d. duct insulation is installed and sealed; and
  - e. chilled water line and refrigerant line insulation are installed and sealed.]

C. Schedule:

1. Schedule work such that absorptive materials, including but not limited to porous insulations, paper-faced gypsum board, ceiling tile, and finish flooring, are not installed until they can be protected from rain and construction-related water.
2. Weather-proof as quickly as possible. Schedule installation of moisture-control materials, including but not limited to air barriers, flashing, exterior sealants and roofing, at the earliest possible time.

- D. Testing for Moisture Content: Test moisture content of porous materials and absorptive materials to ensure that they are dry before sealing them into an assembly. Document and report results of testing. Where tests are not satisfactory, dry materials and retest. If satisfactory results cannot be obtained with retest, remove and replace with new materials.



1. Concrete: Moisture test prior to finish flooring application as specified in Division 09 (9). Moisture test as per one or more of the following; unless otherwise indicated, acceptable upper limits for concrete are < 4% top inch; < 85% headspace RH; <3 lbs/1000ft<sup>2</sup>/day:
  - a. ASTM D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
  - b. ASTM F1869 Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - c. ASTM F2170 Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes]
2. Wood: Moisture test as per ASTM D4444 - Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters; unless otherwise indicated acceptable upper limits for wood products are < 20% at center of piece; < 15% at surface.

E. Testing for Moisture Penetration:

1. Windows: Test as per ASTM E1105 Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference; unless otherwise indicated, acceptable upper limits are no leakage for 15 minutes.
2. Horizontal Waterproofing (not roofing): Test as per ASTM D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations; acceptable upper limits are no leakage for 15 minutes.
3. Masonry: Test as per ASTM C1601 Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces; acceptable upper limits are no leakage for 15 minutes.
4. Exterior Walls:
  - a. Air tightness of the enclosure test: ASTM E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization or ASTM E1827 Standard Test Methods for Determining Air tightness of Buildings Using an Orifice Blower Door; acceptable upper limits are 0.25 CFM/sf or less at 50 Pascals.
  - b. Water Leakage: Review as per ASTM E2128 Standard Guide for Evaluating Water Leakage of Building Walls.

### 3.3 ASBESTOS

- A. Area of concern:
  - 1. Cellar (Main house)
    - a. Do not use Asbestos tape on the warm-air duct joints
- B. All asbestos should be removed prior to any work
- C. All suspected material should be tested by a licensed asbestos testing service.
  - 1. Clean out the interior of all ductwork to assure all ducted air is free of asbestos and any other contaminants.
  - 2. A general cleaning should be undertaken to remove potentially unsafe or contaminated surfaces and air quality.

END OF SECTION 01 57 19.11

## SECTION 01 57 23 – UNDER-AN-ACRE POLLUTION PREVENTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. NPS Standards and Guidelines require that water quality be protected at all times to ensure compliance with the Organic Act. The Contractor shall prepare an Under-An-Acre Pollution Prevention Plan (UPPP) for each project resulting in less than 1 acre of soil disturbance or not otherwise subject to the requirements of the NPDES program. *[ Link to the UPPP GUIDE].*
- B. The work of this section consists of implementing measures to Temporary Storm Water Pollution during construction activities, either through compliance with the NPDES permit program; Or in conformance with NPS guidance for UPPPs.

#### 1.2 DEFINITIONS

- A. Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.
- B. UPPP: Developed and implemented pollution prevention plan (including stormwater management measures, if needed) to protect the environment from pollutants on construction projects with less than one acre of disturbance in conformance with NPS guidelines.

#### 1.3 SUBMITTALS

- A. After contract award and before the pre-construction conference, prepare and submit:
  - 1. A UPPP in conformance with NPS guidelines and adherence to all applicable construction storm water management practices.
- B. Inspection Schedule: Submit schedule for inspection and monitoring of all pollution prevention measures.
- C. Erosion Control Products: Submit manufacturer's product information and installation recommendations for silt fence, filter fabric, erosion control blanket, straw bales, and any other materials proposed for use on this project.

#### 1.4 QUALITY ASSURANCE

- A. The Contractor shall prepare and submit a plan to the Contracting Officer (CO) for review and concurrence.
- B. Orientation Meeting: The Contractor shall be responsible for arranging and conducting a Pollution Prevention meeting/briefing to inform all parties scheduled to be on-site during the project of the

measures to be implemented for proper pollution prevention and control (may be included as part of the Pre-Construction Meeting).

1. Installation of silt fences, storm drain protection, and all other forms of pollution prevention controls shall not begin until after this meeting has occurred.
- C. Pollution Prevention Manager: The Contractor shall designate the Pollution Prevention Manager who will be responsible for the implementation, inspection, maintenance, and amendments to the approved plan.
1. The Pollution Prevention Manager shall be familiar with UPPP procedures and Best Management Practices (BMPs) and shall ensure that emergency procedures and the plan are updated as needed and available for inspection.
  2. When changes in the approved plan are required, the Pollution Prevention Manager shall prepare and certify an amendment and submit to the CO for review and concurrence.

## PART 2 - PRODUCTS

### 2.1 UNDER-AN-ACRE POLLUTION PREVENTION PLAN:

- A. Provide a UPPP which conforms to all NPS requirements (utilize [UPPP template](#)) and include the following information and forms:
1. Responsible Parties
  2. General Information: Project Scope, Project Details, Site Information, and Spill Prevention.
  3. Standards and Constraints
  4. Project Scheduling
  5. Known Data on Soil and Fill
  6. Activities with the Potential to Generate Sediment
  7. Activities and Materials with the Potential to Pollute Storm Water
  8. Management and Reporting BMPs
  9. Waste Management BMPs
  10. Non-Storm Water Pollution Control BMPs
  11. Soil Stabilization BMPs
  12. Sediment Control BMPs
  13. Other Pollution Control BMPs
  14. References
  15. Preparer's Certification
  16. Appendices: Contact Information, Pollution Prevention Control Map or Sheet(s), Standard Installation Specifications for each BMP, and Blank forms.

## PART 3 - EXECUTION

### 3.1 ENVIRONMENTAL PROTECTION

- A. Protection of Natural Resources: Comply with applicable regulations and these specifications. Preserve the natural resources within the project boundaries and outside the limits of work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by the CO.
- B. Construction Zone: Arrange construction activities to minimize pollution (i.e., erosion, trash, etc.) to the maximum practical extent.
  - 1. Clearing, excavation, and grading shall be limited to those areas of the project site necessary for construction. Minimize the area exposed and unprotected.
  - 2. Clearly mark and delineate the limits of work activities.
  - 3. Equipment shall not be allowed to operate outside the limits of work or to disturb existing vegetation.
  - 4. Excavation and grading shall be completed during the dry season to the maximum extent possible
  - 5. Material should be stored away from locations where water is present to the greatest extent practicable.

### 3.2 UNDER-AN\_ACRE POLLUTION PREVENTION PLAN

- A. Review and Acceptance: The Contractor and the CO will jointly review the draft Plan and agree to any needed revisions. The Contractor shall incorporate all revisions, sign, and submit the final Plan to the CO. The final Plan will be the document enforced on the project.
  - 1. The accepted Plan will describe and ensure implementation of the practices which will be used to reduce the pollutants in storm water discharges.
  - 2. The Contractor shall maintain a current copy of the Plan and all associated records and forms at the jobsite throughout the duration of the project.
  - 3. The Plan shall be available at all times for public inspection and for the inspection and use of the CO.
  - 4. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.
- B. Implementation: Implement the Plan as required throughout the construction period and maintain all erosion control elements in proper working order.
  - 1. Do not perform clearing and grubbing or earthwork until the Plan has been implemented.

### 3.3 SITE INSPECTIONS AND PLAN REVISIONS

- A. Inspections: The Contractor and the CO will perform a weekly inspection of the site.

1. The inspection shall include disturbed areas that have not been completely stabilized, areas used for storage of materials, locations where vehicles enter or exit the site, and all other erosion and sediment controls that are included in the Plan.
  2. Inspections shall be documented.
  3. The inspection forms shall be retained onsite in the Plan notebook throughout the construction period.
- B. Plan Revisions: It may be necessary to revise the Plan during construction to make necessary improvements, revisions, or to respond to unforeseen conditions noted during construction or site inspections.
1. The Plan shall specify the mechanism whereby revisions may be proposed by the Contractor or the CO.
  2. The Contractor and the CO will jointly review each revision to the Plan before changes are incorporated and implemented. The Contractor will then provide a revised copy of the Plan to the CO.
  3. Accepted modifications will be implemented within 7 calendar days following the date of the inspection when deficiencies or necessary corrections are first noted.
- C. Negligence: Provide additional temporary erosion and pollution controls made necessary by Contractor's errors or negligence at no additional cost to the Government.

### 3.4 EROSION CONTROL MEASURES

- A. Erosion control measures shall consist of any and all BMPs for storm water discharges, including but not limited to silt fencing, barrier protectors, straw bales, temporary soil retention blankets, excelsior drainage filters, sediment traps and berms.
- B. Berms and excelsior drainage filters shall be used to form sediment traps and to control run-on and run-off into other areas, including creeks, streams, marshes, access roads, well areas, and the staging areas.
- C. Erosion control measures shall be used to contain only direct precipitation in the construction zone. The contained water shall be allowed to percolate into the ground or drain slowly through the drainage filter sediment traps.
- D. Earthen sediment traps or holding ponds shall not be used unless accepted by the CO.
- E. Reduce runoff velocity as well as direct surface runoff around and away from all fuel containment, storage, and borrow areas.
- F. Divert surface runoff around and away from cut and fill slopes.
- G. Place drainage filters around all catch basins to create sediment traps to control run-off from the construction area.
- H. Excess water used for dust control shall be contained within the demolition areas by the erosion control measures.

- I. The Contractor shall prevent the deposition of materials onto paved areas. The Contractor shall inspect the paved areas for deposited materials weekly and remove the materials immediately.
- J. Furnish, install, maintain, and operate necessary control measures and other equipment necessary to prevent erosion as described in the approved UPPP.
- K. Before the work begins, sufficient equipment shall be available on the site to assure that the operation and adequacy of the erosion control system can be maintained.

### 3.5 MAINTENANCE OF TEMPORARY FACILITIES

- A. Ensure erosion and sediment control structures remain effective throughout excavation and grading operations. Relocate structures as necessary.
- B. Inspect control structures after each significant rainfall. Promptly repair breaches which occur.
- C. The Contractor shall remove entrapped sediment from behind excelsior drainage filter after each storm.

### 3.6 REPORTING

- A. If a discharge occurs or if the project receives a written notice or order from any regulatory agency, the Contractor will immediately notify the CO and will file a written report to the Agency(ies) with Jurisdiction within 7 days of the discharge event, notice, or order. Corrective measures shall be implemented immediately following the discharge, notice, or order. The report to the Agency(ies) with Jurisdiction shall contain the following items at a minimum:
  - 1. The date, time, location, nature of operation, and type of discharge, including the cause or nature of the notice or order.
  - 2. The BMPs deployed before the discharge event, or prior to receiving the notice or order.
  - 3. The date of deployment and type of BMPs deployed after the discharge event, or after receiving the notice or order, including additional BMPs installed or planned to reduce or prevent re-occurrence.
  - 4. An implementation and maintenance schedule for any affected BMPs.

### 3.7 SEDIMENT DISPOSAL

- A. Sediment excavated from temporary sediment control structures shall be disposed on the site with general fill, or with topsoil. Sediment shall be allowed to dry out as required before reuse.
- B. Contractor shall place the sediment removed from traps and other structures where it will not enter a storm drain or watercourse and where it will not immediately reenter the basin.

### 3.8 REMOVAL OF TEMPORARY POLLUTION CONTROL MEASURES

- A. All temporary control measures shall be removed with permission of the CO within 20 working days after final acceptance of the project, and/or once grading is completed and slopes have stabilized.

END OF SECTION 01 57 23



## SECTION 01 67 00 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and environmental requirements.

#### 1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility[, **except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise**]. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- D. Biobased Materials: As defined in the Farm Security and Rural Investment Act, for purposes of Federal procurement of biobased products, "biobased" means a "commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials." Biobased materials also include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by The Biomass Research and Development Act of 2000.
  - 1. Biobased content: The amount of biobased carbon in the material or product as a percentage of weight (mass) of the total organic carbon in the material or product.

- E. Chain-of-Custody: Process whereby a product or material is maintained under the physical possession or control during its entire life cycle.
- F. Environmentally preferable products: Products and services that have a lesser or reduced effect on the environment in comparison to conventional products and services. Refer to EPA's Final Guidance on Environmentally Preferable Purchasing for more information <http://www.epa.gov/oppt/epp/>.
- G. Stewardship: Responsible use and management of resources in support of sustainability.
- H. Sustainability: The maintenance of ecosystem components and functions for future generations.
  - 1. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock. Recycled content claim shall be consistent with ISO 140001 Standard for the Use of Environmental Marketing Claims.
  - 2. Rapidly Renewable Material: Material made from plants that are typically harvested within a ten-year cycle.
  - 3. Regional Materials: Materials that are manufactured and extracted, harvested, or recovered within a radius of 500 miles from the Project location.

### 1.3 SUBMITTALS

- A. Record Submittals as specified in – Sustainable Design Close-Out Documentation, submit the following:
  - 1. Affirmative Procurement Reporting Form. Submit on form in Appendix A of this Section, or similar form as approved by Contracting Officer.
  - 2. Submit environmental data in accordance with Table 1 of ASTM E2129 for the following products:
    - a. Masonry
    - b. Finish Carpentry
    - c. Plastic Fabrications
    - d. Building Insulation
    - e. Roofing
    - f. Joint Sealers
    - g. Wood & Plastic Doors
    - h. Windows
    - i. Skylights
    - j. Glazed Curtain Wall
    - k. Gypsum Board
    - l. Tile
    - m. Acoustical Ceilings
    - n. Resilient Flooring
    - o. Carpet
    - p. Wall Coverings
    - q. Paints & Coatings
    - r. Toilet Compartments
    - s. Loading Dock Equipment
    - t. Office Equipment

- u. Furnishings & Accessories
  - v. Renewable Energy Equipment
  - w. Elevators
  - x. Plumbing fixtures and equipment.
  - y. HVAC equipment
  - z. Lighting equipment
3. Material Safety Data Sheets (MSDS): For each product required by OSHA to have a MSDS, submit an MSDS. MSDS shall be prepared no earlier than June 1998 within the previous five years. Include information for MSDS Sections 1 – 16 in accordance with ANSI Z400.1 and as follows:
- a. Section 1: Chemical Product and Company Identification.
  - b. Section 2: Composition/Information on Ingredients.
  - c. Section 3: Hazards Identification.
  - d. Section 4: First Aid Measures.
  - e. Section 5: Fire Fighting Measures.
  - f. Section 6: Accidental Release Measures.
  - g. Section 7: Handling and Storage.
  - h. Section 8: Exposure Controls/Person Protection.
  - i. Section 9: Physical and Chemical Properties.
  - j. Section 10: Stability and Reactivity Data.
  - k. Section 11: Toxicological Information. Include data used to determine the hazards cited in Section 3. Identify acute data, carcinogenicity, reproductive effects, and target organ effects. Provide written description of the process used in evaluating chemical hazards relative to preparation of the MSDS.
  - l. Section 12: Ecological Information. Include data regarding environmental impacts during raw materials acquisition, manufacture, and use. Include data regarding environmental impacts in the event of an accidental release.
  - m. Section 13: Disposal Considerations. Include data regarding the proper disposal of the chemical. Include information regarding recycling and reuse. Indicate whether or not the product is considered to be "hazardous waste" according to the US EPA Hazardous Waste Regulations 40 CFR 261.
  - n. Section 14: Transportation Information. Identify hazard class for shipping.
  - o. Section 15: Regulatory Information. Identify federal, state, and local regulations applicable to the material.
  - p. Section 16: Other Information. Include additional information relative to recycled content, biobased content, and other information regarding environmental and health impacts. Identify the date MSDS was prepared.
4. Chain Of Custody: Submit chain-of-custody documentation for sustainable forestry for the following products:
- a. Rough Carpentry
  - b. Finish Carpentry
  - c. Wood Doors
  - d. Windows
  - e. Wood Flooring
  - f. Furnishings & Accessories

#### 1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

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

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

#### 1.6 PACKAGING

- A. Where Contractor has the option to provide one of the listed products or equal, preference shall be given to products with minimal packaging and easily recyclable packaging as defined in ASTM D5834.
- B. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.

- C. Provide minimum **[45] [xxxx]** percent post-consumer recycled content and minimum 100 percent recovered fiber content of industrial paperboard in accordance with EPA's Comprehensive Procurement Guidelines and ASTM D5663.
- D. Provide minimum **[10] [15] [xxxx]** percent post-consumer recycled content and minimum **[10] [xxxx] [100]** percent recovered fiber content of carrier board in accordance with EPA's Comprehensive Procurement Guidelines and ASTM D5663.
- E. Provide minimum **[5] [20] [xxxx]** percent post-consumer recycled content and minimum **[5] [40] [xxxx]** percent recovered fiber content of brown papers (e.g., wrapping papers and bags) in accordance with EPA's Comprehensive Procurement Guidelines and ASTM D5663.

#### 1.7 ENVIRONMENTALLY PREFERABLE PRODUCTS

- A. Provide environmentally preferable products to the greatest extent possible.
  - 1. To the greatest extent possible, provide products and materials that have a lesser or reduced effect on the environment considering raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and/or disposal of the product.
  - 2. Eliminate the use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI or the Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account life cycle impacts.
  - 3. Use products meeting or exceeding EPA's recycled content recommendations for EPA-designated products. Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in the project.

#### 1.8 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  - 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  - 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
  - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Government reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Contracting Officer will make selection.
  5. Where products are accompanied by the term "match sample," sample to be matched is Governments.
  6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements or approved equal.
  2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements or approved equal.
  3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements or approved equal.
  4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements or approved equal.
  5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
  6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.

7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product, system, or approved equal.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers, or approved equal. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Contracting Officers decision will be final on whether a proposed product matches.
  - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
  - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Contracting Officer will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
  - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Contracting Officer will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

## 2.2 COMPARABLE PRODUCTS

- A. Conditions: Contracting Officer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Contracting Officer will return requests without action, except to record noncompliance with these requirements:
  1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  5. Samples, if requested.

## PART 3 - EXECUTION

### 3.1 PROTECTION AFTER INSTALLATION

- A. Provide adequate coverings as necessary to protect installed materials from damage resulting from natural elements, traffic, and subsequent construction. Remove when no longer needed.

END OF SECTION 01 67 00



## SECTION 01 73 29 - CUTTING AND PATCHING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching on buildings that do not contain Historic Fabric.

#### 1.2 SUBMITTALS

- A. Cutting and Patching Plan: Submit a Plan describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
  - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
  - 3. Products: List products to be used and firms or entities that will perform the Work.
  - 4. Dates: Indicate when cutting and patching will be performed.
  - 5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
  - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure. Do not cut and patch structural elements in a manner that could change their load carrying capacity or increase deflection.
  - 7. Contracting Officer's: Obtain approval of cutting and patching plan before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

#### 1.3 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

#### 1.4 WARRANTY

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
  - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

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

### 3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

## SECTION 01 73 40 - EXECUTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Coordination with utility service providers.
  - 2. Construction layout.
  - 3. Field engineering and surveying.
  - 4. General installation of products.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
  - 8. Correction of the Work.

#### 1.2 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor professional engineer certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit two copies signed by land surveyor professional engineer.
- D. Quantity Surveys: Submit 2 copies showing quantities of work performed and actual construction completed and in place.

#### 1.3 QUALITY ASSURANCE

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

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 COORDINATION WITH UTILITY SERVICE PROVIDERS

- A. Coordination with Utility Service Providers: Contact the following Utility Service providers, sufficiently in advance to avoid delaying the work, to coordinate the contractor's portion of the work, testing requirements, inspections, etc.
  - 1. Electrical: Service Contact: Contact the local power supply company to coordinate Electrical service requirements.
    - a. Construction Contractor Responsibilities: Contractor is responsible for obtaining temporary electric power as required for use to complete project.

### 3.3 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to the Contracting Officer in accordance with Division 01 Specification 01 31 00 "Project Management and Coordination".

### 3.4 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the existing benchmarks. If discrepancies are discovered, notify Contracting Officer promptly.
- B. General: Engage a land surveyor professional engineer to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 3. Inform installers of lines and levels to which they must comply.
  - 4. Check the location, level and plumb, of every major element as the Work progresses.
  - 5. Notify the Contracting Officer when deviations from required lines and levels exceed allowable tolerances.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by NPS.

### 3.5 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations. Controls that are destroyed by Contractor will be replaced by the Contractor at their expense.
  - 1. Existing Monuments: All bench marks, land corners, and triangulation points, established by other surveys, existing within the construction area shall be preserved. If existing monuments interfere with the work, secure written permission before removing them.
- B. Benchmarks: Establish and maintain a minimum of [two] <Insert number> permanent benchmarks on Project site, referenced to data established by survey control points. Comply with NPS requirements for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

### 3.6 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by the Contracting Officer.
  2. Allow for building movement, including thermal expansion and contraction.
  3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.
- J. Quantity surveys: Shall be conducted, and the data derived from these surveys shall be used in computing the quantities of work performed and the actual construction completed and in place.
1. The Contractor shall conduct the original and final surveys and surveys for any periods for which progress payments are requested. All these surveys shall be conducted under the direction of a representative of the Contracting Officer, unless the Contracting Officer waives this requirement in a specific instance. The Government shall make such computations as are necessary to determine the quantities of work performed or finally in place. The Contractor shall make the computations based on the surveys for any periods for which progress payments are requested.
  2. Promptly upon completing a survey, the Contractor shall furnish the originals of all field notes and all other records relating to the survey or to the layout of the work to the Contracting Officer, who shall use them as necessary to determine the amount of progress payments. The Contractor shall retain copies of all such material furnished to the Contracting Officer.

### 3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.



2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
  3. Contractor shall provide progress cleaning that minimizes sources of food, water, and harborage available to pests.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
1. Utilize non-toxic cleaning materials and methods.
    - a. Comply with GS 37 for general purpose cleaning and bathroom cleaning.
    - b. Use natural cleaning materials where feasible. Natural cleaning materials include:
      - 1) Abrasive cleaners: substitute 1/2 lemon dipped in borax.
      - 2) Ammonia: substitute vinegar, salt and water mixture, or baking soda and water.
      - 3) Disinfectants: substitute 1/2 cup borax in gallon water.
      - 4) Drain cleaners: substitute 1/4 cup baking soda and 1/4 cup vinegar in boiling water.
      - 5) Upholstery cleaners: substitute dry cornstarch.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- K. Final Cleaning: At completion of Work, remove all remaining waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all exposed surfaces; leave Project clean and ready for occupancy.
1. Provide final cleaning in accordance with ASTM E1971.

### 3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

### 3.9 PROTECTION OF INSTALLED CONSTRUCTION

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

### 3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 40

## SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition and construction waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.

#### 1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Solid Waste: Garbage, debris, sludge, or other discharged material (except hazardous waste) including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations.
- D. Debris: Non-hazardous solid waste generated during the construction, demolition, or renovation of a structure which exceeds 2.5 inch (60 mm) particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders). A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.
- E. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- F. Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.
- G. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.
- H. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261.

- I. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- J. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Project shall minimize creation of construction, deconstruction, and demolition waste to protect and restore natural habitat and resources. Factors that contribute to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, and contamination shall be minimized. A Waste Management Plan shall be developed to ensure that existing site and building materials are reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.
- B. Salvage /Recycle Requirements: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 75 percent by weight of total waste generated by the Work. The following waste categories, at a minimum, shall be diverted from a landfill:
  - 1. Land clearing debris (chipped debris can be used on site for mulch or erosion control)
  - 2. Clean dimensional wood, pallets
  - 3. Plywood, OSB, and particle board
  - 4. Concrete (can be ground and used for fill on site)
  - 5. Asphaltic concrete (can be ground and used for fill on site)
  - 6. Cardboard, paper, packaging, newsprint
  - 7. Metals (from banding, stud trim, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze)
  - 8. Gypsum drywall—unpainted
  - 9. Non-hazardous paint and paint cans
  - 10. Beverage containers: Aluminum, glass, and plastic containers
  - 11. Insulation
  - 12. Ceiling grid and tiles
  - 13. Ductwork
  - 14. Wiring
  - 15. Other mixed construction and demolition waste as appropriate
- C. If any waste materials encountered during the deconstruction/demolition or construction phase are found to contain lead, asbestos, PCBs, (such as fluorescent lamp ballasts), or other harmful substances, they are to be handled and removed in accordance with local, state, and federal laws and requirements concerning hazardous waste.
- D. Existing items and material to be removed during the deconstruction/demolition phase shall be reused in the construction phase of the Project. Items that cannot be reused shall be recycled. Items considered for reuse must be in refurbishable condition and must meet the quality standards set forth in these specifications. Contractor shall ensure that the quality of the item(s) in question will meet or exceed accepted industry or trade standards for first quality commercial grade application. During construction, deconstruction, or demolition the Contracting Officer may designate other objects or materials for reuse.

- E. Salvage/Recycle Requirements: Government goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:
- F. Salvage/Recycle Requirements: Government goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible. Government has established minimum goals for the following materials:

#### 1.4 SUBMITTALS

- A. Waste Management Plan: After award of contract and prior to the scheduled Pre-Construction Conference, Contractor shall submit a draft Waste Management Plan to the Contracting Officer for approval. Submit 3 copies of plan. Revise and resubmit Plan as required by the Contracting Officer. Approval of Contractor's Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.
- B. Progress Documentation: Supplemental to the Waste Management Plan, document solid waste disposal, diversion, and cost/revenue analysis and submit completed worksheet on a monthly basis. Use Appendix A - Project Waste Management Plan Worksheet, and report totals to date for all column headings. Use Appendix B for solid waste volume to weight conversions.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. LEED™ Submittal: LEED™ letter template for Credit MR 2.1 and 2.2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- I. Qualification Data: For [Waste Management Coordinator] [and] [refrigerant recovery technician].
- J. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

K. Progress payment requirements:

1. With each Application for payment, submit updated Project Waste Management Plan worksheet for solid waste disposal and diversion.
2. With each Application for Payment, submit manifests, weight tickets, receipts, and invoices specifically identifying the Project and waste material.

L. Closeout Submittals

1. With Closeout Submittals, submit a summary of the Project Waste Management Plan worksheet for solid waste disposal and diversion. Submit on form in Appendix A of this Section.

1.5 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED™-Accredited Professional, certified by the USGBC, as waste management coordinator. Waste management coordinator may also serve as LEED™ coordinator.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Waste Management Meeting: Conduct separate meeting or cover in the Pre-Construction Conference and comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
  1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
  2. Review requirements for documenting quantities of each type of waste and its disposition.
  3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  5. Review waste management requirements for each trade.

PART 2 - PRODUCTS

2.1 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification and waste reduction work plan. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  - 2. Salvaged Materials for Sale: For materials sold to individuals and organizations, include list of names, addresses, and telephone numbers.
  - 3. Salvaged Materials for Donation: For materials donated to individuals and organizations, include list of names, addresses, and telephone numbers.
  - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 6. Handling and Transportation Procedures: Include method used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
  - 1. Landfill tip fees/ton
  - 2. If diverted, tip fee savings from landfill diversion
  - 3. Costs of recycling, salvage, or reuse
  - 4. Revenue from recycling, salvage, or reuse
  - 5. Total cost or savings from diversion (Calculate by using tip fee savings and subtracting costs of recycling or adding revenue from recycling)

## PART 3 - EXECUTION

### 3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by the Contracting Officer. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Contractor shall establish contacts with local recycling and reuse companies to set up lines of responsibility. Contractor shall be responsible for coordination in terms of identifying materials, pickup schedules, and standard quality for recycled materials.

- D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- F. Separation facilities:
  - 1. Contractor shall designate and Contracting Officer shall approve a specific area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return.
  - 2. Waste and recycling bins are to be placed near each other, and close to the point of waste generation but out of the traffic pattern.
  - 3. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid co-mingling of materials.
  - 4. Bins shall be protected during non-working hours from off-site contamination.
  - 5. Garbage dumpsters should be checked periodically to monitor recyclables being thrown away or if there are undocumented materials that could be recycled.
- G. Materials handling procedures: Materials to be recycled shall be protected from contamination and shall be handled, stored, and transported in a manner that meets the requirements set by the designated facilities for acceptance. Establish a defined area for the operations of each trade, especially woodcutting so that off-cuts will be kept in one area and can be sorted by dimension for future reuse.

### 3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.
  - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Governments Use:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Allow for inspection if necessary.
  - 4. Store items in a secure area until delivery to Government.
  - 5. Protect items from damage during transport and storage.



### 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:
  - 1. <Insert names and telephone numbers of local recycling receivers and processors of recyclable materials.>
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to contractor.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - 4. Store components off the ground and protect from the weather.
  - 5. Remove recyclable waste off Governments property and transport to recycling receiver or processor.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Grind asphalt to maximum [1-1/2-inch (38-mm)] [4-inch (100-mm)] <insert size> size.
- B. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
  - 1. Crush asphaltic concrete paving and screen to comply with requirements in Division 31 Section "Earth Moving".
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
  - 1. Pulverize concrete to maximum [1-1/2-inch (38-mm)] [4-inch (100-mm)] <insert size> size.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Plumbing Fixtures: Separate by type and size.

- F. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.
- H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
- I. Conduit: Reduce conduit to straight lengths and store by type and size.
- J. Electronic Products: Ensure that all non-usable electronic products are reused, donated, sold, or recycled using environmentally sound management practices at end of life.

### 3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees [on-site] [at landfill facility].
- C. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
  - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

### 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Government property and legally dispose of them.

END OF SECTION 01 74 19

## SECTION 01 77 00 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Project Record Drawings
  - 2. Closeout Submittals
  - 3. Substantial Completion and Final Inspection
  - 4. Permit Closure and Transfer
  - 5. Final Acceptance of the Work
  - 6. Warranties

#### 1.2 PROJECT RECORD DRAWINGS

- A. Maintain one complete full-size set of contract drawings and one full-size set of vendor-supplied drawings. Clearly mark changes, deletions, and additions using National Park Service drafting standards to show actual construction conditions. Show additions in red, deletions in green and special instructions in blue.
- B. Keep record drawings current. Make record drawings available to the Contracting Officer for inspection at the time of monthly progress payment requests. If project record drawings are not current, the Contracting Officer may retain an appropriate amount of the progress payment.
- C. On completion of the total project, submit complete record drawings. Include shop drawings, sketches, and additional drawings that are to be included in the final set, with clear instructions showing the location of these drawings.

#### 1.3 CLOSEOUT SUBMITTALS

- A. A list of closeout requirements has been attached at the end of the Division 1 specifications for your convenience. The intent is to provide an overall summary of requirements and not a comprehensive list. The terms and conditions of the contract still require you to satisfy the requirements of the individual specification sections regardless of what is shown on the list. Submit the following before requesting final inspection:
  - 1. Specific warranties, guarantees, workmanship bonds, final certifications, and similar documents.
  - 2. NPS required forms for occupancy, Fire Sprinkler/Alarm acceptance, and any other similar forms or certificates.
  - 3. Project Record Documents, operation and maintenance manuals, final completion construction digital images recorded on CD-R or DVD-R with index and descriptions, and similar final record information.

4. Posted Operating Instructions: As specified in individual sections. Furnish operating instructions attached to or posted adjacent to equipment. Include wiring diagrams, control diagrams, control sequence, start-up, adjustment, operation, lubrication, shut-down, safety precautions, procedures in the event of equipment failure, and other items of instruction recommended by the manufacturer.
5. Deliver tools, spare parts, extra materials, and similar items to location designated by Contracting Officer. Label with manufacturer's name and model number where applicable.
  - a. Special Tools: One set of special tools required to operate, adjust, dismantle, or repair equipment. Special tools are those not normally found in possession of mechanics or maintenance personnel.
6. Complete final cleaning requirements, including touchup painting.
7. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

#### 1.4 FINAL INSPECTION, SUBSTANTIAL COMPLETION AND ACCEPTANCE PROCEDURES

- A. Request a final inspection in writing when a project or designated portion of a project is substantially complete. The Contracting Officer will proceed with the inspection within 10 days of receipt of the written request or will advise the Contractor of items that prevent the project from being substantially complete.
- B. If the work is determined to be substantially complete, following the final inspection. Contracting Officer will prepare a Punch List and issue a Letter of Substantial Completion.
- C. If the work is not determined to be substantially complete following the final inspection, Contracting Officer will notify Contractor in writing. Contractor shall request a new final inspection after completing the work. Re-inspection costs may be charged against the Contractor in accordance with the Inspection of Construction contract clause.
- D. Contractor shall complete the Punch List within 30 calendar days, documented weather permitting.
- E. If Contractor completes all items of work on the Punch List and all contractually required items, Contracting Officer will issue Letter of final acceptance of work.
- F. If the Contractor fails to complete the work within the time frame, the Contracting Officer may correct the work with an appropriate reduction in contract price or charge for re-inspection costs in accordance with the Inspection of Construction contract clause.

#### 1.5 PERMIT CLOSURE AND TRANSFER

- A. When the construction work covered by the permits is complete, create a list of tasks required to close or transfer the permits to the Park. Submit to Contracting Officer for approval.
- B. After substantial completion and the Punch List has been completed, the permits shall be closed and documented by the Agency(ies) with Jurisdiction for the permit.

- C. If responsibility for permits is to be transferred to the Park, the Park shall be informed of the permit provisions completed and responsibilities that will transfer to park staff.

## 1.6 WARRANTIES

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. See Division 01 Specification Section "Execution" for information on cleaning agents.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Conduct final cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

- a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
  - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
  - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - e. Remove snow and ice to provide safe access to building.
  - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - h. Sweep concrete floors broom clean in unoccupied spaces.
  - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
  - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - k. Remove labels that are not permanent.
  - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - m. Wipe surfaces of mechanical and electrical equipment[, **elevator equipment**,] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - n. Replace parts subject to unusual operating conditions.
  - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
  - r. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Provide Government with report.
- D. Waste Disposal: Comply with requirements of Division 01 section, "Construction Waste Management and Disposal."

END OF SECTION 01 77 00



## SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Manuals, General.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
- B. See Divisions 02 through 49 Sections for additional operation and maintenance manual requirements for the Work in those Sections.

#### 1.2 SUBMITTALS

- A. Manual: Submit two copies of each manual in draft form at least 15 days before final inspection. Contracting Officer will return copy with comments within 15 days of receipt.
- B. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Contracting Officer.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
  - 2. Correct or modify each manual to comply with Contracting Officers comments. Submit 4 copies of each corrected manual within 15 days of receipt of Contracting Officers comments.

#### 1.3 QUALITY ASSURANCE

- A. Coordinate with division 01 section on Commissioning. The Commissioning Agent shall review the Operation and Maintenance Manuals for systems that were commissioned.

## PART 2 - PRODUCTS

### 2.1 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  - 1. Project Title.
  - 2. Location.
  - 3. Park.
  - 4. Contract Number.
  - 5. Prime Contractors Name and Address.
  - 6. Date of Substantial Completion.
  - 7. Binder Volume number.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
  - 1. Binders: White, commercial quality, hard back, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic window sleeve on front and spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. Cover Sheet: Identify each binder on front and spine, with the project title, location, park, contract number, prime contractor's name and address, date of substantial completion, and binder volume number. Insert cover sheet into clear plastic view pocket on front of binder. Insert sheet into clear plastic view pocket on spine with title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
  - 2. Data: Fill binders to no more than 75 percent of capacity. Punch holes shall not obscure any data. When the contents of a single tabbed section covers more than one item, provide colored paper sheets to separate the data for each item.
    - a. Manufacturers' Data: Provide originals for color or copyrighted data. Black and white data may be originals or clean, good quality reproductions. Copies produced by facsimile transmission and sheets with stamps, such as submittal approval stamps, will not be acceptable. Include only sheets that apply to items installed; cross out inapplicable data.
    - b. Vendor Furnished As-Built Drawings: Maximum 24-inch by 36-inch sheets with minimum character or lettering size of 1/8 inch. Reduced-size reproductions may be provided instead of full-size drawings if the reproductions are clear and legible.

- If reduced-size drawings are used, identify as "REDUCED SIZE" and provide graphic scales, if applicable.
  - c. Equipment Data Sheet: Data, using form at the end of this section.
  - d. Schedules: Schedules reflecting final, as-installed conditions.
  - e. Data that is poorly reproduced or in any way illegible will be rejected.
- 3. Dividers: Divider sheets with Mylar reinforced edges and pre-printed numbered tabs aligned with numbers and title lines on index sheet. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
- 4. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
- 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.2 OPERATION AND MAINTENANCE MANUALS

### A. Operation Requirements

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

### B. Maintenance Requirements for Systems and Equipment

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

## 2.3 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in the manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
  1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. Environmental Requirements
  1. Identify environmentally preferable products incorporated into the Project. Include: product model; manufacturer's name, address, phone, and website; and local technical representative, if any

- a. Verify that plastic products to be incorporated into the Project are labeled in accordance with ASTM D1972. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.
    - 1) Type 1: Polyethylene Terephthalate (PET, PETE)
    - 2) Type 2: High Density Polyethylene (HDPE).
    - 3) Type 3: Vinyl (Polyvinyl Chloride or PVC).
    - 4) Type 4: Low Density Polyethylene (LDPE).
    - 5) Type 5: Polypropylene (PP).
    - 6) Type 6: Polystyrene (PS).
    - 7) Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.
  - b. Describe maintenance procedures associated with environmentally preferable materials and systems. Provide cleaning recommendations in accordance with ASTM E1971 and the approved Integrated Pest Management (IPM) plan.
    - 1) Include potential environmental impacts of recommended maintenance procedures and materials.
    - 2) Include potential indoor air quality impacts of the recommended maintenance procedures and materials.
    - 3) Where the proposed maintenance procedures incorporate composting of plastics, assess the potential effect of each type of plastic to be included on the composting process in accordance with ASTM D5509 or ASTM D6002
  - c. Identify **[take-back programs]** **[green leases]** and appropriate contact information for the following:
    - 1) Carpet
    - 2) Ceiling Tile
    - 3) Office Equipment
  - d. Material Safety Data Sheets: Include MSDSs as specified.
2. Develop environmental management programs for the facility as follows:
- a. Waste management program: Develop in accordance with ASTM E1609. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.
  - b. IAQ management program: Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with ASTM D6245. Provide for evaluation of VOCs (volatile organic compounds) in indoor air in accordance with ASTM D6345
  - c. Water management program: Develop a water monitoring program for surface and ground water on the project site in accordance with ASTM D5851 and consistent with the water management program utilized during construction operations.
- E. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.

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

## 2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. At start of project, begin accumulating operation and maintenance data and initiate an index. Install and index all data in binders within 30 days after delivery of items. As custom written data and test results are produced, add them to the operation and maintenance data file.
- B. A list of Operation and Maintenance requirements has been attached at the end of the division 01 specifications for your convenience. The intent is to provide an overall summary of requirements and not a comprehensive list. The terms and conditions of the contract still require you to satisfy the requirements of the individual specification sections regardless of what is shown on the list.
- C. Keep operation and maintenance data current. Make operation and maintenance binders available to the Contracting Officer for inspection at the time of monthly progress payment requests. If operation and maintenance binders are not current the Contracting Officer may retain an appropriate amount of the progress payment.

### 3.2 MANUAL PREPARATION

- A. Manual Types
  - 1. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by NPS operating personnel for types of emergencies indicated.
  - 2. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
  - 3. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- B. Manual Contents: Including but not limited to:
  - 1. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

2. Equipment Data Sheets: For each item of equipment included in the operation and maintenance data, provide an Equipment Data Sheet using the form at the end of this section. For equipment consisting of a driven machine and a driver (for example, a pump and a motor), the equipment data shall cover both the driven machine and the driver. For similar type equipment (for example, multiple exhaust fans of the same model and type), provide a single equipment data sheet with an attached schedule listing the individual equipment items
  3. Vendor Furnished As-Built Drawings: Provide for each electrical and each mechanical control system.
    - a. For each control system, provide control circuit schematic drawings. Identify each wire and terminal block number. Show terminal numbers on all control devices. Show control wires and devices remote from the control panel.
    - b. For each control panel, provide a general arrangement drawing showing location of each control component and terminal block on the panel front and interior. Include a materials list of all panel-mounted control components as well as field-installed control components remote from the panel, identifying components, manufacturer, model number, and initial set points or sensing ranges of devices where applicable.
    - c. For packaged equipment systems, provide general arrangement drawings showing interrelationships of the various items of equipment and components.
    - d. In addition to the control wiring schematic, provide a power wiring schematic drawing showing the power flow to each motor. Identify each power conductor. Show all over-current protection and motor starting devices.
- C. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23



## EQUIPMENT DATA SHEET

Equipment Item: \_\_\_\_\_ Designation: \_\_\_\_\_

Function: \_\_\_\_\_

Location: \_\_\_\_\_

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

Model No.: \_\_\_\_\_ Serial No.: \_\_\_\_\_

Manufacturer Address and Phone:

Supplier Address and Phone:

Preventive Maintenance Tasks:

Nameplate Data:

Spare Parts Furnished and Other Information:

## SECTION 01 79 00 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing NPS personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment, including environmental considerations.
  - 3. Demonstration and training video.
- B. See Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

#### 1.2 GENERAL REQUIREMENTS

- A. A list of System Demonstration and Training requirements has been attached at the end of the division 01 specifications for your convenience. The intent is to provide an overall summary of requirements and not a comprehensive list. The terms and conditions of the contract still require you to satisfy the requirements of the individual specification sections regardless of what is shown on the list.

#### 1.3 SUBMITTALS

- A. Instruction Program: Submit 2 copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. For each training session, the Contractor shall submit for approval a proposed outline of the subjects to be covered. The training shall not be conducted until the outline is approved.
- B. Demonstration and Training Video: Submit 2 copies of each DVD for all training sessions within 7 days of end of each training module.
  - 1. Label each DVD with the date of demonstration or training, the instructor's name, and provide an index of the contents. The index shall list the start and end time of each subject covered during the training session. The sequence of the training subjects shall follow the sequence listed in the approved training outline or as actually conducted

#### 1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and

whose work has resulted in training or education with a record of successful learning performance.

- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Contracting Officer.

## PART 2 - PRODUCTS

## PART 3 - EXECUTION

### 3.1 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Contracting Officer for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct NPS personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with NPS through the Contracting Officer with at least 7 days' advance notice.
  - 2. Conduct training sessions after the equipment or system has been accepted and turned over to the Government. Coordinate with commissioning requirements.
  - 3. Coordinate with Integrated pest management requirements. Refer to the specifications section and the approved IPM plan.
  - 4. Individual sections specify the duration of training required. If no duration is listed, provide training of sufficient duration to adequately cover the subjects.

### 3.2 DEMONSTRATION AND TRAINING VIDEO

- A. General: Engage a qualified commercial photographer to record demonstration and training video. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Format: Digital Video Disc (DVD).

- C. Video Recording: Record all of the above sessions with high resolution equipment. The instructor's voice shall be clearly audible and understandable on the DVD. Utilize a supplemental microphone worn by the instructor

END OF SECTION 01 79 00

## SECTION 02 41 00 - SELECTIVE DEMOLITION

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. This section includes the following:
  - 1. Obtain all required permits and furnish all equipment, tools, labor, materials and incidentals to perform the scope of work.
  - 2. Disconnect, remove, and cap all utility services as indicated or as required.
  - 3. Unless indicated otherwise, remove, and legally dispose of all demolished or other materials from this site.
  - 4. Selective demolition of built site elements.
  - 5. Selective demolition of building elements for alteration purposes.
    - a. Includes historic treatment procedures in the form of special types or selective demolition work for designated historic spaces, area, rooms, and surfaces.
  - 6. Salvage of existing items to be reused or recycled.

#### 1.2 DEFINITIONS

- A. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- B. Existing to Remain: Existing items that are not to be removed or dismantled, except to the degree indicated for performing required Work.
- C. Remove: To detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- D. Remove and Reinstall: To detach items from existing construction in a manner to prevent damage, to prepare for reuse, and to reinstall where indicated.
- E. Retain: To keep and protect from damage existing items that are not to be removed or dismantled.
- F. Salvage: To protect removed or dismantled items from damage and to deliver them to Owner ready for reuse.

#### 1.3 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Salvage in a manner to prevent damage and promptly return to Owner.

#### 1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of construction to be demolished.
  - 2. Review structural load limitations of existing structures.
  - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review and finalize protection requirements.
  - 5. Review procedures for noise control.
  - 6. Review procedures for protection of adjacent buildings.
  - 7. Review items to be salvaged and returned to Owner.

#### 1.6 SUBMITTALS

- A. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by Contractor's removal and dismantling operations.
- B. List of Items Indicated to Be Salvaged: Prepare a list of items indicated on Drawings to be salvaged for Owner's use or for reinstallation. Submit 15 days before preconstruction conference.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and noise control, and for environmental protection. Indicate proposed locations and construction of barriers.
- D. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
  - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
- E. Schedule of Demolition Activities: Indicate the following;
  - 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
  - 2. Temporary interruption of utility services.
  - 3. Shutoff and capping or re-routing of utility services.
- F. Project Record Documents:
  - 1. Record Drawings: Accurately record actual locations of capped and active utilities and subsurface construction.
  - 2. Inventory: Submit a list of items that have been removed and salvaged.

#### 1.7 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.

- B. Regulatory Requirements: Comply with notification regulations of authorities having jurisdiction before beginning removal and dismantling work. Comply with hauling and disposal regulations of authorities having jurisdiction.

## 1.8 EXISTING CONDITIONS

- A. Before starting demolition work of this Section, inspect all preparatory work.

## 1.9 PROJECT CONDITIONS

- A. Notify Architect and Owner of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- B. Hazardous Materials:
  - 1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
  - 2. Hazardous materials will be removed by Contractor .
  - 3. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
- C. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
  - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## PART 2 PRODUCTS -- NOT USED

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. The contractor shall inspect the site in relation to the scope of demolition work described herein prior to start of work.
- B. Remove other items indicated, for salvage, relocation, and recycling.

### 3.2 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, driveways, roadways, and other existing site facilities during demolition operations. Maintain existing vehicular exits and entrances.
- B. Temporary Protection:
  - 1. Protect existing site improvements, appurtenances, and landscaping to remain.
  - 2. Remove temporary barriers and protections where hazards no longer exist. Where open excavation or other hazardous conditions remain, leave temporary barriers and protections in place.

### 3.3 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Comply with applicable requirements of NFPA 241.
  - 3. Use of explosives is not permitted.
  - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  - 6. Do not close or obstruct roadways or sidewalks without permit.
  - 7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.
- E. Protect existing structures and other elements that are not to be removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.
- F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- G. If hazardous materials are discovered during removal operations, stop work and notify Contracting Officer and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.



### 3.4 EXISTING UTILITIES

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

### 3.5 SELECTIVE DEMOLITION, GENERAL

- A. Selective Demolition Equipment:
  - 1. For removal and dismantling, utilize only tools and equipment submitted in the historic treatment program as approved by the Owner and Architect.
- B. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
  - 2. Remove items indicated on drawings.
  - 3. Uncovered existing conditions that are identified in the Historic Structures Report as "Character Defining Features" must be reported to the COR immediately upon discovery.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
  - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
  - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

- D. Selective Demolition Procedures: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  3. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- E. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area on-site designated by Owner.
  5. Protect items from damage during transport and storage.
- F. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- G. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Contracting Officer, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.
- H. Protection:
1. Temporary Shoring:
    - a. Prevent movement of structure; provide shoring and bracing if necessary.
    - b. Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  2. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
    - a. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
    - b. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
    - c. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

- d. Cover and protect furniture, furnishings, and equipment that have not been removed.
- e. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 - Temporary Facilities and Controls
- 3. Remove temporary barricades and protections where hazards no longer exist.

I. Cutting and Patching:

- 1. Perform cutting to accomplish removals neatly and as specified for cutting new work.
- 2. Repair adjacent construction and finishes damaged during removal work.
- 3. Patch as specified for patching new work.

### 3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Loose Plaster: Identify loose, nonhistorical plaster, and separate it from its substrate by tapping with a hammer and prying with a chisel or screwdriver. Do not use pry bars. Leave sound, firmly adhered plaster in place. Do not damage, remove, or dismantle historic plasterwork, except where indicated or where it is an immediate hazard to personnel and as approved by Architect.
- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

### 3.7 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Division 31.

- C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

### 3.8 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

## SECTION 21 13 00 - FIRE SUPPRESSION

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

Fire protection system includes all piping, valves, use of existing fire suppression water tank, use of existing fire department connection, cabinets, upgrade of existing nitrogen system as necessary, sprinklers, test and drain lines, pressure gages, hangers and supports, signs and other such standard appurtenances as required for a complete installation.

#### 1.2 RELATED DIVISIONS AND SECTIONS

- A. Division 01 - General Requirements
- B. Section 22 40 00 - Plumbing Fixtures and Equipment
- C. Section 23 05 00 - Basic Mechanical Materials and Methods
- D. Section 23 20 00 - Building Services Piping
- E. Division 26 - Electrical
- F. Division 28 - Fire Alarm

#### 1.3 QUALITY ASSURANCE

- A. All work, materials, equipment, installation and accessories shall comply with the standards of the National Fire Protection Association, federal and all state and local regulations.
- B. Wiring connections and voltage for water flow, pressure, and valve supervisory positions shall be suitable for connections to the building fire alarm system.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Divisions 01 and Section 23 05 00.
- B. Manufacturer's technical project data, installation instructions, and accessories:
  - Sprinklers
  - Waterflow Indicator
  - Wet Sprinkler System Devices
- C. Sprinklers shall be referred to on submittals and other documentation by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be permitted.

- D. Prior to commencement of associated work, submit sprinkler system hydraulic calculations and coordinated piping system shop drawings including location of heads, valves, alarms, test connections, drains, etc. coordinated with mechanical, electrical, structural and building elements.
- E. Sprinkler system test reports.

## 1.5 APPLICABLE PUBLICATIONS

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

## 1.6 PROJECT CONDITIONS

- A. Provide all material and equipment necessary for a complete system of fire protection as indicated on the drawings and as specified herein.
- B. Wet Sprinkler System: Provide a modification of the existing wet pipe sprinkler system as indicated. Wet pipe system shall be complete in all respects and ready for operation including all test and drain lines, pressure gages, hangers and supports, signs and other standard appurtenances.
- C. Glycol Sprinkler System: Provide an automatic glycol sprinkler system for the unheated attic spaces. Glycol system shall be complete in all respects and ready for operations including all test and drain lines, pressure gages, glycol, glycol loop, hangers and supports, signs and other standard appurtenances.

## PART 2 PRODUCTS

### 2.1 SHUTOFF VALVES

- A. Shutoff valves in sprinkler system shall be approved indicating type. In lieu of gate valves specified in Section 23 20 00, "Building Services Piping," wafer type valves in accordance with NFPA and listed by UL and FM Global are acceptable.
- B. Sprinkler system shutoff valves shall be supervised open by the building fire alarm system. Provide valve supervisory devices that have a minimum of one normally open and one normally closed contact.

### 2.2 SPRINKLER SYSTEM

- A. Provide spray type sprinklers. Sprinklers shall be used in accordance with their listed spacing limitations. Sprinklers with internal O-rings are not acceptable. In general, sprinklers shall be of the fusible strut or frangible glass bulb type and of ordinary temperature rating. Sprinklers located within the air streams of unit heaters or other heat emitting equipment and those in high heat areas such as boiler rooms, etc. shall be selected for proper temperature rating.
- B. Quick response sprinklers shall be used in Light Hazard area locations.

- C. Entire sprinkler system shall be drainable. Return bends shall be used to avoid traps in the sprinkler system.
- D. Sprinkler Types
  - 1. Exposed Upright sprinkler shall have a brass finish.
  - 2. Exposed Pendant sprinklers shall have a brass finish.
  - 3. Pendent Sprinkler with Concealed Cover: Concealed pendent sprinklers with brass finish shall provide the appearance of a smooth ceiling with the sprinkler hidden from view by a low-profile cover plate flush with the ceiling. Cover plate shall be removable without effect on sprinkler. Cover plate shall have factory finish as selected by the COR from standard color palette.
  - 4. Sidewall Sprinkler with Concealed Cover: Concealed, sidewall sprinklers with brass finish shall provide the appearance of a smooth wall with the sprinkler hidden from view by a low-profile cover plate flush with the wall. Cover plate shall be removable without effect on sprinkler. Cover plate shall have a factory finish as selected by COR from standard color palette.
  - 5. Specific application sprinklers for protecting attics.
  - 6. Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
- E. Provide sprinkler coverage around fixed obstructions, such as large ducts, in accordance with NFPA.
- F. Sprinkler Cabinet: Spare sprinklers shall be provided in accordance with NFPA and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.
- G. Manufacturers: Grinnell (GEM), Reliable Sprinkler Co., Star Sprinkler Corp., Viking, Central Sprinkler Corp., Victaulic.

## 2.3 WET PIPE SPRINKLER SYSTEM WATERFLOW INDICATOR

Provide vane type waterflow indicator where shown on the drawings equal to Grinnell Model WFD, Potter Electric Signal Co. Model VSR-F or System Sensor Model WFD with 0 to 70-second adjustable retard. Provide fire department test connection including piping to drainage system. Style 720 Victaulic Test Master II Alarm Test Module with threaded or grooved ends may be used in lieu of field fabricated test connection.

## PART 3 EXECUTION

### 3.1 SHUTOFF VALVES

Install shutoff valves where indicated on the drawings in sprinkler systems including water line supplying system.

### 3.2 SPRINKLER SYSTEM

- A. Sprinkler system shall be hydraulically designed unless otherwise noted on the drawings. Head spacing in general and water quantity shall be based on Hazard Occupancy required by NFPA. Utilize specific application sprinklers for protecting the attic.
- B. Pressures and flows shall be based on the boost provided by the existing pressure tank and nitrogen pump. Tank and nitrogen pump shall be upgraded as necessary to meet the building demand.
- C. The fire protection mains are shown on the drawings and the size indicated shall be the minimum size provided. Branch sprinkler piping and heads are not shown. The contractor shall be responsible for the location of pipe and heads and the sizing of the mains not sized on drawings and branch sprinkler piping.
- D. Submit shop drawings showing the complete piping system including location of heads, valves, alarms, etc., completely coordinated with mechanical, electrical and structural systems prior to commencement of work.
- E. Sprinklers installed in ceilings of finished areas shall be symmetrical in relation to ceiling systems components centered in tile and coordinated with other equipment in the ceiling. Submit typical layouts to Contracting Officer for review.
- F. Sprinkler heads shall be generally installed in accordance with NFPA except additional heads shall be provided to satisfy requirements of symmetry or aesthetics.
- G. The sprinkler bulb protector must remain in place until the sprinkler is completely installed and before the system is placed in service. Remove bulb protector carefully by hand after installation. Do not use any tools to remove bulb protectors.
- H. Sprinklers subject to mechanical injury shall be protected with guards. Provide guards on sprinklers located in mechanical and electrical equipment rooms and where required by NFPA.
- I. Piping in spaces with ceilings shall be concealed in the ceiling space. Heads shall be installed at a uniform projection distance from ceiling. Sprinkler piping installation shall be such that access to the ceiling space is not impaired.
- J. Hydraulic calculations shall be prepared and submitted to the Authorities Having Jurisdiction before submitting to Contracting Officer for review.
- K. Sprinkler Cabinet: Locate where directed, but not where they will be subjected to temperatures exceeding 100 degrees F.
- L. Waterflow and supervisory devices shall be furnished and installed by the Fire Protection Contractor and wired to the building fire alarm system by the Fire Alarm and/or Electrical Contractor. The Fire Protection Contractor shall coordinate completion of this work.
- M. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve and sized according to NFPA. Locate in the most remote location of the system and discharge drain to the exterior at 24 inches above grade with hot dipped galvanized wall plate and 45-degree elbow onto a precast concrete splash block.



- N. Discharge the alarm valve main drain to the exterior at 24 inches above grade with hot dipped galvanized wall plate and 45-degree elbow onto a precast concrete splash block.
- O. Hydraulic Data Nameplate Installation: The hydraulic data nameplate shall be securely mounted to the sprinkler riser. The nameplate shall include the NFPA Edition on which the design and installation of the system was based.
- P. Precast Concrete Splash Blocks: 7.5 inches wide at upper end, 13.5 inches wide at lower end, 36 inches long.

### 3.3 WET PIPE SPRINKLER SYSTEM WATERFLOW INDICATOR

Install in accordance with manufacturer's recommendations and NFPA.

### 3.4 APPROVAL AND TESTING

Arrange for approval of sprinkler systems and conduct tests in accordance with NFPA.

END OF SECTION

## SECTION 22 11 29 - PLUMBING SYSTEM PUMPS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

Pumps and accessories, supports, component piping, and controls associated with plumbing system piping.

#### 1.2 RELATED DIVISIONS AND SECTIONS

- A. Division 01 - General Requirements
- B. Section 22 34 00 - Domestic Water Heaters
- C. Section 22 40 00 - Plumbing Fixtures and Equipment
- D. Section 23 05 00 - Basic Mechanical Materials and Methods
- E. Section 23 07 00 - Mechanical Insulation
- F. Section 23 20 00 - Building Services Piping
- G. Section 26 05 00 - Basic Electrical Materials and Methods

#### 1.3 QUALITY ASSURANCE

All work, materials, equipment, installation and accessories shall comply with the International Plumbing Code and all state and federal regulations.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.
- B. Manufacturer's technical product data, including installation instructions, appurtenances, accessories, supports, fittings, finishes, construction details, and dimensions of assemblies and components:

Domestic Hot Water Recirculating Pump  
Submersible Sump Pump

#### 1.5 APPLICABLE PUBLICATIONS

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

#### 1.6 PROJECT CONDITIONS

Provide all materials, equipment and perform all labor required for complete plumbing pumping systems as indicated on the drawings and as specified.

## PART 2 - PRODUCTS

### 2.1 TYPE J - DOMESTIC HOT WATER RECIRCULATING PUMP

- A. Pump shall be direct drive replaceable cartridge type.
- B. Capacity shall be as scheduled on drawings.
- C. Cast iron casing in-line Taco 00 series circulator with stainless steel cartridge, ceramic shaft, non-metallic impeller, carbon bearings.
- D. Manufacturers: Armstrong, Bell & Gossett, Taco, Thrush.

### 2.2 TYPE M – SUBMERSIBLE SUMP PUMP

- A. Provide sump pump with float switches, starters, and control wiring.
- B. Pump capacity, and inlet connections shall be as indicated on the drawings.
- C. Pump shall be Federal Model P submersible pump.
- D. Shaft shall be stainless steel.
- E. Motor shall be mounted in cast iron enclosure. Motor shall have built-in automatic reset thermal protection, micro-switch, waterproof conductor cables, and grounding plug.
- F. Pump shall have an enclosed drip proof automatic float switches.
- G. Provide shutoff valve and silent check valve in discharge of each pump.
- H. Pump impeller shall be bronze semi-open type.
- I. Basin cover shall be complete with openings for discharge, inspection, and wiring.
- J. Manufacturers: Aurora, Federal, Peerless, Sta-Rite, Weil, Yeomans, Zoeller.

## PART 3 - EXECUTION

### 3.1 TYPE J - DOMESTIC HOT WATER RECIRCULATING PUMP

- A. Install in accordance with manufacturer's recommendations.
- B. Provide automatic control to cycle pump on at 90 degrees F and off at 110 degrees F.

### 3.2 TYPE M - SUBMERSIBLE SUMP PUMP

- A. Install in accordance with manufacturer's recommendations.

- B. Install silent check valve in discharge pipe.
- C. Secure plug to outlet in lockable enclosure.

END OF SECTION

## SECTION 22 34 00 - DOMESTIC WATER HEATERS

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

Domestic service, potable water heating equipment, accessories, controls, component piping and supports. Includes electric water heaters.

#### 1.2 RELATED DIVISIONS AND SECTIONS

- A. Division 01 - General Requirements
- B. Section 22 11 29 - Plumbing System Pumps
- C. Section 22 40 00 - Plumbing Fixtures and Equipment
- D. Section 23 05 00 - Basic Mechanical Materials and Methods
- E. Section 23 20 00 - Building Services Piping
- F. Division 26 - Electrical

#### 1.3 QUALITY ASSURANCE

- A. All work, materials, equipment, installation and accessories shall comply with the latest edition of the International Plumbing Code and all county, state and federal regulations.
- B. Comply with requirements of the following:
  - 1. ASME Boiler and Pressure Vessel Code
  - 2. UL Standards
  - 3. ASHRAE Standard 90.1-2016, Energy Standard for Buildings except Low Rise Residential Buildings, Section 7.
- C. Tank insulation shall comply with ASHRAE 90.1-2016.
- D. Water heaters and storage tanks shall have a temperature and pressure relief valve with ASME and AGA (CGA) ratings and label. Valves shall also be in accordance with ANSI 221.22. Relief valves shall be automatic reseating type with test lever. Relief valves shall have extension thermostat element with a non-metallic protective coating to retard mineral deposits.
- E. Tank and potable waterside surfaces shall be suitable for potable water and acceptable by FDA for potable water.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.

- B. Manufacturer's technical product data, including installation instructions, accessories, supports, fittings, finishes, construction details, and dimensions of assemblies and components:

Domestic Water Heaters  
Expansion Tank  
Safety Drain Pan

## 1.5 APPLICABLE PUBLICATIONS

The publications form a part of this specification to the extent referenced and shall be the latest adopted date of the publication. The publications are referenced in the text by the basic designation.

## 1.6 PROJECT CONDITIONS

- A. Provide all materials, equipment and perform all labor required for a complete domestic water heating system as indicated on the drawings and as specified.
- B. Heating capacity and size as indicated on drawings.

## PART 2 PRODUCTS

### 2.1 ELECTRIC WATER HEATER

- A. Provide State Industries Patriot Light Duty Electric Domestic Water Heater.
- B. Duty
  - 1. Heater capacity and tank size as indicated on the drawings.
- C. Unit shall be pre-piped and pre-wired with immersion thermostats, high temperature limit switch, low-water cutoff, temperature and pressure relief valve, and vacuum relief valve.
- D. Thermostat with automatic control setting to deliver a constant supply of hot water at desired temperature.
- E. Unit shall comply with all UL Safety Specifications.
- F. Unit shall have a three year warranty on tank.
- G. Manufacturers: A.O. Smith, Bradford-White, Hubbel, Rheem, State.

### 2.2 EXPANSION TANK

- A. Construction
  - 1. Wilkins Model XT or approved equal, ASME labeled, steel pressure rated tank, constructed with welded joints and factory installed FDA approved, butyl-rubber diaphragm.
  - 2. NSF listed: Standard 61.
  - 3. Tapings: Factory fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

4. Interior Finish: Comply with NSF 61 and 372 barrier materials for potable water tank linings, including extending finish into and through tank fittings and outlets.
  5. Air Charging Valve: Factory installed. Include air precharge to minimum system operating pressure at tank.
  6. Working Pressure: 150 psig.
- B. Duty: Capacity and size as indicated on drawings.
- C. Manufacturers: Amtrol, A.O. Smith, Armstrong, State, Taco, Watts, Wessels, Wilkins.

### 2.3 SAFETY DRAIN PAN

- A. Provide a galvanized steel metal drain pan for installation under Electric Water Heaters.
- B. Pan shall extend 1-inch beyond edge of water heater and shall be not less than 1-1/2 inches deep and shall have a minimum 3/4-inch chain connection.

## PART 3 EXECUTION

### 3.1 ELECTRIC WATER HEATER

- A. Install in accordance with manufacturer's instructions and recommendations.
- C. Pipe relief discharge full size as directed.
- D. Electric power shall be connected to control panel under the Electrical Division.
- E. Field wiring shall meet requirements of Electrical Division.

### 3.2 EXPANSION TANK

Install in accordance with manufacturer's instructions and recommendations.

### 3.3 SAFETY DRAIN PAN

- A. Install metal drain pan under water heater.
- B. Pipe 3/4-inch drain to plumbing fixture, receptor, floor drain, or disposal point.

END OF SECTION

## SECTION 22 40 00 - PLUMBING FIXTURES AND EQUIPMENT

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

Plumbing fixtures and specialties; fittings; supports; as indicated on the drawings, as required by code and as specified.

#### 1.2 RELATED DIVISIONS AND SECTIONS

- A. Division 01 - General Requirements
- B. Section 21 13 00 - Fire Suppression
- C. Section 23 05 00 - Basic Mechanical Materials and Methods
- D. Section 23 07 00 - Mechanical Insulation
- E. Section 23 20 00 - Building Services Piping
- F. Division 26 - Electrical

#### 1.3 QUALITY ASSURANCE

- A. All work, materials, equipment, installation and accessories shall comply with the current enforced edition of the International Plumbing Code and all city, county, state and federal regulations.
- B. Comply with requirements of ADA and ANSI Standards for plumbing fixtures and fittings for wheelchair accessibility.
- C. All inline devices installed on the domestic service lines or building distribution system downstream of the water main and before end point devices and is in contact with the water intended for human ingestion shall comply with the Safe Drinking Water Act and National Sanitation Foundation (NSF) Standard 61 and Standard 372 to provide lead free water (not containing more than 0.25 percent lead).
  - 1. Inline devices include water meters, building valves, check valves, meter stops, fittings, backflow preventers, etc.
- D. Provide UL label on electric powered equipment or certification that the equipment has been tested by a testing agency approved by local authority and is equivalent in safety to UL labeled equipment.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.



- B. Manufacturer's technical product data, including installation instructions, appurtenances, accessories, supports, fittings, finishes, construction details, and dimensions of components:
  - Plumbing Fixtures and Accessories
  - Food Disposers
  - Dishwasher Air Gap Fittings
  - Cleanouts
  - Shock Absorbers
  - Vacuum Breakers
  - Backflow Preventers
  - Hose Bibbs
  - Water Pressure Reducing Valve
  - Water Mixing Valves
  - Air Admittance Device
- C. NSF 61 Certification of domestic water devices.

## 1.5 APPLICABLE PUBLICATIONS

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

## 1.6 PROJECT CONDITIONS

- A. Provide all materials, equipment and perform all labor required to install plumbing system complete as indicated on the drawings and as specified.
- B. Plumbing system includes fixtures, equipment, piping and the supports for these items; supplies; stops; faucets; spouts; traps; drains; tailpieces; fittings and accessories.
- C. Provide all plumbing fixtures and equipment with accessible stops.
- D. Provide P-traps on fixtures for which traps have not been included as part of the furnished equipment. Size of trap shall be equal to size of fixture tailpiece.
- E. All exposed metal parts of fixtures shall be chromium-plated brass. Piping, fittings, valves, traps and accessories including piping escutcheons shall be chromium plated metals where exposed in finished spaces.

## PART 2 PRODUCTS

### 2.1 PLUMBING FIXTURES AND SUPPORTS

- A. Provide fixtures as listed. Catalog numbers are American Standard, unless otherwise noted.
- B. Fixtures shall be vitreous china unless otherwise noted. Cast iron fixtures shall have acid resisting enamel finish.
- C. Restricting Flow Fittings and Flow Restricting Aerators

1. Provide restricting flow fittings or flow restricting aerators on non-self-closing and non-metering lavatory and sink faucets to restrict flow to 1.5 gpm.
2. Restrictor shall compensate for pressure fluctuations between 25 to 80 psig with flow within 10 percent.
3. Manufacturers: Dole, Omni Products

**D. Plumbing Fixture Schedule**

**A-1** Water Closet: 2232.128US Cadet 3 16-1/2-inch, floor-mounted, siphon jet action, 1.28 gallons/flush, elongated bowl, free standing close coupled toilet combination, color-matched trip lever, two bolt caps with retainer clips. Fitted with:

Tank Flushing Device: Gravity tank feed to bowl with backflow prevention, device shall flush with 1.28 gallons.

Supply Pipe: McGuire No. 166 chrome plated 3/8-inch supply pipe to wall with wheel handle control stop, 3/8-inch outside diameter flexible tube riser.

Seat: Church 380TC white, extended back seat for elongated bowl, closed front with cover.

**P-3** Lavatory: 9482 "Ovalyn" 19 by 16-inch undercounter mounted vitreous china lavatory. Fitted with:

Faucet: Chicago Faucet No. 786-GN2FC "Hi-Lite" combination lavatory faucet with rigid copper connection between handle valves and spout, renewable cartridge with ceramic disc, No. 317, 4-inch wrist blade handles, 8-inch centers, with FC internal stream regulator, 3/8-inch gooseneck spout, outlet 5 inches above slab.

Supply Pipes: McGuire No. 158WC, 3/8-inch wheelchair supply with loose key straight stop with cast brass escutcheon and set screw.

Trap: McGuire No. 8902 1-1/4 by 1-1/2-inch adjustable P-trap, cast body, cleanout plug, slip inlet tubing drain to wall, cast brass escutcheon and set screw.

Waste, Tailpiece: McGuire 155-WC chromeplated wheelchair lavatory, cast grid drain plug with strainer and offset 1-1/4-inch tailpiece.

**P-4** Double Compartment Sink: Just DL-1625-A-GR, double compartment sink, two 16 by 25 inches, undercoated 18 gage stainless steel sink compartments with 3-hole punch. Furnish each sink with Bridgeport No. 667 chromeplated cup strainer and tailpiece. Fitted with:

Faucet: Chicago 786-GN2-FC-E2605, chromeplated faucet with 4-inch wrist blade handles, E3 aerator with E2605 flow restrictor, GN2A rigid swing gooseneck spout

Supply Pipes: Brass Craft SR-1512-A, chromeplated supply, loose key stop valve, cast brass escutcheon and set screw, flexible tube riser.

Trap: Kohler K-9000, 1-1/2 by 1-1/4-inch chromeplated P-trap, cast body, cleanout plug, slip inlet tubing drain to wall, cast escutcheon and set screw.

**P-5**     Shower: Aquarius Model A4834SH, white acrylic one-piece seamless shower unit with integral dome, 5-year warranty. Shower shall comply with ANSI 124.1 and designed to meet IAPMO, HUD, IBC, and SBC.

Valve: Symmons S-9601-X-PLR Temptrol, pressure-balancing mixing valve, integral volume control, lever handle, integral stops, maximum temperature limit stop, chromeplated brass escutcheon.

Showerhead: Symmons No. 4-226F Clear-Flo showerhead with 1.5 gpm flow regulator, spray adjusting lever handle, and No. 300 chromeplated shower arm with cast brass flange.

Drain: Aquarius, 2-inch brass drain, with stainless steel strainer. Provide P-trap.

Accessories: Stainless steel 1-inch diameter curtain rod and curtain; molded soap-accessory tray for seated and standing position.

Additional reinforcement shall be suitably located to provide required structural integrity. After all valves, grab bars, curtain rods, and wall brackets, etc., have been installed, they will be sealed from the backside with fiberglass to make the unit waterproof.

**P-6**     Washing Machine Supply and Drain Unit: IPS Corporation Model No. W4700HA recessed unit with 1/2-inch hose-end quarter turn valves and supply connectors and hammer arresters and 2-inch sanitary line connection.

Washing Machine Safety Drain Pan: IPS Model No. WMP-1 27 inches by 29 inches white plastic washing machine drain pan. Coordinate exact size with supplied washing machine prior to ordering.

**P-7**     Ice Machine Supply Unit: Guy Gray Manufacturing Co., Inc., Model No. BIM875 recessed unit with 1/2-inch hose-end valves and supply connectors.

E.     Manufacturers

1.     Fixtures: American Standard, Crane, Eljer, Kohler, Sloan, and where named:
  - a.     Stainless Steel Sinks: American Standard, Elkay, Just, Kohler.
  - b.     Acrylic Showers: Aqua-Bath, Aquarius, Fiat, Universal Rundle.
2.     Faucets and Accessories: American Standard, Chicago Faucet, Crane, Delta, Eljer, Kohler, Moen, Price Pfister, Speakman, Symmons, T&S Brass.
3.     Supplies, Traps: American Standard, Brass Craft, Chicago Faucet, Crane, Eljer, Engineered Brass Co., Keeney, Kohler, McGuire.
4.     Water Closet Seats: Bemis, Benecke, Church, Comfort, Olsonite.
5.     Showerheads: American Standard, Moen, Powers, Price Pfister, Sloan, Speakman, Symmons.
6.     Washing Machine Supply and Drain Unit: Acorn, Guy Gray, IPS Corp., LSP Products Group, Oatey, Symmons, Zurn.
7.     Ice Machine Supply Unit: Acorn, Guy Gray, IPS Corp., LSP Products Group, Oatey, Symmons, Zurn.

## 2.2 DISHWASHER AIR-GAP FITTINGS

- A. Fitting suitable for use with domestic dishwashers and for deck mounting; with plastic body, metallic cover with enamel finish to match color of sink; minimum capacity of 5 gpm; minimum inlet pressure of 5 psig at a minimum temperature of 140 degrees F.
- B. Hoses: Rubber and suitable for minimum temperature of 140 degrees F.
  - 1. Inlet Hose: 5/8-inch ID and 48 inches long.
  - 2. Outlet Hose: 7/8-inch ID and 48 inches long.
- C. Manufacturers: B & K Industries, Inc., Brass Craft, Brasstech Inc., Dearborn Brass, Geberit, Sioux Chief Manufacturing Company, Inc., Watts.

## 2.3 FOOD WASTE DISPOSERS

- A. Continuous-feed household, food-waste disposer. Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; 1-1/2-inch outlet; dishwasher drain connection; quick-mounting, stainless-steel sink flange; antisplash guard; combination cover/stopper; sound insulated chamber; 115 watt motor with overload protection, and unjamming wrench. Provide 1 horsepower unit.
- B. Manufacturers: American Standard, In-Sink-Erator, KitchenAid, Maytag Co., WhiteRock Corp.

## 2.4 CLEANOUTS

- A. Cleanouts shall be full size of pipe up to 6 inches.
- B. In lieu of joints specified in Section 23 20 00, "Building Services Piping," neoprene gaskets may be used if designed for use with drains and cleanouts employed and if approved by the local plumbing authority.
- C. Materials and Manufacturers: Acorn, Josam, J.R. Smith, MIFAB, Wade, Watts, Zurn. Josam numbers are indicated:

CONCEALED PIPING	CAST IRON PIPE	STEEL
<b>Unfinished Areas</b>		
Floors	56000	58460A
Walls	58790	58890
<b>Finished Areas – Floors</b>		
Composition Tile	56000-12	56000-12
Ceramic Tile	56020	56020
Carpet	56000-14	56000-14
<b>Finished Areas – Walls</b>		
Plaster	58790	58600
Tile	58790	58640*
* With 9 by 9-inch frame		

## 2.5 SHOCK ABSORBERS

- A. Josam 75000-S Shoktrol shock absorbers. Sizes shall be in accordance with PDI Standard WH-201 and ASSE Standard 1010.
- B. Manufacturers: Ancon, Josam, J.R. Smith, MIFAB, Precision Plumbing Products, Sioux Chief, Wade, Watts, Zurn.

## 2.6 VACUUM BREAKERS AND BACKFLOW PREVENTERS

- A. Vacuum Breakers:
  - 1. Atmospheric-type, not subject to back pressure, Watts No. 288A; ASSE 1001.
  - 2. Subject to back pressure, Watts series 9D; ASSE 1012.
  - 3. For hose threads, Watts series 8A; ASSE 1011.
- B. Reduced pressure zone for connection where indicated, Watts 909 backflow preventer with strainer and valves; ASSE 1013.
  - 1. Sizes through 3-inch shall have full-port ball valves.
  - 2. Sizes 4-inch and larger shall have OS&Y rising stem gate valves.
  - 3. Valves on backflow preventer supplying water to fire protection system shall be UL/FM listed.
  - 4. Backflow preventer 2-1/2-inch and larger shall have FDA approved epoxy coating and lining for the entire assembly including valves and strainer.
  - 5. Backflow preventer 2-inch and smaller shall have bronze strainer and valves; internal polymer coating for preventer body. Provide with air gap for drain outlet.
- C. Manufacturers: Conbraco, Febco, Hersey, MIFAB, Sloan, Watts, Wilkins, Woodford, Zurn.

## 2.7 HOSE BIBBS

- A. Chicago 998-RCF hose-end faucet, rough chrome finish.
- B. Manufacturers: American Standard, Chicago Faucet, Crane, T&S Brass.

## 2.8 WATER MIXING VALVES

- A. Type B-2
  - 1. Unit shall be for individual sink Chicago Faucet ECAST Model 131-ABNF.

## 2.9 AIR ADMITTANCE DEVICE

- A. Plastic housing with mechanical operation sealing diaphragm, designed to admit air into drainage and vent piping and to prevent transmission of sewer gas into building.
- B. Fixture Vent Valve: ASSE 1051, designed for installation on waste piping, instead of vent connection, for single fixture, in pipe sizes 1-1/4 to 2 inches.
- C. Manufacturers: B & K Industries, Durgo, IMI Cash Valve, IPS Corporation, J & B Products, Magic Vent Co., Oatey, Sioux Chief Manufacturing Co., Studor

## PART 3 EXECUTION

### 3.1 PLUMBING FIXTURES AND SUPPORTS

- A. Setting heights of fixtures, etc. shall be as directed prior to installation.
- B. Install floor-mounted fixtures only after finished floor has been installed.
- C. Protect chromium plated trim from corrosive solutions used to clean tile work.
- D. Provide ASTM C920, Type S white, silicone caulking where fixtures come in contact with walls and floors. Sealant shall be mildew resistant type.
- E. Shower valve temperature limit stops shall be factory and field set to deliver a maximum outlet temperature of 110 degrees F based on inlet water temperatures of 50 degrees F cold water and 110 degrees F hot water. Confirm outlet temperature in field and adjust as required.
- F. Provide insulation protection in accordance with ADA for exposed traps and supplies for all lavatories and sinks. Insulation shall provide access to supply valves and shall be equal to Handi-Lav-Guard as manufactured by Truebro, Inc.

Manufacturers: Proto, Truebro.

- G. Showers: Additional reinforcement shall be suitably located to provide required structural integrity. After all valves, grab bars, curtain rods, wall brackets, etc. have been installed, they shall be sealed to make the unit waterproof.
- H. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- I. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- J. Install fixtures level and plumb according to roughing-in drawings.
- K. Install floor-mounted water closets on closet flanges.
- L. Install counter-mounted fixtures in and attach to casework.
- M. Install stops in locations where they can be easily reached for operation.
- N. Install toilet seats on water closets.
- O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. 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.
- Q. Install shower flow-control fittings with specified maximum flow rates in shower arms.

- R. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- S. Install traps on fixture outlets, except fixtures with integral traps and indirect wastes.
- T. Set shower receptors in leveling bed of cement grout. Grout is specified in Section 23 05 00 are complete with trim, faucets, fittings, and other specified components.
- U. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- V. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- W. Install supply and drain unit where indicated on drawings. Mount drain rim 18 to 48 inches above drain trap.
- X. Install ice maker unit where indicated on drawings. Mount supply outlet 48 inches above finished floor.
- Y. Replace washers and seals of leaking and dripping faucets and stops.

### 3.2 DISHWASHER AIR GAP FITTING

- A. Install in accordance with manufacturer's recommendations.
- B. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting.
- C. Install on countertop at sink.
- D. Connect inlet hose to dishwasher and outlet hose to disposer.

### 3.3 FOOD WASTE DISPOSERS

- A. Install in accordance with manufacturer's recommendations.
- B. Install disposer in outlet of each sink indicated to have disposer.
- C. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- D. Coordinate with Electrical Contractor.
- E. Operate and adjust disposers. Replace damaged and malfunctioning units

### 3.4 CLEANOUTS

- A. Install cleanouts in sanitary drainage systems at ends of runs, at changes in direction that are greater than 45 degrees, near the base of stacks, every 50 feet in horizontal runs, and where indicated.

- B. Vertical Pipes: Install cleanout in tees near floor.
- C. Horizontal Pipes: Install cleanouts in wyes or long sweep quarter bends.
- D. Extend cleanouts on concealed piping flush to finished walls, floors and grade.
- E. Waterproofing: Cleanouts puncturing waterproofing membrane shall have flashing clamps.

### 3.5 SHOCK ABSORBERS

Install shock absorbers at solenoid and fast closing valves, at the top of cold water risers, at each flush valve or battery of flush valves, and where indicated.

### 3.6 VACUUM BREAKERS AND BACKFLOW PREVENTERS

- A. Install vacuum breakers on water connections to fixtures and equipment where minimum air gaps required by plumbing code are not possible, on hose bibbs and other outlets to which hoses can be attached, and where indicated on the drawings
- B. Install backflow preventers where indicated on drawings and where required by code. Install air gap on reduced pressure zone backflow preventer and pipe discharge drain to floor drain. Do not install bypass piping around backflow preventers.

### 3.7 HOSE BIBBS

Install hose bibbs where indicated on drawings. Locate 2 to 3 feet above floor or deck.

### 3.8 WATER MIXING VALVES

Install water mixing valve assembly beneath the lavatory.

### 3.9 AIR ADMITTANCE DEVICE

Install in accordance with manufacturer's instructions and recommendations.

END OF SECTION



## SECTION 23 05 00 - BASIC MECHANICAL MATERIALS AND METHODS

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Requirements of this Section are applicable to work in Divisions 21, 22, and 23.
- B. Contract Documents
  - 1. Unless otherwise modified, drawings and general provisions of the Contract, including provisions of General Conditions, and Division 01 govern work under Divisions 21, 22, and 23.
  - 2. Contract drawings for fire protection, plumbing, and mechanical work are diagrammatic, intended to convey scope and general arrangement.
  - 3. Refer questions involving document interpretation or discrepancies to Contracting Officer's Representative (COR) for review and direction.
  - 4. Correct faulty work due to resolving discrepancies without proper approval.
  - 5. Specifications establish quality of materials, equipment, workmanship and methods of construction.
  - 6. Follow drawings and specifications in laying out work. Consult other applicable contract drawings and specifications, become familiar with conditions affecting work.
- C. Scope
  - 1. The work in Divisions 21, 22, and 23 includes furnishing and installing the fire protection, plumbing, and mechanical work complete and ready for satisfactory service.
  - 2. Requirements specified govern work in all sections of Divisions 21, 22, and 23.

#### 1.2 RELATED DIVISIONS

- A. Division 01 - General Requirements
- B. Division 07 - Thermal and Moisture Protection
- C. Division 08 - Openings
- D. Division 09 - Finishes
- E. Division 21 - Fire Suppression
- F. Division 22 - Plumbing
- G. Division 23 - Heating, Ventilating, and Air Conditioning
- H. Division 26 - Electrical
- I. Division 31 - Earthwork

### 1.3 QUALITY ASSURANCE

- A. Regulations: Comply with regulations of NFPA, state, county, and municipal building ordinances, and other applicable codes and regulations.
- B. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by the local authority as equivalent in safety to UL labeled equipment.
- C. Material and Equipment Requirements
  - 1. Use products of one manufacturer where two or more items of same kind of equipment are required.
  - 2. Materials and equipment shall have a record of one-year successful field use.
  - 3. For certain items of equipment, the specification and the project design are based upon the specified manufacturer's product. Other manufacturers' names are listed. Contractor may purchase, conditional upon meeting project requirements, equipment from the listed manufacturers.
  - 4. Only the manufacturer's equipment upon which, the specification and the project design has been based, has been checked for this project. Check allocated space and structure for suitability of equipment of other listed manufacturers, including parts replacement and servicing.
- D. Workmanship
  - 1. Remove and replace, at no extra cost, work not in conformance with contract requirements.
  - 2. Coordinate work and cooperate with other trades to facilitate execution of work.
- E. Coordination with Other Trades
  - 1. Contractor shall give full cooperation and coordination with other trades and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily with the least possible interference or delay.
  - 2. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans and shop details for the proper installation of the work and for the purpose of coordination adjacent work.
- F. Asbestos or asbestos-containing materials shall not be utilized or allowed on this project. The Contractor shall be rigorous in assuring that all materials, equipment, systems, and components do not contain asbestos. Any deviations from this exclusion shall be remedied at the Contractor's expense without regard to prior submittal approvals.
- G. Access: The Contractor shall specifically consider all materials and equipment installations and shall coordinate with the work of all trades to insure easy and unobstructed accessibility of all systems for operations, maintenance, repairs, and replacement. Installation of all specified materials and equipment including but not limited to, equipment, supports, ductwork, pipe, electrical conduit and controls shall be in a manner which will allow complete unobstructed access to all panels, access doors, filter racks, control boxes, controls actuators, sensors, valves, tube bundles and all other items requiring access for operations or maintenance. All items such as controls, actuators and valves which require servicing or manual operations for system use shall be located such as to be accessible without standing on other equipment,

whenever it is possible or practical. Any installation of new equipment or materials which causes problems related to access of new or existing equipment shall be disapproved by the COR and reaccomplished by the Contractor.

#### 1.4 SUBMITTALS

- A. Manufacturer's technical product data, installation instructions and description of accessories for each type to be used and system designation:
  - 1. Certificate of completion of cleaning and disinfecting of water systems.
  - 2. Concrete compressive strength test.
  - 3. Motors (submit under section specifying related equipment).
  - 4. Layout drawings for equipment supports.
  - 5. Pipe penetration seals.
  - 6. Identification.
  - 7. Charts for shutoff valve and fire alarm device locations.
  - 8. Operating and maintenance manuals.
  - 9. Statement of field instruction completion.

#### 1.5 APPLICABLE PUBLICATIONS

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

#### 1.6 PROJECT CONDITIONS

- A. References
  - 1. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.
  - 2. Refer to applicable contract drawings and specifications pertaining to other Divisions for conditions affecting work.
- B. Definitions: The following are definitions of terms and expressions used in Divisions 21, 22, and 23:
  - 1. "Approve" - To permit use of material, equipment or methods conditional upon compliance with contract document requirements.
  - 2. "Concealed" - Hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.
  - 3. "Directed" - directed by Contracting Officer.
  - 4. "Ductwork" - includes ducts, fittings, housings, dampers, supports and accessories comprising a system.
  - 5. "Equal, equivalent" - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.
  - 6. "Exposed" - not concealed.
  - 7. "Furnish" - Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.
  - 8. "Indicated" - indicated in Contract Documents.

9. "Install" - Operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimensions, finishing, curing, protecting, cleaning and similar operations.
10. "Piping" - includes pipe, fittings, valves, supports and accessories comprising a system.
11. "Provide" - furnish and install, complete and ready for the intended use.
12. "Removable" - detachable from the structure or system without physical alteration of materials or equipment and without disturbance to other construction.
13. "Review" - limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

## 1.7 WARRANTY

Deliver to the COR certificates of equipment warranty extending beyond the guarantee period.

## PART 2 PRODUCTS

### 2.1 PAINTING

Painting of piping, ductwork and equipment is included under Division 09 unless otherwise indicated.

### 2.2 FLASHING

Flashing materials are specified in Section 07 62 00, "Sheet Metal Flashing and Trim."

### 2.3 CONCRETE WORK

- A. Compressive Strength: 3000-psi minimum after 28 days.
- B. Reinforcing Steel: Yield strength as determined by structural design.
- C. Grout: Non-shrink, non-metallic, pre-mixed, equivalent to Nordbak Fast-set, U.S. Grout Five-star, or Polymeric.

### 2.4 MOTORS AND ELECTRICALLY OPERATED EQUIPMENT

- A. References, Characteristics and Ratings
  1. Refer to Electrical Division for requirements of electrical work including starters specified in the Plumbing and Mechanical Divisions.
  2. Provide motors and other equipment requiring electrical power or control service suitable for the electrical characteristics indicated on the Electrical Drawings.
  3. Horsepower indicated is for manufacturer's equipment upon which the specification is based. Submit proposed deviations from these ratings for review by the COR. Pay costs incurred by deviations, which are permitted.

4. Provide motor rated for 200 volts for 208-volt service. Provide 230 and 460 volt rated motors for 240 and 480 volt service.
  5. Brake horsepower rating at specified duty shall not exceed 85 percent of nameplate horsepower rating times NEMA service factor for motors with 1.15 service factor except where other limits are stated for certain equipment, i.e. fans and pumps, the maximum load percentage shall be as stated under that equipment times the 1.15 service factor. For water or refrigerant cooled motors driving compressors the maximum load percentage shall be 78 percent, 72 percent and 70 percent, for motors with 1.25, 1.35, and 1.4 service factors, respectively.
- B. Overload Protection
1. Protect each motor, either individually mounted or in unitary equipment, with overload devices such as fuses, thermal cutouts, or thermal protectors installed in each ungrounded conductor serving each motor. Mount these overload devices in the motor controller or in a control panel in unitary equipment.
  2. For equipment that requires the use of fuses, provide the proper size and type of fuses mounted on accessible fuse blocks, integral to the equipment, wired in accordance with applicable codes.
- C. Construction
1. Construct motors in accordance with NEMA Standard Publication MG-1, latest edition, and the applicable IEEE standards.
  2. Frame sizes in accordance with NEMA Standard MG-1 and MG-13, latest editions.
  3. Starting torque, NEMA Design B, 2-4 percent slip.
  4. Starting (locked rotor) kVA as required by the driven equipment. On motors with a locked rotor indicating code letter of "F" or higher, the manufacturer shall notify the electrical contractor for circuit breaker adjustment in accordance with Division 26, "Electrical."
  5. Indoor, General Use: Open dripproof construction, 1.15 service factor.
  6. Outdoor, Exposed Motor: Totally enclosed fan cooled construction, 1.15 service factor, stator windings totally encapsulated having non-hygroscopic insulation approved for outdoor use, and double shielded bearings.
- D. Insulation: NEMA Insulation Class B for operation in 40 degrees C ambient except premium efficient motors shall be NEMA Class F insulation with horsepower rating based on Class B rise.
- Where motors operate in a maximum ambient temperature above 40 degrees C, provide motors suitably designed for the ambient temperature indicated, employing a different class of insulation or having a change in frame size, i.e., the ambient temperature plus motor full load temperature rise plus 10 degrees C shall not exceed the temperature rating of the insulation system.
- E. Electronically Commutated (EC) Motors
1. Motor shall be direct drive motor.
  2. Motor shall be variable speed, DC, brushless type specifically designed for pump applications and include heavy duty ball bearings and electronic commutation.
  3. Motor shall be speed controllable down to 20 percent of full speed and 85 percent efficient at all speeds.

4. Motor shall be complete with, and operated by, a single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator.
5. All EC Motors shall be designed for synchronous rotation.
6. Motor rotor shall be permanent magnet type with near zero rotor losses.
7. Motor shall be able to be mounted with shaft in horizontal or vertical orientation.
8. Motor shall have permanently lubricated ball bearings.
9. Motor shall include inductors to minimize harmonic distortion and line noise.

F. Single Phase Motors

1. 1/6 Horsepower or Less: Split phase capacitor start, permanent split capacitor or resistance start, capacitor run.
2. 1/4 and 1/3 Horsepower: Capacitor starts.
3. Bearings: "Life-time" sealed ball bearing type, oilable ball bearing or sleeve type.
4. High efficiency energy saving type with a minimum efficiency of 70 percent and a minimum full load power factor of 77 percent.

G. Three Phase Motors:

1. NEMA Premium efficiency polyphase induction type.
2. Minimum full load power factor before power factor correction of horizontal and vertical shaft motors shall be as follows:

HP	RPM	POWER FACTOR
1/2	3600 and 1800	70 Percent
3/4	3600 and 1800	70 Percent
1, 1-1/2 and 2	3600 and 1800	79 Percent
3 to 5	3600 and 1800	85 Percent

3. Minimum efficiency (in percent) of horizontal and vertical shaft motors shall be follows:

Open Dripproof (ODP) Motors

HP	1200 RPM	1800 RPM	3600 RPM
	Minimum Nominal Efficiency (%)	Minimum Nominal Efficiency (%)	Minimum Nominal Efficiency (%)
1	82.5	85.5	77.0
1-1/2	86.5	86.5	84.0
2	87.5	86.5	85.5
3	88.5	89.5	85.5
5	89.5	89.5	86.5

NOTE: Efficiencies are nameplate ratings and must be tested in accordance with IEEE Standard 112, Method B.

Totally Enclosed Fan Cooled (TEFC) Motors

HP	1200 RPM	1800 RPM	3600 RPM
	Minimum Nominal Efficiency (%)	Minimum Nominal Efficiency (%)	Minimum Nominal Efficiency (%)
1	82.5	85.5	77.0
1-1/2	87.5	86.5	84.0
2	88.5	86.5	85.5
3	89.5	89.5	86.5
5	89.5	89.5	88.5

NOTE: Efficiencies are nameplate ratings and must be tested in accordance with IEEE Standard 112, Method B.

Measure motor efficiencies as tested in accordance with ANSI/IEEE Standard 112, Test Method B. Do not extrapolate efficiencies from other data. Measure each horsepower size. Submit test data from certified independent testing laboratory of standard manufacturer run per horsepower size.

#### H. Bearings and Bases

1. Motors 1/2 through 2 Horsepower: Sealed "life-time" ball bearing or regreaseable ball bearing type with minimum life of 25,000 hours under "V" belt load conditions.
2. Motors 3 through 5 Horsepower: Anti-friction bearings sized for a minimum life of 25,000 hours under "V" belt load conditions or a minimum life of 100,000 hours for a direct connected load. House bearings in a regreaseable race with provision for purging old grease. Preload bearings with a bearing load spring to minimize noise and increase bearing life.
3. Motors for Belt Drive: Cast iron or steel base with slide rails having screw adjustments.

### 2.5 HANGER ATTACHMENT - Application and Type

- A. Concrete (New): Iron or steel inserts. Expander type anchors, specified for existing may be used provided concrete is clear of conduit for drilled depth.
- B. Concrete (Existing): Double plated expander type anchors. Phillips, Hilti or approved equivalent. Loads shall not exceed 1/4 of tested pullout (or shear) strength.
- C. Steel Beams: Iron or steel beam clamps.
- D. Wood Beams: Light duty, screws; heavy duty, bolted bracket.
- E. Brick or Block Walls: Brackets fastened with self-drilling anchors or toggle bolts, light duty; or through bolts with backplates, heavy duty.

### 2.6 SLEEVES AND ESCUTCHEON PLATES

- A. Sleeves for Piping and Conduits - Material and Application
  1. Galvanized Standard Weight Steel Pipe:

- a. Floors where pipes will be exposed above the floor.
    - b. Interior concrete walls
    - c. Interior masonry walls.
  - 2. Galvanized Standard Weight Steel Pipe with Anchor Flange Welded to Perimeter:
    - a. Exterior concrete walls.
    - b. Exterior masonry walls.
    - c. Roof vent stacks, which are flashed into stack terminal or terminal fitting.
  - 3. 22 Gage Galvanized Steel:
    - a. Stud partitions.
    - b. Suspended plaster and gypsum board ceilings.
- B. Escutcheon Plates for Piping: Chromeplated brass.
- C. Sleeves for Ductwork: 20 gage galvanized steel.
- D. Sealant
- 1. One part polysulfide, equivalent to Pecora Synthacaulk GC24 or polycarbonate; equivalent to ProSeal 34 for general use.
- E. Pipe Penetration Seals
- 1. Modular interlocking EPDM or silicone rubber links, dielectrically sealed to pipe and wall opening with pressure plates and bolts.
  - 2. Link sealing elements shall be rated for pipe fluid temperature for each application.
  - 3. Pressure plates shall be Delrin plastic or equivalent electrical insulating material.
  - 4. Bolts and nuts shall be zinc phosphated low-carbon steel.

## 2.7 IDENTIFICATION

- A. Stenciling: Stencil letters 1-inch high and colored to contrast with background.
- B. Labels: WH Brady B-946 vinyl cloth pipe markers, 3/4-inch pipe banding tape with 1/2-inch wide tape to wrap the circumference of the pipe. Match color of tape with marker.
- C. Nameplates: Laminated phenolic plates, 1/8-inch thick, with beveled edges and engraved 1/4-inch high block, capital white letters on a black background. Provide laminated plates, 1/8-inch thick, with beveled edges and engraved 1/4-inch high white letters on red background for emergency instructions on sprinkler protection, fire protection, emergency generator starting, and other emergency operating instructions.
- D. Tags: Polished, lacquered, 1-1/2-inch diameter 18 gage solid polished brass tags with stamped letters or numerals 1/2-inch high, filled with black paint and fastened with brass "S" hooks or chains.
- E. Wire Markers: Self-sticking W. H. Brady Co. Perma Code wire markers.
- F. Flow Arrows: W.H. Brady Pipe Marker arrows Stock No. 91000 Series to identify the direction of flow in the pipe or duct. Match color with service marker for the system. One-



inch arrow tape for marker Style 4; two-inch arrow tape for marker Style 1; four-inch arrow tape for marker Style 1HV; and Style 3C arrow tape for marker Style 3C.

## PART 3 EXECUTION

### 3.1 PAINTING

- A. Paint miscellaneous ironwork which is not copper, galvanized, aluminum, and stainless steel.
- B. Touch-up scratches and marred places on factory painted equipment to match finish.
- C. Remove grease, scale, rust, and dirt from work to be painted under this or other parts of the specification.
- D. Do not paint when surfaces are damp, exposed to sun, or when temperature is below 50 degrees F.
- E. Do not paint bearings, lubrication fittings, gages, brass trim, nameplates, or other elements where such application would interfere with operation and maintenance of equipment.
- F. Wash galvanized surfaces with pretreating preparations as directed by paint manufacturer.
- G. Omit primer if equipment has factory shop coat. Finish coats must be compatible with shop coat.

### 3.2 FLASHING

Flash conduits, ducts, roof curbs, and pipes projecting through roof or outside walls. Extend flashing 12 inches into roofing materials. Make watertight seal to roof material and pipe. Turn vent stack flashing down into stack tight against inside of pipe. See Division 07.

Protect sleeve packing and flashing joints with counterflashing. Solder or weld counterflashing to pipe, conduit or duct. Clean joint and coat with zinc dust paint. See Division 07.

### 3.3 CONCRETE WORK

- A. Location: Equipment housekeeping pads, and where indicated under plumbing, mechanical and electrical work.
- B. Perform work in conformance to American Concrete Institute Standard ACI 301-72, Specifications for Structural Concrete for Buildings
- C. Bond new work to existing concrete, by approved adhesive or by roughing existing surface to expose aggregate uniformly, then cleaning surface. Key new pads to concrete floors using expansion bolts.

- D. Bevel exposed vertical and horizontal edges 3/4-inch.
- E. Install grout according to manufacturer's recommendations.
- F. Testing: Test concrete using a qualified testing agency.

#### 3.4 MOTORS AND ELECTRICALLY OPERATED EQUIPMENT

- A. Align motor, drives, and driven equipment to avoid excessive strain or wear.
- B. Check belt tension with a tension tester for the deflection force recommended by the manufacturer. Check and adjust tension after several minutes operation and then after eight hours of operation.

#### 3.5 HANGER ATTACHMENT

Select and install structural attachments for hangers supporting pipes, ducts, conduit and equipment adequately for stresses to which they may be subject and for proper distribution of load to building structural members.

#### 3.6 SLEEVES AND ESCUTCHEON PLATES

- A. Sleeves are not required for core-drilled holes except where sleeves are specified and required to extend above the floor.
- B. Sleeves are not required for floor slabs on-grade.
- C. Install sleeves for pipes and conduits passing through roofs, floors, plaster ceilings, gypsum board ceilings, walls, partitions, air handling unit casings, structural members, and other building parts. Install sleeves in time to permit construction progress as scheduled.
- D. Where ducts pass through walls and floor slabs that require a fire damper or combination fire/smoke damper protection at the penetration, provide removable form to create the opening for duct penetration.
- E. Install sleeves for ducts passing through walls, plaster ceilings, gypsum board ceilings, floors, and partitions as follows:
  - 1. Where vermin control is indicated.
  - 2. Walls with waterproofing.
  - 3. Floors.
- F. Install sleeves with length to pass through full thickness of construction.
- G. Provide 1/2-inch minimum clearance between sleeve and conduit, pipe, duct or covering. Center conduit, pipe or duct in sleeve unless otherwise indicated.

Insulation thickness specified for use through sleeves requiring vermin proofing shall be as specified but not less than 1-inch minimum thickness. Refer to Section 23 07 00, "Mechanical Insulation."

- H. Install ends of sleeves flush with finished wall surfaces.
- I. Extend floor sleeves for exposed conduits, pipes, and ducts 2-inch above finished floor.
- J. Hem edges of duct sleeves extending above floor.
- K. Reinforce sleeves temporarily, if necessary, to preserve accurate shape without distortion during construction.
- L. Grout sleeves in concrete floors and concrete walls into building structure to make joint watertight.
- M. Install escutcheon plates for pipes and conduits at floors, ceilings, walls, and partitions in finished areas unless otherwise indicated.
  - 1. Fit escutcheons around insulation, uninsulated pipe, or conduit.
  - 2. Outside diameter shall cover sleeve.
  - 3. Where sleeve extends above finished floor, cover sleeve extension with escutcheon.
- N. Pack annular space between sleeve and conduit, pipe, or duct and voids between building construction and conduit, pipe, duct, or sleeves as follows:
  - 1. Firestop equal to U.S. Gypsum Thermafiber, caulked at both ends to manufacturer's recommended depth with sealant, for the following sleeve locations:
    - a. Where vermin control is indicated.
    - b. Roof and walls with waterproofing.
  - 2. For the following locations, pack annular space between sleeve and conduit, pipe, or duct and voids between building construction and conduit, pipe, or duct sleeves with industrial felt fire material equal to U.S. Gypsum Thermafiber, caulked at both ends to manufacturer's recommended depth with sealant, or code approved firestopping foam, caulk, or putty that meets ASTM E-814 with UL classification. Sealants shall not contain toxic or flammable solvents and shall not produce toxic or flammable outgassing during any stage of application, curing, drying or fire conditions.
    - Floors
- O. See Section 23 07 00, "Mechanical Insulation," for fire stop insulation on pipes and ducts through sleeves.
- P. Vermin Control: Provide vermin control for conduits, pipes, and ducts passing through ceilings, walls, and partitions.
- Q. Prime surfaces prior to caulking to obtain good adhesion where recommended by sealant manufacturer.
- R. Install pipe penetration seals on pipes passing through underground walls and floors as recommended by the manufacturer. Installation shall result in a watertight and electrically insulated seal.

- S. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

### 3.7 IDENTIFICATION

- A. Surfaces shall be cleaned and painted if specified, before applying markings.
- B. Place markings so that they are visible from the floor.
- C. Protect finished identification to ensure that markings are clear and legible when project is turned over to Government.
- D. Ductwork and Piping
1. Apply labels and flow direction arrows on mains and principal branches of piping and ductwork. Wrap the circumference of pipe, overlapping both ends of each marker to give 360-degree identification. Mark each type of service every 25 feet with a minimum of one marking per room and additionally, at each side of penetration of walls, partitions and floors within one foot of penetration.
  2. Identify piping with Brady Marker Number as follows:

PIPING SERVICE	TEXT/BACKGROUND COLOR	MARKER NO. FOR PIPES
Cold Water	White/Green	7084
Condensate Drain	White/Green	7063
Domestic Hot Water	Black/Yellow	7087
Domestic Hot Water Recirculation	Black/Yellow	7088
Glycol Sprinkler Water	White/Red	Custom
Pump Discharge	Black/Yellow	7280
Refrigerant Liquid	Black/Yellow	7235
Refrigerant Relief Vent	Black/Yellow	Custom
Refrigerant Suction	Black/Yellow	7236
Sanitary Vent	White/Green	7252
Sanitary Waste	Black/Yellow	7253
Sprinkler Water	White/Red	7269

- a. Provide Style 4 for pipes 1 to 2-1/2 inches, Style 1 for pipes 3 to 5 inches and Style 1HV for pipes 6 inches and larger. For pipes smaller than 1-inch, use same legend and color with Style 3C marker.
  - b. Provide circumferential tape around both ends of marker to keep it in place.
3. Identify ductwork with Brady Marker labels as follows:

DUCTWORK SERVICE	TEXT/BACKGROUND COLOR	MARKER NO. FOR DUCT
Air Conditioning Return	White/Green	Custom
Air Conditioning Supply	White/Green	Custom
Outdoor Air	White/Blue	Custom
Toilet Exhaust	Black/Yellow	Custom

- E. Access Doors: Identify the device within ductwork access doors using letters not less than 1/2-inch in height.

- F. Equipment
  - 1. Identify as to nature, services, system number or other designation by stenciling with letters 1-inch high and colored to contrast with background or using nameplates. Designate which items are main or standby.
  - 2. Equipment requiring identification:
    - Air Cooled Condensers
    - Air Handling Units
    - Expansion Tanks
    - Fans
    - Pumps
    - Water Heaters
- G. Secure nameplates to devices or adjacent surface.
- H. Valves, Regulators and Controls: Identify valves, regulators, controls, dampers and similar items, with tags. Valves adjacent to equipment they serve need not be tagged.
- I. Electrical Items
  - 1. Identify disconnect switches, starting devices, controls, control switches, pushbutton stations with nameplates. Secure nameplate to device or adjacent surface with screws.
  - 2. Identify control wires with wire markers.

### 3.8 CONTRACTOR'S INSTALLTION DRAWINGS

- A. These drawings shall not be construed as shop drawings that require review and action by the COR.
- B. Submit, prior to installation of mechanical systems, six copies of composite working drawings prepared in coordination with other trades at a scale not less than 1/2-inch = 1-foot, clearly showing how work is to be installed in relation to the work of all trades. Contractor shall assist in working out congested space conditions to make a satisfactory adjustment. Drawings shall show the work of all trades (ductwork, conduit, piping, plumbing, lights, equipment, sprinklers, electrical work, etc.) exposed and concealed, coordinated with each other and with the structure. Drawings shall be submitted and bear the COR's review stamp before any materials are ordered or fabricated.
- C. Work installed before coordinating with other trades or as to cause any interference with work of other trades shall be changed by the Contractor to correct the conditions at their expense.
- D. Drawings shall show existing services where clearances for access are to be maintained.
- E. Relocate existing work or modify location of new work as required to maintain required access and code clearances.

### 3.9 PROJECT RECORD DOCUMENTS

Maintain at the site one set of black or blue line on white prints of drawings, copies of specifications, addenda, shop drawings reviewed by COR, change orders and other

modifications in good order and marked in red ink to record changes made during construction. Deliver these in final complete form to the COR upon completion of work.

### 3.10 MATERIAL AND EQUIPMENT LIST

- A. Submit for COR's review a list of subcontractors' and manufacturers' names for items proposed for the work within 15 days after award of the contract.
- B. Failure to submit list or name manufacturers acceptable to COR within time limit will result in COR selecting a list of manufacturers, and selection shall be binding upon Contractor.

### 3.11 SHOP DRAWINGS AND DESCRIPTIVE DATA

- A. Submit electronic copies, in accordance with Division 01, of manufacturer's shop drawings and descriptive data.
- B. Establish that the physical and functional character of each item including, size, type and required service access is suited for its intended location and use.
- C. Coordinate drawings and data before submitting and certify that provisions of the contract documents have been met.
- D. Call attention, in writing, to deviations from contract requirements.
- E. Do not fabricate, deliver to site, or install items requiring shop drawing review, until the review has been completed by the COR and the shop drawing has been marked to indicate "No Exception Noted" or "Make Corrections Noted."
- F. Specifically identify pertinent project data on the shop drawings.
- G. Include Operation and Maintenance Data.
- H. Use only final or corrected drawings and data for construction.
- I. The COR's review of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

### 3.12 SITE EXAMINATION

Failure to visit site and become familiar with local conditions prior to bidding will not relieve the Contractor of his responsibility for complying with the Contract Documents.

### 3.13 CUTTING AND PATCHING

- A. Unless otherwise directed, do cutting and patching. Repair damaged fireproofing and waterproofing to original or better condition.
- B. Do not cut walls, floors, reinforced concrete or structural steel without COR's permission. Install services without affecting reinforcing steel.

### 3.14 CLEANING UP

- A. Keep premises free from accumulation of debris.
- B. Remove tools, scaffolding, surplus material, debris, and leave premises broom clean.
- C. On discontinuance of part of the work, place debris in containers and promptly remove them from the Government's property.

### 3.15 WORK IN EXISTING BUILDINGS

- A. General:
  - 1. Provide adequate protection for the building, its contents, and occupants.
  - 2. Comply with regulations of /Owner/COR/ pertaining to circulation, sanitation, and behavior of Contractor's personnel.
- B. Storage and Loading Facilities
  - 1. Provide office and storage facilities where designated by the COR.
  - 2. Provide adequate furnishings including file space, lighting, telephone, and heat where necessary.
  - 3. Use only those toilet facilities designated by the COR for use by Contractor's personnel.
  - 4. Store equipment and materials in areas designated by COR in a manner which will not cause concentrations of weight potentially damaging to building structure.
  - 5. Use only rubber wheeled wheelbarrows, dollies, or carts over finished floors.
  - 6. Keep office, storage, and loading areas neat and clean.
- C. Temporary Heat
  - 1. Where existing heating is removed or temporarily discontinued, provide temporary heat to protect the building elements, to permit proper conduct of work, and to maintain occupied areas at comfort level.
  - 2. Do not use new heating systems without written permission of the COR, and if used (a) pay energy costs, (b) do not operate without air filters, and (c) place in as good as new condition including new filters and clean apparatus prior to Government acceptance. Guarantee period shall not be shortened by such operation.
- D. Barricades

1. Erect temporary barriers for protection of building and building contents.
2. Where partitions separating occupied areas must be cut, close hole with tight fitting temporary plywood closure panel, 1/2-inch minimum thickness, to form visual and acoustical barrier.
3. Protect exposed holes in floors in accordance with applicable codes and regulations.
4. Take the necessary precautions to prevent the spread of dust and dirt through the new HVAC system, including outdoor intakes. Protect new return and exhaust air openings.

E. Alterations

1. Cut, alter, remove or temporarily remove and replace existing work necessary for installation of mechanical and electrical work. Maintain the necessary clearances for accessibility or compliance with code around existing equipment, devices, etc., that are to remain.
2. Verify dimensions of existing building elements pertaining to the installation of new work to assure physical compatibility prior to fabrication or installation.
3. Where the installation of new services or the extension of existing services requires cutting of existing floors, walls, partitions, etc., check for the presence of existing mechanical and electrical services within or immediately beneath construction and exercise necessary precautions to prevent damage to the service or injury to personnel due to contact with same. Where practical, temporarily disconnect such existing service during the cutting operation. Schedule such outages in service with the COR, 14 days in advance.

F. Removal of Materials and Equipment

1. Remove promptly from the site, materials and equipment specified to be removed and not reinstalled or stored.
2. Unless otherwise indicated, removal of pipes, ducts, and equipment includes removal of accessories such as hangers, air outlets, piping connections, junction boxes, starters, etc. Remove to source or, if concealed, to point of concealment, connections to mechanical equipment required to be removed or disconnected. Terminate connections behind finished surfaces and, if subject to movement, clear of building construction. Cap connections extending from ducts or piping remaining in service.

G. Connections to Existing Systems

1. Connect to existing systems as indicated.
2. Repair insulation damaged at points of connection. Restore integrity of vapor barriers and surface finish.

### 3.16 PROTECTION

A. Protect mechanical and electrical material and equipment from the elements or other injury as soon as delivered on premises. Protect plumbing fixtures as soon as they are set. Cover water closets and post notices prohibiting their use.

1. Accept in original packaging.
2. Store in clean, dry space.
3. Protect from dirt, water, construction debris, and traffic.
4. Handle in accordance with manufacturer's written instructions.



- B. Cap or plug openings in equipment, piping, duct, and conduit systems, to exclude dirt and other foreign material. Do not use rags, wool, cotton, paper, waste or similar materials for plugging.
- C. Existing components of the building and its systems shall be protected from damage. Any damage to these components shall be repaired or replaced to the satisfaction of the COR. Special care shall be taken with regards to insulation on existing piping and ductwork. Damaged insulation shall be replaced so that the vapor barrier and insulating characteristics of the material match those prior to damage taking place.

### 3.17 CLEANING OF SYSTEMS

- A. Thoroughly clean systems after satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers, and other accessory items. Blow out and flush piping until interior are free of foreign matter.
- B. Clean fans, ductwork, enclosures, registers, grilles, and diffusers at completion of work.
- C. Install air filters of equal efficiency to those specified in permanent air systems operated for temporary heating or air balancing during construction. Replace with clean filters as specified prior to acceptance and after cleaning of system.
- D. Pay for labor and materials required to locate and remove obstructions from systems clogged with construction refuse after acceptance. Replace and repair work disturbed during removal of obstructions.
- E. Thoroughly clean plumbing fixtures using non-scratching cleaners. Polish chromium plated work.
- F. Disinfect potable water systems as prescribed by local code. Take precautions to avoid use of fixtures during disinfecting period.

### 3.18 ASBESTOS

Should material resembling asbestos-containing materials be encountered during execution of work, immediately notify COR for instructions before proceeding.

### 3.19 EXCAVATION AND BACKFILL:

- A. Excavate and backfill as required to install fire suppression tank and associated suction line to building.
- B. Establish required lines and grade.
- C. Excavate to sufficient depth as indicated on drawing details.
- D. Keep excavation drained and pumped out.

- E. Remove excavated materials not required or suitable for backfill.
- F. Protection
  - 1. Protect existing utilities and underground work by shoring and bracing.
  - 2. Provide guardrail, lamps, flags, and other safeguards at temporary walk and road crossings.
  - 3. Provide shoring, sheet piling and bracing for protection of work and safety of personnel. Timber sheeting below top of pipe shall not be removed.
  - 4. Protect trees, structures, and other property from injury during work.
  - 5. Prevent debris and other materials from entering piping and drains.
- G. Backfill
  - 1. Use only backfill material free of organic matter, cinders, frozen earth, clay, and rocks exceeding 6 inches in any dimension.
  - 2. Provide bed of firmly compacted sand, gravel, or crushed stone of proper grade to form a uniform support. Backfill excessive overdepth with firmly compacted sand or gravel.
  - 3. Provide a structurally suitable reinforced concrete beam supported by the structure and undisturbed earth to support tank where a properly compacted bed is difficult to obtain, because of fill conditions, such as may occur adjacent to building walls.
  - 4. As items to be buried are laid, backfill with layer of sand, crushed stone, or gravel bedding material to centerline of tank, and tamp.
  - 5. After tests and inspections are complete, backfill with fine earth or sand in 6-inch layers until buried item has 1-foot of cover. Carefully tamp each layer. Compact to at least 95 percent of the maximum dry density as determined by ASTM D 1557.
  - 6. Deposit remainder of backfill material in 8-inch layers and tamp each layer. Compact to at least 95 percent of the maximum dry density as determined by ASTM D 1557.
- H. Restoring
  - 1. Restore existing pavement, curbs, sidewalks, fences, sod, shrubs, and other appurtenances removed or damaged in connection with work to original condition.
  - 2. Replace sod with sod and replace trees, which are damaged, with trees of similar type and size.

### 3.20 EQUIPMENT SUPPORTS

- A. Provide equipment supports consisting of platforms, concrete pads, cradles, structural members, hangers, rods, racks, and incidental materials.
- B. Design and construct supporting structures of strength to safely withstand stresses to which they may be subjected and to properly distribute the load and impact over building areas.
- C. Concrete Equipment Pads
  - 1. Provide concrete pads not less than 4 inches high and projecting not less than 3 inches on all sides beyond equipment for floor mounted equipment.
  - 2. Place anchor bolts in steel pipe sleeves, with a plate at bottom end of sleeve to hold bolts.
  - 3. Grout between base plate and foundation.

- D. Ceiling Suspended Platforms: Construct with steel hangers. Brace and fasten to building structure.
- E. Wall Mounted Platforms: Construct with steel brackets.
- F. Saddles for Tank Supports: Cast iron or welded steel of curvature to fit tank. Locate supports to avoid undue strain on shell and interference with pipe connections to tank outlets.

### 3.21 OPERATING AND MAINTENANCE MANUAL

- A. Furnish manual bound and indexed containing:
  - 1. Brief description of each system and components.
  - 2. Starting and stopping procedures.
  - 3. Day/night changeover.
  - 4. Seasonal changeover
  - 5. Special operating instructions.
  - 6. Routine maintenance procedures.
  - 7. Schedule for periodic servicing and lubrication.
  - 8. Manufacturers' printed operating and maintenance instructions, parts lists, illustrations and diagrams.
  - 9. Manufacturers' Data Report Form U-1 certifying code compliance for equipment specified to be constructed in accordance with ASME Code for Unfired Pressure Vessels.
  - 10. One final or corrected reviewed copy of each shop drawing and Contractor's drawings.
  - 11. One copy of each wiring and piping diagram.
  - 12. One reviewed copy of certified test reports.
  - 13. Product warranty information.
  - 14. Air and water balancing report.
- B. Submit to COR for review at least 30 days prior to date it is expected system will be turned over to the Government.
- C. After review by COR, submit record copy to Government.

### 3.22 FIELD INSTRUCTION

- A. Upon completion of work, instruct Government's representatives in the proper operation and maintenance of the mechanical and electrical systems.
- B. Instruction periods specified below shall be in addition to instructions specified for certain items elsewhere in the specifications.
- C. Instructions shall be given by persons expert in the operation and maintenance and shall be for a period of not less than one eight-hour days.
- D. Prepare statement(s) for signing by Government's representative indicating date of completion of instructions and hours expended. Furnish copy of signed statement to COR.

- E. The Contractor shall submit, 14 days prior to the instruction period, a written description on the procedures and systems to be demonstrated subject to the approval of the COR. The system shall be fully tested by the Contractor and operational prior to the instruction period. The Contractor shall submit written documentation that the systems have been fully tested and operational by the Contractor prior to the Government's demonstration period. Final acceptance prior to the issuance of Substantial Completion will be subject to the approval of the systems by the COR. Coordinate with Commissioning requirements.
- F. Training of the Government's operation and maintenance personnel is required in cooperation with the Commissioning Authority. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in cooperation with the Commissioning Authority after submission and approval of formal training plans.

END OF SECTION

## SECTION 23 05 48 - MECHANICAL SOUND AND VIBRATION CONTROL

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

Vibration isolation devices, accessories, and supports to prevent transmission of vibration from mechanical equipment and distribution systems to building structure.

#### 1.2 RELATED DIVISIONS AND SECTIONS

- A. Division 01 - General Requirements
- B. Section 22 11 29 – Plumbing System Pumps
- C. Section 23 05 00 - Basic Mechanical Materials and Methods
- D. Section 23 20 00 - Building Services Piping
- E. Section 23 34 16 - Fans
- F. Section 23 70 00 - HVAC

#### 1.3 QUALITY ASSURANCE

- A. The vibration isolator manufacturer's representative shall determine spring sizes and mountings, and shall provide field supervision and inspection to assure proper installation, adjustment and performance. The representative shall notify the Contracting Officer's Representative (COR) of any isolator selections, which may experience resonance with the approved equipment, and upgrade any isolators that are found to resonate with the installed and operating supported equipment.
- B. Vibration isolation mounts and hangers for Divisions 22 and 23 work shall be from the product line of a single manufacturer or products represented by the same manufacturer's representative.
- C. Work shall be performed by skilled workers who are experienced in the necessary workmanship to meet the requirements of this Section.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.
- B. Vibration Isolation Product Data:
  - 1. Manufacturer's technical project data for each type of vibration isolation, including installation instructions, accessories, supports, fittings, finishes, construction details and dimensions of components.
  - 2. System application for each type of vibration isolation.

C. Operation and Maintenance Data

1.5 APPLICABLE PUBLICATIONS

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

1.6 PROJECT CONDITIONS

A. Schedule of Equipment Isolation is included in this Section.

B. Wind-Restraint Loading

1. Three-second Wind Gust Speed: 109 mph.
2. Building Risk Category: II.
3. Exposure Category: C.
4. Minimum 10 lb/sq. ft. multiplied by maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATION DEVICES

- A. Select isolators for uniform static deflections according to distribution of weight and to meet requirements shown elsewhere in the Contract Documents.
- B. Select isolators for not less than the deflections indicated on the Schedule.
- C. Select vibration isolation for stable operation during starting and stopping of equipment without excessive movement of equipment.
- D. Corrosion Resistance: All springs and associated metal hardware shall be designed or treated for resistance to corrosion. Steel components shall be PVC coated, or phosphated and painted with industrial grade enamel. All nuts, bolts and washers shall be zinc electroplated. Structural steel bases and exposed steel components of concrete inertia bases shall be cleaned of welding slag and primed with zinc-chromate or metal etching primer. A finish coat of industrial grade enamel shall be applied over the primer.
- E. Outdoor Locations: Steel parts PVC coated, hot-dip galvanized, zinc-electroplated plus coating of neoprene, bitumastic paint, or powdered coating. Aluminum components for outdoor installation shall be etched and painted with industrial grade enamel. Nuts, bolts, and washers may be zinc-electroplated.

2.2 MOUNTINGS

- A. Type D1: Double layer neoprene cross-ribbed or waffle pattern, each layer 5/16-inch thick.

Maximum hardness shall be 40 durometer. Imprint durometer on material. Size for deflection of 10-20 percent of unloaded pad height. Hot dipped galvanized steel bearing plates where necessary to spread loads. Mason Industries Type W or Super W.

- B. Type D2: Same as Type D except with a cemented steel plate on top with a 3/4-inch diameter center hole for bolting through. Include a 3/4-inch Neoprene isolation washer cemented to a steel washer is provided as well. Mason Industries Type MBSW and Type HLW.
- C. Type E: Closed cell neoprene strip, 4 inches wide, 3/4-inch high.

## 2.3 HANGERS

- A. Type G: Combination spring and double deflection neoprene in series, 0.30-inch minimum deflection for neoprene element. Spring diameter not less than 0.8 times compressed spring height at rated load. Springs shall have minimum additional travel to solid equal to 50 percent of rated deflection. Design shall allow for 15-degree misalignment from vertical before contact of housing and hanger rod. Mason Industries Type 30N.
- B. Type J: Thrust restraints shall be in sets of two or more, and shall be springs in series with neoprene. Deflection shall be equal to deflection of isolators supporting the unit being restrained. Provide thrust restraints complete with rods and adjustment nuts, plus angle brackets and backing plates for attachment to the unit being restrained and anchor supports. Mason Industries Type WB series.
- C. Type K: Neoprene element with molded rod isolation bushing that prevents the rod from contacting the hanger box. Design for 0.25 - 0.35-inch minimum static deflection at rated load. Mason Industries Type HD.

## 2.4 HOSES

- A. Type S
  - 1. Metallic, flexible bellows type bronze hose with bronze braid or Type 321 stainless steel hose with stainless steel braid. Bronze for application with copper tubing and brass piping; stainless steel for ferrous applications. Hose shall have weld, thread, flange or sweat connections as required for piping or tubing connection application.
  - 2. Hose length shall be a minimum length of 9 inches.
  - 3. For freon refrigeration service, hose shall have adequate pressure rating for compressor discharge service working pressure of 300 psig at 250 degrees F; suction service working pressure of 200 psig at 100 degrees F.
  - 4. Mason Industries/Mercer Rubber Type BBS stainless, CPS bronze.

## 2.5 ELASTOMERIC GROMMETS

Type U: Grommets shall be a separate bushing with a separate washer or combination neoprene washer/bushing. Grommets shall be formed to prevent bolts from directly contacting the secured item. Elastomer shall be 56 durometer maximum. Mason Industries Type HLB bushing with HLW washer or HG washer/bushing.

## 2.6 RESILIENT PENETRATION SLEEVE/SEAL

- A. Field fabricate from pipe or sheet metal section 1/2 to 3/4-inch larger in each dimension than penetrating element in all direction around the element. Use to provide a sleeve through the construction penetrated. Extend sleeve 1-inch beyond the penetrated construction on each side. Pack annular space between sleeve and the penetrating element tightly with glass fiber or mineral wool to within 1/4-inch of ends of sleeve. Fill remaining 1/4-inch space on each side with acoustical sealant to form an airtight seal. Penetrating element shall be able to pass through sleeve without contacting sleeve. Alternatively, prefabricated sleeves accomplishing same result are acceptable. Mason Industries Type SWS
- B. Do not use at fire-rated penetrations.

## 2.7 MANUFACTURERS

- A. Mountings, Hangers and Resilient Sleeves/Seals: Amber-Booth, Kinetics Noise Control, Inc. Korfund, Mason Industries, Vibration Eliminator, Vibration Mountings and Controls, Vibrex.
- B. Hoses: Amber-Booth, General Rubber, Mason-Mercer Rubber, Metroflex.
- C. Grommets: EAR Specialty Composites Corp., Gates Molded Products, Mason Industries, Tech Products Corp., Vibration Mountings and Controls, Vibrex.

## PART 3 EXECUTION

### 3.1 VIBRATION ISOLATION DEVICES

- A. Install in accordance with manufacturer's recommendations. Corrosion coatings damaged during installation shall be repaired.
- B. Install isolators in locations to permit inspection and adjustment, and to provide proper operation. Install isolators as high as possible in hanger rod assembly, but clear of structure. Maintain 2-inch clearance between isolated equipment and walls, ceilings and other equipment. Maintain side clearance for hanger housings to allow a full 360-degree hanger rotation about the rod axis without contacting any object. Isolated systems shall be independently supported.
- C. Adjust leveling bolts and hanger rod bolts so that isolated equipment is level and in proper alignment with connecting ducts and pipes. All vibration isolators shall be aligned squarely above or below mounting points of supported equipment.
- D. Provide structural base plate under isolator where isolator is wider than supporting structural member. Tack weld plate to structural member.
- E. Where necessary, provide lateral snubber or Type J thrust restraint isolation, which will not interfere with main isolator performance, to prevent movement in excess of 1/4-inch due to dynamic forces.
- F. Mount equipment on steel base of adequate structural rigidity when equipment or frame is not



structurally suitable for the type of isolation specified. Spring and rail and spring supports are specified on the basis that the equipment is structurally built or supported on a rigid frame. Isolators for equipment with bases shall be located on sides of the base, which are parallel to the equipment shaft.

- G. Install Type E strips under air handling unit perimeter base and between Type D pad isolation without any gaps between pads and strips so as to prevent placement of any materials under the air handling unit that prevents function of Type D pad.

### 3.2 EQUIPMENT ISOLATION SCHEDULE

- A. If the mount baseplate is bolted to structure or framework rigidly connected to the structure, Type U elastomeric grommets shall be used between each bolt and the baseplate to prevent rigid connection. These additional neoprene washers and bushings may be omitted if the baseplate and friction pad incorporate neoprene elements that eliminate rigid contact between bolts and the baseplate. Bolt holes shall be properly sized to allow for bushing sleeve. The anchor bolt shall incorporate steel washers to distribute load evenly over neoprene washers.

#### B. Isolation Schedule

TYPE OF EQUIPMENT	SUPPORTING STRUCTURE			
	FLOOR SLAB ON EARTH		OTHER FLOOR AND ROOF	
	ISOLATION BASE TYPE	MIN. STATIC DEFLECTION IN INCHES	ISOLATION BASE TYPE	MIN. STATIC DEFLECTION IN INCHES
<b>Factory Assembled Air Handling Units and Cabinet Fans</b>				
<b>Suspended</b>				
thru 5 HP	-	-	G	1.0 Note 1
<b>Floor Mounted with Internally Mounted Motor and Drive</b> (Note 3)	D1+E	0.10	D1+E	0.10
<b>In-line Centrifugal Fans</b>				
<b>Suspended (Note 4)</b>				
225-349 rpm	-	-	G	3.5
350-499 rpm	-	-	G	2.5
500 rpm and Over	-	-	G	1.5
<b>Air-Cooled Condensing Units</b>	D2	0.10	-	-

#### NOTES:

- (1) Spring Deflection
- (2) Not Used.
- (3) The AHU shall be mounted on Type D isolators with Type E strips to provide a continuous strip under the entire perimeter of AHU.
- (4) When fan is suspended, the specified isolation shall be provided in the suspension framework.

### 3.3 PIPING ISOLATION

- A. Type S Hoses: Provide on refrigerant piping connected to compressors and condensing units.
- B. On Type D pumps, provide Type K hanger on pipe at pump suction and discharge.
- C. The installation of vibration isolators shall not cause any change of position of piping, that will result in stresses in piping connections or misalignment of shafts or bearings. Account for changes in height and weight when pipes are filled with water.
- D. Resilient Penetration Sleeve/Seals: Provide penetration seals to maintain an airtight seal around penetrating elements and to prevent rigid contact of penetrating element and building construction. Fit sleeve tightly to building construction and seal airtight on both sides of construction penetrated with acoustic sealant.

#### 3.4 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.

END OF SECTION

## SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

Preparation, testing, adjusting, and balancing of mechanical equipment, and air distribution systems including inspection and certification reports.

#### 1.2 RELATED DIVISIONS

- A. Division 01 - General Requirements
- B. Division 22 - Plumbing
- C. Division 23 - Heating, Ventilating, and Air Conditioning
- D. Division 26 - Electrical

#### 1.3 QUALITY ASSURANCE

- A. Agency shall be a member of the Associated Air Balance Council or the National Environmental Balancing Bureau.
- B. Perform work in accordance with AABC or NEBB National Standards.
- C. Certify that measurement instruments have been calibrated within 12 months prior to use on this project.
- D. Agency shall directly oversee work performed by it employing a competent supervisor subject to the approval of the Contracting Officer's Representative (COR).

#### 1.4 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.
- B. Qualifications of Personnel
- C. List of Instrumentation and Instrumentation Certification Report
- D. Proposed Work Schedule Outline
- E. Equipment Installation Inspection Report(s)
- F. Testing, Adjusting and Balancing Report
- G. Test Report Examples

## 1.5 APPLICABLE PUBLICATIONS

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

## 1.6 PROJECT CONDITIONS

- A. Obtain applicable contract documents and copies of submittals for equipment and automatic control systems.
- B. After cleaning, prepare systems for proper operation. Systems shall be completely installed and in continuous operation before testing, adjusting and balancing (TAB) work is performed.

## PART 2 PRODUCTS

### 2.1 DUCTWORK TEST HOLE PLUGS

Removable self-sealing plastic

### 2.2 INSULATION REPAIR

Match original material type, vapor barrier jacket and thickness.

## PART 3 EXECUTION

### 3.1 DUCTWORK TEST HOLE PLUGS

Install plugs in ductwork after drilling test holes.

### 3.2 INSULATION REPAIR

Repair insulation removed or damaged for TAB work.

### 3.3 TAB AGENCY

- A. Procure the services of a balancing and testing agency to perform the testing, adjustment and balancing (TAB) of equipment and air and water flows including plumbing system; hot water recirculation system; air outlets in the heating, ventilating and air conditioning systems. Report instances in which the specified quantities cannot be provided by the installed equipment so that corrections to the equipment can be made under the section wherein it was specified. The heating, ventilating and air conditioning equipment shall be completely installed and in continuous operation before the initial work specified herein shall begin. TAB work shall begin whenever suitable outside conditions exist for the season or cycle in effect (cooling or heating mode).

- B. Add dampers and valves required for correct balance as recommended by the agency at no additional cost to Owner. Submit such additions for COR's review.

### 3.4 TAB INSTRUMENTS

Calibrate instruments used for testing and balancing of air and hydronic systems within a period of 12 months prior to TAB. Submit final test analysis reports, including a letter of certification listing instrumentation used and last date of calibration.

### 3.5 TAB REPORTS

- A. Inspection reports covering equipment and systems installation shall be submitted during early stage of the project in order to allow timely correction of deficiencies.
- B. Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser, register, and grille sizes are correct.
- C. TAB reports covering flow balance, adjustments, and performance tests, working copy of reports shall be submitted as soon as TAB is performed for any necessary system evaluation.
- D. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- E. Submit three copies of complete test reports for review.

### 3.6 TAB PHASING

- A. Coordinate TAB procedures with phase construction completion requirements for the project. Systems serving completed phases of the project will require TAB for such phases prior to partial acceptance and for final acceptance.
- B. Allow sufficient time in construction schedule for TAB and submission of reports prior to partial acceptance and for final acceptance.

### 3.7 EQUIPMENT INSTALLATION INSPECTION

An evaluation report shall be completed after air distribution equipment is on site and duct installation has begun, but in advance of performance testing and balancing work. Identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

### 3.8 TAB REQUIREMENTS

- A. Provide TAB for equipment and motors including performance tests as required in applicable sections of Division 23.
- B. During final TAB, related systems shall be in full operation.

- C. Test and balance systems in all specified modes of operation. Verify that dampers and other controls function properly.
- D. Operate fans at slowest speed that will deliver indicated air quantity.
- E. Compensate for condition of filters at time of balancing so that system will deliver proper amount of air when filters become dirt-laden and nearly due for replacement.
- F. Record positions of outdoor, return, and relief dampers as set for cooling cycle.
- G. Adjust duct volume dampers to minimize outlet and inlet damper throttling.
- H. Install sectorizing baffles in diffusers to overcome drafts caused by flow interference of obstructions.
- I. Test and balance the domestic hot water recirculation system.
- J. Operating Tests: Demonstrate to COR the specified performance of systems and components.

END OF SECTION

## SECTION 23 07 00 - MECHANICAL INSULATION

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

Insulation for piping and ductwork specified in Divisions 22 and 23.

#### 1.2 RELATED DIVISIONS AND SECTIONS

- A. Division 01 - General Requirements
- B. Section 23 05 00 - Basic Mechanical Materials and Methods
- C. Section 23 20 00 - Building Services Piping
- D. Section 23 31 13 - Ducts and Duct Accessories

#### 1.3 QUALITY ASSURANCE

- A. Unless otherwise noted, pipe insulation shall have a K value insulation conductivity Btu inch/hour-ft<sup>2</sup> degrees F in accordance with ASHRAE 90.1-2016.
- B. Unless otherwise noted, duct insulation shall have an insulation R-value (hour)(ft<sup>2</sup>) (degrees F)/Btu in accordance with ASHRAE 90.1-2016.
- C. Duct insulation materials are restricted to those which are UL listed in accordance with the requirements of NFPA 90A, latest edition, and with a flame spread index not over 25 and a smoke developed index no higher than 50.
- D. Insulation on pipes and ducts through floors, fire rated walls, and smoke barriers shall be UL listed fire-stop insulation to maintain fire resistance of the floor, fire rated wall, or smoke barrier in accordance with NFPA 101.
- E. Canvas covering shall be flame and mildew proof.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.
- B. Each type of insulation: Manufacturer and product designation, surface burning characteristics, thickness, density in pounds in accordance with cubic foot, thermal conductivity or R-value, water vapor permeance thickness, jackets (factory and field applied), and accessories.

- C. System application for each type of insulation.
- D. Statement of compliance with ASHRAE 90.1-2016.
- E. Statement of compliance with NFPA 90A, flame spread index and smoke developed index requirements.
- F. Statement of compliance with National Architectural and Industrial Maintenance Rule for VOC levels on Adhesives, Mastics, and Coatings for the State of Pennsylvania.
- G. Statement of compliance with Ozone Transport Commission for VOC levels on Adhesives, Mastics, and Coatings for the State of Pennsylvania.

## 1.5 APPLICABLE PUBLICATIONS

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

## 1.6 PROJECT CONDITIONS

- A. Where insulation must be stored outdoors, provide polyethylene film cover for protection. Insulation that becomes wet shall be replaced; drying of insulation is not acceptable.
- B. Coordinate clearance requirements for installation of insulation and field applied jackets and finishes on pipe, ductwork, and equipment installation.

# PART 2 PRODUCTS

## 2.1 GENERAL MATERIAL REQUIREMENTS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products shall comply with the National Architectural and Industrial Maintenance (AIM) Rule for VOC levels for the State of Pennsylvania.
- C. Products shall comply with the Ozone Transport Commission limits for VOC levels for the State of Pennsylvania.

## 2.2 ADHESIVES, MASTICS, COATINGS

- A. Adhesives
  - 1. Type A1
    - a. High tack, rapid setting water-based adhesive.
    - b. Solvent free, low VOC (0.03 pounds/gallon) synthetic elastomer emulsion.
    - c. Non-flammable when wet and fire-resistive when dry.



- d. Moisture resistant.
  - e. Flame spread index 0 and smoke developed index 0.
  - f. Asbestos, lead, and mercury free.
  - g. ASTM C916 Type 11.
- B. Mastics
  - 1. Type M1
    - a. White, flexible, water-based vapor barrier mastic.
    - b. Low VOC (0.3 pounds/gallon).
    - c. Non-flammable when wet and fire-resistive when dry.
    - d. Water resistant and low water vapor permeance.
    - e. Flame spread index 5 and smoke developed index 25.
    - f. Asbestos, lead, and mercury free.
    - g. MIL-C-19565C, Type II.
- C. Coatings
  - 1. Type C1
    - a. White, washable, abrasion-resistant coating.
    - b. Low VOC (0.13 pounds/gallon).
    - c. Fire resistant.
    - d. Flame spread index 10 and smoke developed index 5.
    - e. Asbestos, lead, and mercury free.
    - f. MIL-A-3316C, Class I, Grade A.
- D. Manufacturers: Childers, Foster, Mon-Eco Industries.

## 2.3 INSULATION TYPES

- A. Type A
  - 1. Insulation: Sectional molded glass fiber pipe insulation. Minimum density: 3.0 pounds per cubic foot meeting ASTM C547 Standard Specifications for Mineral Fiber Pipe Insulation of Type I, Grade A.
  - 2. Factory Applied Jacket: White, polypropylene-coated ASJ jacket with self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip, kraft paper, fiberglass reinforced scrim with aluminum foil backing, complying with ASTM C1136, Type I.
  - 3. Factory fabricated shapes in accordance with ASTM C450 and ASTM C585.
  - 4. Insulated Fitting Covers: Insulation insert with PVC cover equivalent to Zeston.
  - 5. Manufacturers: Johns-Manville Micro-Lol HP Ultra, Knauf Earthwool 1000° Pipe Insulation, Owens-Corning Fiberglass Insulation SSLII with ASJ Max.
- B. Type C
  - 1. Insulation: Flexible, closed-cell elastomeric pipe insulation equal to AP Armaflex or AP Armaflex SS, meeting ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form, Type I.
  - 2. Minimum Density – 5 pounds in accordance with cubic foot.
  - 3. Material shall have a flame spread index of 25 or less and a smoke developed index of 50 or less as tested by ASTM E84.
  - 4. Suitable for temperatures 0 to 220 degrees F.

5. Maximum moisture vapor transmission of 0.08 perms.
6. Manufacturers: Aerocell, Armacell, K-flex.

C. Type E

1. Insulation: Flexible glass fiber blanket bonded with a thermosetting resin meeting ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications, Type II.
2. Minimum Density - 3/4-pound per cubic foot.
3. Factory Applied Jacket: FRK/FSK facing, vapor retardant barrier jacket of minimum 0.001-inch aluminum foil, fiberglass reinforced scrim with kraft paper backing, complying with ASTM C1136, Type II.
4. Maximum moisture vapor transmission of 0.02 perms.
5. Manufacturers: Certain-Teed, Johns-Manville Microlite EQ FSK Duct Wrap, Knauf Microlite EQ FSK Duct Wrap, Owens-Corning SoftR Duct Wrap FRK.

D. Type F

1. Insulation: Semi-rigid glass fiber fiberboard bonded with a thermosetting resin meeting ASTM C1393 Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks, Type II or IIIA, Category 2.
2. Minimum density - 2.5 pounds per cubic foot.
  - a. Up to and Including 22-inch Diameter: Sectional molded type.
3. Factory Applied Jacket: White vapor retardant barrier jacket minimum 0.001-inch aluminum foil reinforced with glass fiber bonded to flame resistant kraft paper.
4. Maximum moisture vapor transmission of 0.02 perms.
5. Manufacturers: Certain-Teed CrimpWrap Pipe & Tank, Johns-Manville Micro-Flex, Knauf KwikFlex, Owens-Corning Flex Wrap ASJ.

E. Type G

1. Insulation: Rigid glass fiberboard meeting ASTM C 612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation, Type IB or IB.
2. Minimum density – 6.0 pounds per cubic foot.
3. Factory Applied Jacket: White, polypropylene-coated ASJ jacket, kraft paper, fiberglass reinforced scrim with aluminum foil backing, complying with ASTM C1136, Type I.
4. Maximum moisture vapor transmission of 0.02 perms.
5. Corner Bead: PVC, Aluminum, or Stainless Steel suitable for the application.
6. Manufacturers: Certain-Teed Commercial Board, Johns-Manville 800 Series Spin-Glas, Knauf Earthwool Insulation Board, Owens-Corning 700 Series Board Insulation.

## 2.4 FIELD APPLIED PIPE JACKETS

A. PVC Jacket

1. High-impact resistant, UV-resistant PVC complying with ASTM D 1784, Standard Specification for Rigid Polyvinyl Chloride (PVC) compounds and Chlorinated Polyvinyl Chloride (CPVC) compounds. and Class 16354-C; 30 mils thick, roll stock ready for shop or field cutting and forming.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color as selected by COR.

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
  5. Manufacturers: Johns Manville; P.I.C. Plastics, Inc.; Proto Corporation; Speedline Corporation.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Width: 2 inches.
  2. Thickness: 6 mils.
  3. Adhesion: 64 ounces force/inch in width.
  4. Elongation: 500 percent.
  5. Tensile Strength: 18 lbf/inch in width.
  6. Manufacturers: ABI, Compac Corporation, Venture Tape.
- C. PVC Jacket Adhesive: Compatible with PVC jacket.
1. For indoor applications; adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Manufacturers: Dow Corning Corporation 739, Dow Silicone; Johns Manville Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive; P.I.C. Plastics, Inc. Welding Adhesive; Speedline Corporation Polyco VP Adhesive.

### PART 3 EXECUTION

#### 3.1 GENERAL PREPARATION AND APPLICATION REQUIREMENTS

- A. Complete piping, ductwork, and equipment tests before insulation is applied.
- B. Clean and dry surfaces to be insulated of loose scale, dirt, oil, water and other foreign matter.
- C. Insulate completely metal surfaces of piping and ductwork other than hangers as delineated under Extent of Insulation.
- D. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings, and piping including fittings, valves, and specialties.
- E. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- F. Install insulation with least number of joints practical.
- G. Permit expansion and contraction without causing damage to insulation or surface finish.
- H. Extend surface finish to protect surfaces, ends, and raw edges of insulation.
- I. Where connections are made to existing systems, provide insulation as specified and to match existing where existing insulation is removed or damaged for new connection. Provide vapor barrier continuously sealed to the existing insulation.

- J. Provide vapor retarding barriers continuous and uninterrupted throughout the system where specified.
- K. Mix insulating cements with clean potable water.
- L. 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.
- M. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- N. Install multiple layers of insulation with longitudinal and end seams staggered.
- O. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- P. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that become wet.
- Q. Cut insulation in a manner to avoid compressing insulation.
- R. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- S. 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.
- T. Penetrations
  - 1. Aboveground Exterior Wall Penetrations: Install insulation continuously through penetrations.
    - a. Seal penetrations with flashing sealant.
    - b. For applications requiring only indoor insulation, terminate insulation at inside wall surface for wall penetrations. Seal with joint sealant
    - c. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
    - d. Extend jacket of outdoor insulation outside wall flashing for wall penetrations and overlap wall flashing at least 2 inches.
    - e. Seal jacket to wall flashing with flashing sealant.
  - 2. Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
  - 3. Non-Fire Rated Interior Floor, Wall and Partition Penetrations: Install insulation continuously through floors, walls and partitions.
- U. Piping
  - 1. Insulate valves, strainers and fittings, including unions and flanges. For the purpose of this specification, fittings include unions and flanges. Install insulation with continuous thermal and vapor retardant integrity, unless otherwise noted. Use premolded material where available.

2. Insulate valve bodies and flanges up to and including bonnets, valve stuffing-box studs, bolts.
3. Fill hollow interior of protection saddles with insulating cement.

V. Ductwork

1. Use of materials is restricted for duct insulation to those which are UL listed in accordance with the requirements of NFPA 90A, latest edition, and with a fire hazard rating as tested in accordance with ASTM E84 and UL 723, not to exceed 25 flame spread index and smoke developed index not to exceed 50.
2. Cover standing seams and metal surfaces with insulation.
3. Provide staples that are stainless steel, outward clinching, and sealed to maintain vapor barrier.
4. Unless otherwise indicated, insulation is not required on:
  - a. Ducts with internal lining of sufficient thickness to comply with energy code and ASHRAE Standard 90.1
  - b. On factory insulated flexible ducts or factory insulated plenums and casings
  - c. Flexible connectors
  - d. Vibration control devices

- W. Vermin Proofing: Wherever insulated piping and ductwork pass through sleeves or openings which are required to be vermin proof, provide sections of foamed glass insulation equal in length to length of sleeves. Refer to Section 23 05 00, "Basic Mechanical Materials and Methods," in the Article titled, "Sleeves and Escutcheon Plates" for details and extent of vermin proofing.

### 3.2 ADHESIVES, MASTICS, COATINGS

- A. Apply adhesives, mastics and coatings at the rate of coverage and in a manner recommended by the manufacturer.
- B. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise noted.
- C. Mastics shall comply with MIL-C-19565C, Type II.
- D. Lagging adhesives shall comply with MIL-A-3316C, Class I, Grade A.

### 3.3 INSULATION TYPES

A. Type A

1. Application
  - a. Pipe: Fit insulation to pipe, staggering longitudinal joints. Seal longitudinal joint overlaps with 4-inch wide sealing strips of vapor barrier jacket material applied on circumferential joints with Type A1 adhesive.
  - b. Fittings and Valves: Apply fabricated or premolded insulated fitting covers or insulating cement equal in thickness and density to adjoining pipe insulation. Seal with a 1/16-inch thick coat of Type M1 mastic for cold lines. Seal with a 1/16-inch thick coat of Type C1 coating for hot lines. Imbed a layer of glass

fiber fitting tape in the mastic or coating and after the initial coat has dried, apply an additional 1/16-inch coat of mastic or coating.

2. Surface Finish

a. All piping.

1) Pipe

- a) Standard duty, concealed – no additional finish required.
- b) Heavy Duty - Apply a tack coat of Type C1 coating over entire surface; imbed a layer of 8-ounce canvas; when dry, apply a second coat of Type C1 coating.

2) Fittings and Valves:

- a) Standard Duty – no additional finish required.
- b) Heavy Duty – Apply a finish coat of Type C1 coating after mastic has thoroughly dried.

3) Apply heavy-duty surface finish to pipes, fittings, and valves when not concealed behind wall or above the ceiling.

3. Refrigerant Piping: Coat inside of insulation with mineralization coating. Apply coating to inside core of insulation simultaneously with the installation of the insulation and rotate onto the pipe.

B. Type C

1. Pipe: Slip the insulation over the pipe wherever possible or slit the insulation sections and apply around the pipe. Seal seams and joints with insulation manufacturer's adhesive.

2. Fittings, Valves: Fabricate segments of insulation, miter joints. Seal with special adhesive.

3. Outdoors:

- a. Apply two coats of WB Armaflex finish, or approved equal, in accordance with manufacturer's instructions and recommendations.
- b. Locate seams on lower half of the pipe.

4. Refrigerant Piping: Coat inside of insulation with mineralization coating. Apply coating to inside core of insulation simultaneously with the installation of the insulation and rotate onto the pipe.

C. Type E: Wrap insulation around duct and seal joints in accordance with manufacturer's instructions. Secure insulation on ducts with long sides or diameters exceeding 24 inches with pins welded or adhered on 18-inch centers. Secure washers on pins. Butt insulation joints with reinforced foil face extending 2 inches beyond the insulation for lagging and seal flaps with Type A1 adhesive. Use stainless steel staples to assist in securing insulation. Seal vapor barrier penetration with Type M1 Mastic.

D. Type F: Apply to duct, staggering longitudinal joints to provide a complete and tight fit to the contour of the duct surface on the exterior. Seal longitudinal joint jacket overlaps and 4-inch wide sealing strips of jacket material applied on circumferential joints with Type A1 adhesive or self-sealing laps. Use stainless steel staples to assist in securing scored board insulation where joint is hidden.

E. Type G

1. Application

- a. Secure insulation with pins welded or adhered to sheet metal on 15-inch centers. Cut side pieces of insulation to lap top and bottom pieces. Apply

- Type A1 adhesive to entire underside of horizontal metal surfaces. Secure 1-1/2-inch diameter fiber or tin-coated disk to pins.
- b. Protect outer corners of insulation with 3 by 3-inch aluminum angles or roll-on corner bead.
- c. Butt insulation joints, seal with 4-inch vapor barrier foil tape or 2-inch laps adhered with Type A1 adhesive. Seal over penetrations and disks with tape or Type M1 mastic.
- 2. Surface Finish
  - a. Imbed glass-reinforcing fabric, 20 by 20 mesh (1-1/2-ounce minimum) in tack coat of Type C1 coating (2 gallons in accordance with 100-square-foot) lapping joints a minimum of 2 inches.
  - b. Finish when dry with final coat of Type C1 coating (4 gallons in accordance with 100-square-foot).

### 3.4 FIELD APPLIED JACKETS

- A. Where PVC jackets are used, install with 1-inch overlap at longitudinal seams and end joints for horizontal applications. 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.

### 3.5 INSTALLATION SCHEDULE

#### A. Piping

PIPING SYSTEM	MATERIAL TYPE	INSULATION THICKNESS IN INCHES FOR PIPE SIZE				
		Less than 1"	1 to less than 1-1/2"	1-1/2 to less than 4"	4 to less than 8"	8" & Larger
Outdoor Refrigerant Suction and Hot Gas (Note 2)	C	2	2	2	2	2
Indoor Refrigerant Suction; Hot Gas; and Outdoor and Indoor Refrigerant Liquid (Note 2)	C	1	1	1	1	1-1/2
Domestic Cold Water	A, C (Note 6)	1/2	1/2	1	1	1
Domestic Hot Water or Recirculating Water	A, C (Note 6)	1	1	1-1/2	1-1/2	1-1/2
Air Conditioning Condensate	A, C (Note 6)	3/4	3/4	1	1	1
Branch Waste or Storm Drain Carrying Air Conditioning Condensate	A, C (Note 6)	1	1	1	1	1

B. Ductwork and Plenums (Note 7)

<b>FOR AIR SYSTEMS TRANSPORTING AIR AT 48 DEGREES F AND ABOVE</b>	<b>MATERIAL TYPE</b>	<b>INSULATION THICKNESS (INCHES)</b>
<b>Concealed</b>	E	2.2
<b>Exposed Rectangular</b>	G	2
<b>Exposed Round</b>	F	2

Note 1: Not Used

Note 2: Locate hangers outside of insulation with saddles or thermal shields specified under another section. In the saddle, provide a half section of calcium silicate or foam glass equal in thickness to adjoining insulation, sized to carry load without crushing, and vapor sealed. Insulate supports and anchors in contact with pipe the same as piping.

Note 3: Not Used.

Note 4: Not Used

Note 5: Not Used.

Note 6: Type C may be used in lieu of Type A, where indicated, at Contractor's option, for pipes up through 2-inch except where heavy-duty finish is required.

Note 7: If insulated ductwork is supported from the bottom, provide calcium silicate or foam glass equal to thickness of the adjoining insulation at the support. Vapor seal and size to carry the load without crushing.

3.6 EXTENT OF INSULATION

A. Piping: Insulate as designated in Installation Schedule.

B. Ductwork and Plenums: Insulate the following:

1. Outdoor air.
2. Return air
3. Supply air.
4. Intake and exhaust air plenums.
5. Exhaust air ductwork and plenum between motor operated damper or gravity backdraft damper and penetration of building exterior.

END OF SECTION



## SECTION 23 20 00 - BUILDING SERVICES PIPING

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

Piping, fittings, joints, valves, coating and wrapping, and supports for Sections 21 13 00 and Divisions 22 and 23.

#### 1.2 RELATED DIVISIONS AND SECTIONS

- A. Division 01 - General Requirements
- B. Section 21 13 00 - Fire Suppression
- C. Section 22 11 29 – Plumbing System Pumps
- D. Section 22 34 00 – Domestic Water Heater
- E. Section 22 40 00 - Plumbing Fixtures and Equipment
- F. Section 23 05 00 - Basic Mechanical Materials and Methods
- G. Section 23 05 48 – Mechanical Sound and Vibration Control
- H. Section 23 05 93 – Testing, Adjusting and Balancing
- I. Section 23 07 00 - Mechanical Insulation
- J. Section 23 70 00 - HVAC

#### 1.3 QUALITY ASSURANCE

- A. Valves shall conform to ASME Boiler and Pressure Vessel Code Specifications where indicated or required by state or local code.
- B. All inline devices installed on the domestic service lines or building distribution system downstream of the water main and before end point devices and is in contact with the water intended for human ingestion shall comply with the Safe Drinking Water Act and National Sanitary Foundation (NSF) Standard 61 and Standard 372 to provide lead-free water (not containing more than 0.25 percent lead).
  - 1. Inline devices include water meters, valves, check valves, strainers, meter stops, backflow preventers, fittings, etc.
- C. All grooved joint couplings, fittings, valves, check valves, strainers, etc. shall be the product of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
  - 1. All castings used for coupling housings, fittings, valve bodies, etc. shall be stamped for quality assurance and traceability.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.
- B. Statement of piping and fitting material, and type of joint to be used for each piping system.
- C. Manufacturer's technical product data, installation instructions and description of accessories for each type to be used and system designation:
  - Valves
  - Pipe Supports
  - Insulation Protection
  - Thermometers and Test Wells
  - Pressure Gages and Test Connections
- D. NSF 61 Certification of domestic water devices.
- E. Test reports for refrigeration and fire protection piping.
- F. Grooved joint product submittals shall specifically identify the applicable manufacturer's product style or series number.

#### 1.5 APPLICABLE PUBLICATIONS

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

#### 1.6 PROJECT CONDITIONS

- A. Workmanship
  - 1. Cut pipes accurately to measurements established at structure.
  - 2. Install without springing or forcing.
  - 3. Clear windows, doors, and other openings.
  - 4. Permit expansion and contraction without misalignment or damage.
  - 5. During construction, close openings in piping and equipment to keep out foreign matter and to prevent leakage.
  - 6. Piping shall be concealed unless otherwise indicated.
  - 7. Provide offsets required to avoid structural or other interference without extra cost to the Government.
- B. Drainage
  - 1. Grade to low points.
  - 2. Provide hose end drain valves at bottom of risers, low points, and where indicated.
- C. Access: All valves, unions, flanges, devices shall be installed in accessible locations.

## PART 2 PRODUCTS

### 2.1 FITTINGS AND ACCESSORIES

- A. Reducers: Reducing fittings, eccentric type where required to prevent pocketing of air and water.
- B. Unions, Flanges, Mechanical Couplings, and Gaskets
  - 1. Suitable for intended duty and rated for not less than system test pressure.
  - 2. Dielectric (insulating) type in water piping systems, suitable for intended service.

### 2.2 PIPE, FITTINGS AND JOINTS

#### A. Pipe

TYPE	REFERENCE
A	Cast Iron Soil Hub and Spigot Pipe and Fittings: Service weight, except where extra heavy is specified, ASTM A74, 10-foot lengths where possible. Pipe and fittings shall be marked with the collective trademark of the CISPI and NSF listed or receive prior approval from the Contracting Officer's Representative (COR).
E	Black Steel Pipe: American Steel only in compliance with ASME B31.9; ASTM A53 Grade B, ERW or seamless; or ASTM A106 Grade B seamless. Sizes through 10 inches, standard weight, 12 inches and larger 3/8-inch wall.
F	Galvanized Steel Pipe: Same reference as E.
G	Cast Iron Hubless (No-Hub) Pipe and Fittings: Cast Iron Soil Pipe Institute Standard (CISPI) No. 301 and ASTM A888. Install and support in accordance with Cast Iron Soil Pipe Institute recommendation. Pipe and fittings shall be marked with the collective trademark of the CISPI and NSF listed or receive prior approval from the COR.
L	Seamless Copper Water Tube: ASTM B88, Type "L" hard temper; ASTM B280 for Type ACR.
P	Perforated Rigid Polyvinyl Chloride (PVC) Pipe and Fittings: ASTM D2729.

#### B. Fittings

TYPE	REFERENCE
BB	Wrought Copper Solder Joint Fittings: ANSI/ASME B16.22.
FF	Black Cast Iron Screwed Fittings: 125 psi steam, 175 psi water, ANSI/ASME B16.4.
LL	Cast Iron Screwed Drainage Fittings: ANSI/ASME B16.12.
QQ	Factory Grooved End Fittings: UL listed ASTM A395 and A536 ductile iron; ASTM A234 forged steel; or factory fabricated from carbon steel pipe conforming to ASTM A53. Anvil, Central Sprinkler, or Victaulic equal to Victaulic standard dimension or Firelock type UL/FM approved for fire protection service, or approved equal. Tees equal to Victaulic Style 002. Sprinkler Head Connection: Direct sprinkler head connections, branch connections, drop nipples, and sprigs shall be Victaulic 922 outlet connections, or approved equal.

#### C. Joints

TYPE	REFERENCE
1	Threaded-American Standard for Pipe Threads: ANSI B1.20.
3	Packed Oaken or Hemp: ASTM B29, filled molten lead driven to final setting in

TYPE	REFERENCE
	accordance with National Standard and International Plumbing Codes.
7	Soldered: ASTM B32; Tin-antimony, 95-5, tin silver 96-4, or tin silver 94-6.
9	Brazed-Silver Alloy Brazing equal to Sil-Fos and Easy-Flow by Handy and Harman.
10	Gasket-Neoprene Double Seal Compression Type: ASTM C564 for hub and spigot cast iron pipe couplings.
11	Mechanical Couplings: Anvil, Central Sprinkler, or Victaulic equal to Victaulic Style 005 zero-flex rigid couplings or Victaulic Style 75 flexible couplings with gaskets suitable for minus 30 to 230 degrees F continuous temperature, lubricated per manufacturer's recommendation. Victaulic Style 75 or approved equal shall be limited to connections at equipment and where indicated on drawings.
16	Mechanical Couplings for Hubless (No-Hub) Cast Iron Pipe: CISPI-310 with ANSI Type 301-305 stainless steel clamps and shield, ASTM C-564 with integral custom pipe stop. Couplings underground and in aboveground piping shall conform to the requirements of CISPI 310 and ASTM C1277 and shall be heavy-duty Type 304 stainless steel shield, bands, and tightening devices with 3/8-inch socket, and ASTM C564 rubber sleeve with integral, center pipe stop, equal to Husky SD, Series 4000 or Clamp-All Hi-Torq 125. Couplings shall bear the NSF trademark.

## 2.3 COATING AND WRAPPING

- A. Type A: High density, two layer polypropylene coating shop applied in shop over a modified rubber blend adhesive equivalent to Yellow Jacket by Bredero Shaw Company.
- B. Type C: Coal-tar primer and enamel wrapped in coal-tar saturated felt and kraft paper in conformance with American Water Works Association (AWWA) Spec. C-203.

## 2.4 VALVES

- A. Manufacturer's Tests: Each valve shall be given shell and seat tests by the manufacturer and shall carry a permanently affixed indication that tests have been successfully completed.
- B. ASME Boiler Code Compliance: Provide valves, which conform to ASME Boiler Code Specifications, where indicated, or where required by state or local code.
- C. Combination Balancing and Shutoff Valve
  - 1. Domestic Cold and Hot Water Systems
    - a. Type C
      - (1) Calibrated ball valve type equal to Bell & Gossett Circuit Setter Plus.
      - (2) NSF 61 Listed lead-free valve.
      - (3) Pressure/temperature ports with check valves.
      - (4) Positive shutoff
      - (5) Memory setting feature.
      - (6) Calibrated nameplate.
      - (7) Sizes: 1/2 to 1-inch.
      - (8) Manufacturers: Bell & Gossett or approved equal.
- D. Valves used on domestic water lines shall be NSF 61 listed.

- E. Drain Valves: Hose end ball valve with cap and chain equal to NIBCO Fig. T-585-70-HC ball with American Standard Garden Hose type threads. Drain valves on potable water systems shall include a vacuum breaker hose connection.
- F. Gate, Globe, and Check Valves
1. Gate and globe valves designed for repacking under pressure when fully opened, and equipped with packing suitable for the intended service. When the valve is fully opened, the back seat shall protect the packing and the stem threads from the fluid. Each gate and globe valve shall have a gland follower.
  2. Bronze valves with the basic saturated steam rating of 125 psi or 150 psi shall have pressure containing parts of a material having at least the physical properties of ASTM Specification B-62. Metallic seated bronze globe, angle, check and gate valves with a basic steam rating of 200 or 300 psi having pressure containing parts of material conforming to ASTM B-61, for temperatures to 550 degrees F.
  3. Pressure containing parts of iron body valves shall be of material conforming to ASTM A-126 Grade B. If the wedge in OS&Y gate valves is fastened to the stem by threads, it shall be secured by a nickel alloy or monel pin.
  4. Face-to-face and end-to-end dimensions of iron body valves to conform to ANSI B16.1. Design, workmanship, materials, and testing to conform to MSS-SP-70, MSS-SP-71, and MSS-SP-85 (Manufacturers Standardization Society of the Valve and Fitting Industry).
  5. Solid wedge type gate valves, designed and manufactured in such a way that seating surfaces are prevented from contacting until near the point of closure.
  6. Handwheels of ASTM A47 malleable iron or ASTM A126, Class A or B iron.
  7. Manufacturers: Unless otherwise indicated, Crane, Grinnell, Hammond, Kennedy, Milwaukee, NIBCO, Powell or Stockham equal to NIBCO or other listed manufacturer figure numbers as noted in Schedule of Services.
- G. Ball Valves
1. Ball valves shall have stem extension to place handle outside the insulation when valve is to be installed in insulated piping.
  2. Type D: Lead-free silicon brass alloy body, stem, and ball, Virgin PTFE seats, EPDM seals, full port size, threaded or soldered end as required through 2-inch size and acceptable for 2-1/2-inch size if valve is full port. Valve shall be two-piece and be NSF 61 listed. NIBCO 685-80-LF.
  3. Manufacturers: Unless otherwise indicated, Apollo, Contromatics, Crane, Dynaquip, Fairbanks, Hammond, ITT Grinnell, Jamesbury, MarPac, Milwaukee, NIBCO, Powell, Watts, Webstone, Worcester for types listed in Schedule of Services.
- H. Schedule of Services: Unless otherwise indicated, valves are for aboveground service. Size range indicated is size of pipe where valves are required. Valves shall be pipe size or larger.

DOMESTIC HOT AND COLD WATER				
TYPE	SIZE RANGE	SPECIFIC REQUIREMENTS	STYLE	FIGURE NO.
Ball	2-inch and Smaller	NSF 61 Listed	-	Type D
Check	3-inch and Smaller	NSF 61 Listed	Screwed End Soldered End	TI-413-Y-LF SI-413-Y-LF

FIRE PROTECTION				
TYPE	SIZE RANGE	SPECIFIC REQUIREMENTS	STYLE	FIGURE NO.
Gate	2-1/2-12-inch	UL Listed	OS&Y, FLG or MC 175 psi	F-607-O
Check	2-1/2 and Larger	UL Listed	FLG or MC 175 psi	F-908-W

REFRIGERANT				
TYPE	SIZE RANGE	SPECIFIC REQUIREMENTS	STYLE	FIGURE NO.
Packless Globe	1/4-1-1/8-inch ODS	-	-	Henry 626
Wing Cap	1-3/8 - 4-3/8-inch ODS	-	-	Henry 203

## 2.5 PIPE SUPPORTS

- A. General: Supports shall be plastic coated for plastic pipe, copper plated for copper tubing and brass pipe, galvanized for uninsulated galvanized steel pipe, and black steel for other metallic piping. Outdoor supports shall be copper plated for copper tubing and brass piping, and galvanized for all other piping.
- B. Horizontal Piping
  1. Clevis Hangers: Adjustable wrought steel clevis hangers.
  2. Under Supports:
    - a. Where no provision for expansion and contraction is required:
      - (1) Floor Mounted: Adjustable cast iron saddle with floor flanges secured to floor and pipe nipple of suitable length.
      - (2) Trapeze or Metal Frame Mounted: Inverted U bolts with saddle supports for insulated pipe.
      - (3) Wall Mounted: Steel J hooks for pipes 3-inch and smaller; welded steel brackets for larger pipes with hanger or support same as for trapeze.
  3. Metal Frame Supports:
    - a. Provide as required, vertical and horizontal 12 gage galvanized steel channels and fittings bolted together to form a multiple pipe rack secured to the building structure with post bases and brackets. Equal to Grinnell Power-Strut, ASTM A-446, Grade A, hot dipped zinc coated steel with safety end enclosures.
    - b. Manufacturers: B-Line, Steel City, Unistrut, Grinnell.
- C. Vertical Piping
  1. Steel extension pipe clamps for piping not subject to vertical movement by expansion or contraction.
- D. Insulation Protection
  1. Saddle: 18 gage galvanized sheet metal.

## 2.6 EQUIPMENT RAILS

- A. Furnish equipment rails equal to Roof Products and Systems Corporation, Model ER-4B, where indicated on the drawings.
- B. Equipment rails shall be manufactured of 18 gage galvanized steel, fully mitered and welded corners, 3-inch cant. Equipment rails shall be internally reinforced with integral baseplate and factory installed 2 by 8-inch wood nailer. Height shall be 18 inches above finished roof.
- C. Manufacturers: Pate, Roof Products and Systems Corp.

## 2.7 THERMOMETERS AND TEST WELLS

- A. Types
  - 1. Direct Mounting: 5-inch dial, externally calibrated, standard industrial bimetal, with stainless steel stems and cases equal to Weston Models 4503 and 4513. Stem length - minimum, 1/2 depth of pipe; maximum, 24 inches.
  - 2. Where indicating points cannot be conveniently read or temperature correctly sensed, provide organic fluid filled protected capillary tube for remote mounting.
- B. Ranges
  - 1. For Media Temperatures not Exceeding 100 degrees F: 25 to 125 degrees F.
  - 2. For Media Temperatures above 100 degrees F, but not Exceeding 220 degrees F: 30 to 240 degrees F.
- C. Accessories: Provide with separable brass wells with insulation extension on insulated pipe.
- D. Manufacturers: Ashcroft, Marsh, Marshalltown, Moeller, Taylor, Tel-Tru, Trerice, U.S. Gage, Weiss, Weksler, Weston, Winters.
- E. Test Wells: Provide brass thermometer wells with screw cap and chain.

## 2.8 PRESSURE GAGES AND TEST CONNECTIONS

- A. Type: General purpose bronze bourdon tube, bronze bushed movement mounted on socket independent of case, 1 percent minimum accuracy at mid range, 4-1/2-inch white face equal to Ashcroft Catalog No. P2070A.
- B. Ranges: Approximately twice the maximum operating pressure. Provide compound gages wherever negative pressures can occur.
- C. Accessories: Provide gages with Trerice No. 735 or 740 valve suitable for intended pressure, temperature and service.
- D. Manufacturers: Ashcroft, Marsh, Marshalltown, Moeller, Taylor, Tel-Tru, Trerice, U.S. Gage, Weiss, Weksler, Weston, Winters.
- E. Test Connections: Provide with Trerice No. 735 or 740 gage valves suitable for intended pressure.

## PART 3 EXECUTION

### 3.1 FITTINGS AND ACCESSORIES

- A. Reducers: Use reducing fittings to make changes in pipe sizes.
- B. Unions, Flanges, Mechanical Couplings, and Gaskets
  - 1. Install at each piece of equipment, in bypasses, and long piping runs to permit disassembly for alteration and repairs.
  - 2. Equipment Connections: Provide piping connections which conform to indicated sizes, details, reviewed shop drawings, and printed installation instructions furnished by manufacturer.
  - 3. Dielectric (Insulating) Type: Install in water piping systems where pipes of dissimilar metals are joined and where unions are required by contract documents.
  - 4. Contractor shall install tongue and recess mechanical couplings with a torque wrench in accordance with manufacturer's recommendations. Use of an impact wrench is not permitted on tongue and recess mechanical couplings.
- C. Threads: Remove burrs and ream to full inside diameter.
- D. Brace underground pressure piping with clamps and concrete buttresses to prevent movement at joints. Brace or anchor long runs of pressure piping and use mechanical couplings to prevent excessive expansion.

### 3.2 PIPE, FITTINGS AND JOINTS

- A. Schedule

SYSTEM	PIPE	FITTINGS	JOINTS
<b>Sanitary Drainage and Vent</b>			
1. Underground: Within building and to 10 feet outside foundation wall, and under driveways and parking lots	A	A	3, 10
2. Aboveground: Within building	A	A	3, 10
	F	LL	1
	G	G	16
<b>Storm Drainage</b>			
1. Aboveground: Within building	A	A	3, 10
	F	LL	1
	G	G	16
2. Foundation Drains	P	-	-
3. Pumped Discharge	L	BB	7
<b>Domestic Cold Water</b>			
1. Aboveground: 2-inch and smaller	L	BB	9
<b>Domestic Hot Water, Domestic Hot Water Relief</b>			
1. Aboveground	L	BB	9
<b>Fire Protection</b>			
1. Aboveground: Up to 175 psi working pressure	E	QQ	11
	E	FF	1



SYSTEM	PIPE	FITTINGS	JOINTS
<b>Air Conditioning Condensate</b>			
1. Aboveground: 2-inch and smaller	L	BB	7
<b>Refrigeration Piping</b> * Type ACR; Underground with Type A or C Coating	L*	BB	9

### 3.3 COATING AND WRAPPING

#### A. Type A

1. Apply the adhesive for a uniform thickness recommended by manufacturer. Apply the polypropylene coating over the adhesive for a uniform coating thickness recommended by the manufacturer. Coating shall have a tensile strength of 3000-psi and elongation of 100 percent.
2. Wrap fittings and joints with primer and manufacturer's plastic tape or hot applied coal tar tapes.
3. Ship piping 2 inches and smaller from coating plant to job site with pipe caps.

#### B. Type C

1. Coat and wrap piping, except field joints, in factory or shop. Coating shall consist of coal tar primer applied immediately after cleaning and two coats of coal-tar enamel to a thickness of not less than 3/32-inch and a wrapper of coal-tar saturated felt followed by a special wrapping of kraft paper.
2. Coat and wrap field joints manually. Overlap the enamel and felt on each side of field joint with field wrapping.
3. Test coating in shop or factory before shipment and again in field after pipe has been placed in trench. Test joints after installation. Conduct tests by means of an electric holiday detector, operating at a crest voltage of not less than 10,000 volts, furnished by the Contractor and on the site at all times. Repair defects indicated by tests at no additional cost to the Government, as reviewed by Contracting Officer Representative (COR).
4. Pipe coating, wrapping, testing and handling of pipe shall conform to American Water Works Association Spec. C-203.

- C. Provide exterior coating on underground piping system as indicated in piping schedule.

### 3.4 VALVES

- A. Adjust for smooth and easy operation.
- B. Install in locations where valve can easily be adjusted.
- C. Install valves full size of pipe before reducing size to make connection to equipment and controls.
- D. Remove excess solder and other foreign matter from valve interior after installation before operating valve.
- E. Cut Off or Stop Service: Gate or ball, as specified.
- F. Balancing Valves: Combination balancing and shutoff.

### 3.5 PIPE SUPPORTS

#### A. Preparation and Application

1. Provide supports to maintain required slope and alignment.
2. Secure hangers to rods with double nuts.
3. Make allowance for expansion and contraction.
4. Do not support pipes from ducts or other pipes.
5. Use trapeze hangers for parallel runs of pipe with same slope.
6. Provide bracing to prevent lateral motion of horizontal or vertical piping.
7. Provide supports at or near changes in direction.
8. Do not pierce ducts with hanger rods.
9. Provide strength and rigidity suitable for loads imposed.
10. Support piping so there is no strain on the connection to equipment.
11. Support piping using mechanical couplings in accordance with manufacturer's instructions and recommendations.

#### B. Horizontal Piping

1. Adjustment: Provide vertical adjustment of supports for horizontal piping after installation.
2. Maximum Support Spacing:
  - a. Steel Lines: 1-1/2-inch and smaller, 6 feet; 2-inch and larger, 10 feet.
  - b. Copper Lines: 1-1/2-inch and smaller, 5 feet; 2-inch and larger, 8 feet.
  - c. Cast Iron Soil Pipe: One support at each joint, but not greater than 10 feet.
3. Metal Frame Supports: Space frames in accordance with smallest pipe requirements and design for a maximum deflection of 1/360 of the span.

#### C. Vertical Piping

Support copper and cast iron soil pipe at every floor, steel pipe at every other floor.

#### D. Insulation Protection

1. Saddle: Between hanger and covering, provide sheet metal saddle formed to fit bottom half of the insulation. Minimum side dimension of saddle equal to one half the insulation circumference.

### 3.6 EQUIPMENT RAILS

- A. Install in accordance with manufacturer's instructions and recommendations.
- B. Height to bottom of rails shall be 18 inches above finished roof.

### 3.7 THERMOMETERS AND TEST WELLS

- A. Install thermometers at temperature control points and elsewhere as indicated.
- B. Install test wells where indicated on the drawings, located above horizontal position in pipe with 12-inch minimum clearance above well.

### 3.8 PRESSURE GAGES AND TEST CONNECTIONS

- A. Install pressure gages at pressure control points, water service entrance, top of sprinkler risers, and elsewhere as indicated.
- B. Install test connections suitable for intended pressure in piping where indicated for testing.

### 3.9 PIPE TESTING

- A. Preparation and Application
  - 1. Test piping to prove tightness.
  - 2. Test concealed piping before enclosing.
  - 3. Replace and re-test pipe or fittings broken or damaged under test.
  - 4. Remove or protect from damage items not designed to withstand testing pressure; e.g., control devices, air vents, and thermostatic trap elements.
  - 5. Advise COR prior to tests.
- B. Standing Water Test
  - 1. Plug and test sanitary and vent water piping with water by filling to the top of highest pipe.
  - 2. Test sections of piping separately with a minimum head of 10 feet of water.
  - 3. Piping shall show no leakage after standing for eight hours.
- C. Pressure Testing
  - 1. Test pressures shall be 1-1/2 times the system working pressures and a minimum of 100-psi, unless otherwise indicated.
  - 2. Test water piping hydrostatically protecting traps, seals, etc. from excess pressure.
  - 3. Valves shall be open, but not backseated for packing check. However, it is permissible to test against a closed valve if the test pressure does not exceed the valve pressure rating at test temperature.
  - 4. Blind flanges, or the equivalent, shall be used instead of valves for dead-end shutoff.
  - 5. Inspect each joint for leakage while under test.
  - 6. Maintain pressure tests for a minimum of four hours.
  - 7. Perform refrigeration-piping tests in compliance with the American Standard Safety Code for Mechanical Refrigeration, ASA B9.1.
  - 8. Maintain applicable safety methods while performing tests. These methods shall include but shall not be limited to applying pressure at increments of 25 psi, providing sufficient time to allow the piping to equalize strains, until specified test pressure is attained. The piping system shall be examined only when the pressure in it is not increasing.
  - 9. Perform fire protection piping tests in compliance with NFPA 13.

END OF SECTION

## SECTION 23 31 13 - DUCTS AND DUCT ACCESSORIES

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

Sheet metal ductwork.

#### 1.2 RELATED DIVISIONS AND SECTIONS

- A. Division 01 - General Requirements
- B. Section 23 05 00 - Basic Mechanical Materials and Methods
- C. Section 23 05 93 - Testing, Adjusting, and Balancing
- D. Section 23 07 00 - Mechanical Insulation
- E. Section 23 34 16 - Fans
- F. Section 23 37 13 - Air Outlets and Inlets
- G. Section 23 70 00 – Heating, Ventilation and Air Conditioning

#### 1.3 QUALITY ASSURANCE

- A. For details not specified, such as hangers, elbow construction, offsets, obstruction streamlining, branch connections, dampers, sealing, the following reference applies:  
  
Sheet Metal and Air Conditioning Contractors National Association "HVAC Duct Construction Standards, Metal and Flexible," Third Edition, 2005 referred to herein as SMACNA-HVAC.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.
- B. Statement indicating compliance with SMACNA standards and specified system pressure ratings.
- C. Manufacturer's technical product data, installation instructions and accessories for the following:  
  
Access Doors  
Balancing Volume Dampers  
Round Duct and Fittings  
Sealant Compound

## 1.5 APPLICABLE PUBLICATIONS

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

## 1.6 PROJECT CONDITIONS

- A. Physical Interference: Provide offsets or changes in duct shape required to avoid structural or other interference without additional cost to the Government.
- B. Ductwork dimensions indicated on the drawings are internal.
- C. System Pressure Rating: Construct systems in accordance with the following pressure rating.

SYSTEM	PRESSURE RATING (INCHES- W.G.)
Downstream of all fans	2
Suction side of all fans	(-)2

## PART 2 PRODUCTS

### 2.1 FITTINGS AND ACCESSORIES

- A. Elbows
  - 1. Provide 90-degree elbows of radius construction wherever space permits and elsewhere of square construction. Construct 90-degree square elbows with double radius turning vanes unless otherwise indicated. If throat radius on curved elbows must be less than duct width, provide full-length metal turning vanes. Provide 3/4-inch trailing edge on turning vanes of 90 degree square elbows wherever elbow is less than one duct perimeter upstream of change in duct size or direction.
  - 2. Where a size change must occur at a square elbow, extend runners from throat to heel and secure vanes on runners parallel with duct sides.
  - 3. Unless otherwise indicated, provide offsets with 30-degree full radius elbows as maximum.
- B. Flexible Connections: Provide 6-inch wide neoprene impregnated glass fabric collars between fans and ducts or casings, and wherever ducts cross building expansion joints. Collars shall have flame retardant to have flame spread index not over 25 and a smoke developed index not over 50.
- C. Balanced Backdraft Dampers
  - 1. Provide backdraft dampers where indicated on the drawings.
  - 2. Balanced backdraft dampers shall be constructed of 16 gage aluminum and shall be of curved blade design and selected for a pressure drop not to exceed 0.06-inch w.g. when in full open position with a face velocity of 700 feet per minute.

3. Dampers shall be Air Balance Model BSL series or approved equal with outer flange suitable for mounting in outside wall or at inner face of outdoor louver.
- D. Duct Access Door Construction: SMACNA-HVAC, Fig. 7-2, Door A, Frame 1, Hinge Position 1 for 2-inch w.g. static pressure rating and less.
- E. Balancing Volume Dampers
1. Pressure Rating 2 inch W.G. and Less: SMACNA-HVAC, 7-4 A, B, C, 12-inch maximum blade width no internal frame. Fig. 7-5, multi opposed blade larger than 12-inch duct height, 8-inch maximum blade width. Recess frame totally out of airstream. Limit stop penetration into airstream to 1/2-inch. Dampers less than 5 feet upstream of outlets, equivalent to Young Regulator No. 820.
  2. Locate where accessible for adjusting after completion of work. Provide access panels where regulators are concealed. Provide damper regulators equal to "Ventlok" models listed.
    - a. Concealed or Exposed in Unfinished Space: No. 641.
    - b. Exposed in Finished Space: No. 688.
    - c. Manufacturers: Linx Industries, Ventfabrics, Young Regulator.
- F. Instrument Test Holes: Locate where accessible in main or major branch ducts to permit measurement of fan air quantities according to ASHRAE Pitot tube method. Locate holes on more than two sides of larger duct if required by available Pitot tube length. Provide holes with 1-inch high Ventlok No. 699 instrument ports.
- G. Plenum Connections: Provide bellmouth type for round supply ducts connecting to apparatus casings; maximum 20 degrees transition angle for rectangular ducts.
- H. Open End Ducts on Return and Exhaust Systems: Provide 2-inch high flanges on all four sides of openings, same gage as duct. Provide birdscreen on opening.
- I. Secondary Drain Pans: Provide Type 304, 20 gage stainless steel drain pan with 3/4-inch threaded drain outlet beneath entire unit of AHU No. 1 and 2. Pan shall have a minimum depth of 1-1/2 inches and not less than 3 inches larger than the unit or coil dimension in width and length of the equipment served. Pan shall be double sloped to drain toward outlet. Provide a water level detection device in pan to shutdown AHU No. 1 and 2 when water is sensed.
- J. Thermometers
1. Direct Mounting: 5-inch dial, externally calibrated, standard industrial bimetal, with stainless steel stems and cases equal to Weston Models 4503 and 4513. Stem length - minimum, one-half the depth of duct; maximum, 24 inches.
  2. Where indicating points cannot be conveniently read or temperature correctly sensed, provide organic fluid filled protected capillary tube for remote mounting.
  3. Range for Media Temperatures not Exceeding 100 degrees F: 25 to 125 degrees F except minus 40 to 120 degrees F for outdoor air.
  4. Range for Media Temperatures above 100 degrees F, but not exceeding 220 degrees F 30 to 240 degrees F.
  5. Accessories: Provide with flanges and separable brass bushing with insulation extension on insulated ductwork.

6. Manufacturers: Ashcroft, Marsh, Marshalltown, Moeller, Taylor, Tel-Tru, Trerice, U.S. Gage, Weiss, Weksler, Weston, Winters.

## 2.2 RECTANGULAR DUCTWORK - PRESSURE RATED 2-INCH W.G. AND LOWER

G90 Galvanized steel sheets, reinforcing and companion angles, and hangers. Provide metal specification, gages and construction of seams, joints and reinforcing according to SMACNA-HVAC.

## 2.3 ROUND DUCTWORK - PRESSURE RATED 2-INCH W.G. AND LOWER

- A. G90 Galvanized steel ducts, reinforcing, joining angles and hangers. Metal specification, gages and construction of ducts according to SMACNA-HVAC.
- B. Unless otherwise indicated, 90 degree elbows shall be 5 sections or die formed; and 90 degree branch connections shall be long or bell formed conical.
- C. Manufacturers: Spiral conduit and fittings - Eastern Sheetmetal, Hamlin, Lindab, McGill Airflow Corp., Monroe, Semco.

## 2.4 GASKETS

3M Company EC-1202 tape sealer. Minimum size and thickness 1 by 1/8-inch.

## 2.5 SEALING COMPOUND

Childers CP-146, McGill Airseal Corp. "United Duct Sealer," Foster 32-19, Hardcast, Inc.

## 2.6 BLANK-OFF PANELS

- A. Provide panels where indicated on the drawings to completely cover portions of exterior louvers not connected with ductwork or provided with dampers.
- B. Panels shall be fabricated of galvanized steel inner and outer sheets with rigid fiberglass insulation between (R-13). Exposed edges shall be sheet metal. Sides of panel facing louver shall be painted flat black.

# PART 3 EXECUTION

## 3.1 FITTINGS AND ACCESSORIES

- A. Damper Frames: Bolt and seal damper frames to duct, casing or masonry openings.
- B. Provide duct accessories of materials suited to duct materials; use galvanized steel accessories in galvanized steel ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

- C. Vibration: Brace or reinforce ducts where necessary to overcome vibration, buckling or breathing.
- D. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- E. Balanced Backdraft Dampers: Install in accordance with manufacturer's instructions and recommendations.
- F. Balancing Volume Dampers
  - 1. Install a minimum of two duct widths from air outlet or inlet device.
  - 2. Mark balanced position.
  - 3. Elevate dial to face of insulation.
- G. Instrument Test Holes: Install in accordance with manufacturer's instructions and recommendations.
- H. Secondary Drain Pans
  - 1. Locate top of secondary drain pan 6 inches below bottom of air handling unit.
  - 2. Provide hose bibb with cap on drain outlet.
  - 3. Wire water level detection device to fire alarm system. Send an alarm signal to the Fire Alarm System.
- I. Thermometers: Install in outdoor, return, and supply air ductwork at air handling units and elsewhere as indicated.
- J. Install airtight duct access doors in casings, plenums, and ducts to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
  - 1. Downstream from volume dampers, turning vanes, and equipment.
  - 2. To interior of casings, plenums, and ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
  - 3. Locate doors on sides of ducts where adequate clearance is available, otherwise locate on bottom of ducts.
  - 4. Install the following sizes for duct-mounting, rectangular access doors:
    - a. One-Hand or Inspection Access: 8 by 5 inches.
    - b. Two-Hand Access: 12 by 6 inches.
    - c. Head and Hand Access: 18 by 10 inches.
    - d. Head and Shoulders Access: 21 by 14 inches.
    - e. Body Access: 25 by 14 inches.
    - f. Body Plus Ladder Access: 25 by 17 inches.
  - 5. Install the following sizes for duct-mounting, round access doors:
    - a. One-Hand or Inspection Access: 8 inches in diameter.
    - b. Two-Hand Access: 10 inches in diameter.
    - c. Head and Hand Access: 12 inches in diameter.
    - d. Head and Shoulders Access: 18 inches in diameter.
    - e. Body Access: 24 inches in diameter.



### 3.2 RECTANGULAR DUCTWORK - PRESSURE RATED 2-INCH W.G. AND LOWER

- A. Construct ducts true to indicated dimensions, straight and smooth on inside with neatly finished airtight joints.
- B. Where rigid board insulation is applied, do not use cross break or bead construction.
- C. Construct the sides of a section of duct of gage specified for its maximum dimension.
- D. Seal transverse joints, fitting connections and snaplock seams in indoor ductwork with sealing compound and tape.

### 3.3 ROUND DUCTWORK - PRESSURE RATED 2-INCH W.G. AND LOWER

- A. Clean and paint welds with zinc dust paint.
- B. Seal transverse joints, fitting connections and snaplock seams in indoor ductwork with sealing compound and tape.

### 3.4 GASKETS

Overlap gaskets at corners and ends.

### 3.5 SEALING COMPOUND

Follow manufacturer's recommendations. If necessary to achieve an airtight joint, additionally apply duct tape to wet sealant compatible with the sealer used. Allow adequate curing time before pressurizing system.

### 3.6 BLANK-OFF PANELS

- A. Install to completely cover portions of exterior louvers not connected with ductwork or provided with dampers.
- B. Secure to louver frame on interior side of louver.
- C. Seal all joints and edges weatherproof and airtight.

END OF SECTION

## SECTION 23 34 16 - FANS

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

Fans and fan performance criteria for air distribution, ventilation and exhaust systems. Fan performance criteria for fan application in air handling units.

#### 1.2 RELATED DIVISIONS AND SECTIONS

- A. Division 01 - General Requirements
- B. Section 23 05 00 - Basic Mechanical Materials and Methods
- C. Section 23 05 48 - Mechanical Sound and Vibration Control
- D. Section 23 05 93 - Testing, Adjusting and Balancing
- E. Section 23 31 13 – Ducts and Duct Accessories
- F. Section 23 37 13 – Air Outlets and Inlets
- G. Section 23 70 00 - HVAC
- H. Division 26 - Electrical

#### 1.3 QUALITY ASSURANCE

- A. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by local authority and is equivalent in safety to UL labeled equipment.
- B. Fans shall comply with performance requirements and shall be licensed to use AMCA Certified Rating Seal for sound and air pressure.
- C. Operating Limits: Classify according to AMCA 99.
- D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.
- B. Manufacturer's technical product data, installation instructions, performance data, accessories, supports, fittings, finishes, construction details, and dimension of components for each type of product indicated and shall include the following:
  - 1. Certified fan performance curves with system specified rating and operating conditions indicated on the curve.

2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories. Brake horsepower rating with motor NEMA service factor calculations shall be provided.
4. Fan class rating.
5. Operation and Maintenance Data: Include in emergency, operation and maintenance manuals.

## 1.5 APPLICABLE PUBLICATIONS

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

## 1.6 PROJECT CONDITIONS

Provide all materials and equipment specified in this section with performance requirements as stated herein or on the drawings.

# PART 2 PRODUCTS

## 2.1 FANS

- A. Provide fans complete with motors and drives. Type, capacity, wheel diameter, horsepower, special construction features and other requirements are scheduled on the drawings.
- B. Equip belt driven fans with matched set of belts and belt guards. Belt guards shall be constructed to conform to OSHA construction requirements and have provisions for speed measurement of motor and fan without removal of the guard. Balance dynamically fan pulleys over 4-inch face width and 18-inch diameter. Equip fans with motors 20-horsepower and smaller with adjustable pitch drive and conventional V-belts. Provide additional pulleys and belts to adjust speed required for final air balance.
- C. The first critical speed of the fan shaft, wheel, and bearing arrangement shall be at least 125 percent of the maximum cataloged speed of the fan assembly.
- D. Fans shall be (1) catalog rated for 15 percent greater static pressure than specified at specified air volume, (2) selected so that the specified air volume is greater than that at the apex of the fan pressure volume curve, and (3) selected to provide stable operation down to 85 percent of design volume operating at the required speed for the specified conditions. Submit fan curves to indicate all of these conditions as stated below. Brake horsepower at specified duty for airfoil and backward inclined bladed centrifugal fans shall not exceed 78 percent of motor nameplate horsepower times the NEMA service factor and for forward curved bladed centrifugal fans shall not exceed 70 percent of motor nameplate horsepower times the NEMA service factor.
- E. Balance fans statically and dynamically for maximum rated speed.

- F. Fans shall have AMCA certified ratings for sound and air pressure. Submit for review pressure, volume and horsepower curves for all Type P fans. Curves shall indicate fan class ratings and unstable operation area.
- G. Bearings shall have a minimum AFBMA B-10 life of 80,000 hours based on maximum cataloged speed for class indicated.
- H. Type L
  - 1. Centrifugal ceiling type equal to Greenheck SP, with:
    - a. Acoustically insulated housing.
    - b. Silent gravity backdraft damper.
    - c. White ceiling grille.
    - d. UL approved, electric terminal box with cord, plug.
    - e. Receptacle inside housing.
    - f. Motor shall be mounted on vibration isolation.
    - g. EF-3,4: Provide with time delay wall switch for fan and light operation. Time delay shall be adjustable from one to 60 minutes to delay fan stopping after light is turned off.
    - h. Wall mounted motion switch to turn fan on and with delay to stop fan with an adjustable time of 1 to 20 minutes.
  - 2. Manufacturers: Greenheck, Jenco Fan Co., Loren Cook, Penn-Barry.
- I. Type P
  - 1. Duct mounted in-line centrifugal fan equal to Greenheck BSQ belt driven, with:
    - a. Square housing constructed of galvanized steel or steel with enamel or epoxy paint finish.
    - b. Duct mounting collars.
    - c. Removable or hinged access door(s).
    - d. Aluminum fan wheel with backward inclined flat or air foil blades.
    - e. Venturi inlet cone.
    - f. Motor and drive isolated from airstream.
    - g. Steel support brackets.
    - h. Vented galvanized steel motor cover.
    - i. EF-1,2: Provide with line voltage thermostat and humidistat.
    - j. EF-5: Provide with time delay wall switch for fan and light operation. Time delay shall be adjustable from one to 60 minutes to delay fan stopping after light is turned off.
    - k. Wall mounted motion switch to turn fan on and with delay to stop fan with an adjustable time of 1 to 20 minutes.
  - 2. Manufacturers: Acme, Greenheck, Jenco Fan Co., Loren Cook, Penn-Barry.

## PART 3 EXECUTION

### 3.1 FANS

- A. Lubricate bearings for extended shutdown or storage and rotate shafts every four weeks until fans are put into permanent operation. Verify lubrication for bearings and other moving parts prior to fan startup.

- B. Bolt fans securely to supports.
- C. Install centrifugal fans level and plumb.
- E. Suspend Type L ceiling fan units from structure with steel wire or metal straps.
- F. Support Type P suspended fan units from structure using threaded steel rods and vibration-control devices specified in Section 23 05 48, "Mechanical Sound and Vibration Controls."
- G. Install fan units with clearances for service and maintenance.
- H. Install ducts adjacent to fans to allow for service and maintenance of fans.
- I. Verify that shipping, blocking, and bracing are removed.
- J. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
- K. With fan drive disconnected from wheel, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation after electrical wiring is connected to the motor.
- L. Align and adjust belt tension in accordance with equipment manufacturer's recommendations.

END OF SECTION

## SECTION 23 37 13 - AIR OUTLETS AND INLETS

### PART 1 GENERAL

#### 1.1 DESCRIPTION OF WORK

Air distribution registers with application for air outlets and inlets.

#### 1.2 RELATED DIVISIONS AND SECTIONS

- A. Division 01 - General Requirements
- B. Section 23 05 00 - Basic Mechanical Materials and Methods
- C. Section 23 05 93 - Testing, Adjusting, and Balancing
- D. Section 23 31 13 - Ducts and Duct Accessories
- E. Section 23 34 16 – Fans
- F. Section 23 70 00 - HVAC

#### 1.3 QUALITY ASSURANCE

Diffusers and Registers: Test and rate in accordance with ASHRAE Standard 70 and AHRI Standard 890.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.
- B. Statement indicating compliance with ASHRAE and AHRI standards.
- C. Manufacturer's technical product data, installation instructions and accessories:  
  
Registers

#### 1.5 APPLICABLE PUBLICATIONS

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

#### 1.6 PROJECT CONDITIONS

- A. Coordinate with ceiling, floor, and wall construction and materials.
- B. Coordinate with lights, speakers, sprinklers, and other ceiling elements.

## PART 2 PRODUCTS

### 2.1 REGISTERS

Factory-fabricated steel or aluminum without volume-control damper.

### 2.2 OUTLET/INLET TYPE

Air delivery, performance, noise level, function, and type suitable for the duty intended and equal in these respects to the following:

- A. Supply Air, Floor Mounted, Side-Wall, and Ceiling Mounted Registers, Aluminum Construction:
  - Type R-1: Titus 300 F vertical face, double deflection aluminum register with individually adjustable front and rear vanes set on 3/4-inch centers. Complete with flat 1-1/4-inch margin plaster frame, continuous gasket, and factory white finish.
- B. Return or Exhaust Air, Floor Mounted, Side-Wall, and Ceiling Mounted Registers, Aluminum Construction:
  - Type R-2: Titus 350 F vertical face, aluminum register with 0 degrees stationary vanes set on 3/4-inch centers. Complete with flat 1-1/4-inch margin frame, continuous gasket, and white factory finish.
- D. Manufacturers:
  - 1. All Types: Anemostat, Carnes, Krueger, Metalair, Nailor, Price, Titus, Tuttle & Bailey, US Aire.

## PART 3 EXECUTION

### 3.1 REGISTERS

- A. Provide registers to distribute the quantity of air specified evenly over the intended space without causing dead spots or air velocities exceeding 50 fpm in the occupied zone.
- B. Coordinate location with lighting and ceiling pattern. Perform minor duct modifications to suit.
- C. Add internal baffles where necessary to avoid drafts due to air impingement on nearby partitions, columns, etc.

END OF SECTION

## SECTION 23 70 00 - HEATING, VENTILATING, AND AIR CONDITIONING

### PART 1 - GENERAL

#### 9.1 DESCRIPTION OF WORK

Refrigeration equipment, air handling equipment, air distribution devices and associated integral supports, accessories, piping, motors and integral controls.

#### 9.2 QUALITY ASSURANCE

- A. Equipment specified shall meet all requirements of ASHRAE Standard 90.1-2016.
- B. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by local authority and is equivalent in safety to UL labeled equipment.
- C. AHRI rating and certification.
- D. Variable Refrigerant Flow (VRF) System
  - 1. Manufacturer shall have installations in the U.S. market with specified product.
  - 2. Installing Contractor shall be trained and authorized by the system manufacturer. Installing Contractor shall have at least one variable refrigerant system installed, serviced, and operational for a minimum of one year.
  - 3. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
  - 4. A full charge of R-410A for the air-source unit only shall be provided.
  - 5. Each VRF system shall be certified to, and meet or exceed the minimum efficiencies of AHRI Standard 1230, supported by submitted, certified test results including IEER and COP@17F ratings.
  - 6. Provide completely de-rated capacities at design conditions for all zones of each VRF system.
  - 7. If an "or-equal" manufacturer is proposed, the Contractor shall submit a complete system re-design for Contracting Officer's Representative (COR) review and approval. System redesign shall include all components, refrigerant piping, controls, etc., as required to provide a complete, operational system equal to the system specified in the Contract Documents. Submittal shall include complete coordination drawings as specified in Division 01 and Section 23 05 00. Any "or-equal" manufacturers shall be provided at no additional cost to the Government and shall be complete in all respects.
- E. Contractor Installation Drawings: Submit, prior to installation of mechanical and plumbing systems, two copies of installation drawings (minimum scale - 1/8" = 1 foot) showing equipment, ductwork, piping, plumbing, and electrical work, coordinated with each other and with the structure and, where relevant to this work, existing mechanical, plumbing, fire protection, and electrical services. These drawings shall not be construed as shop drawings that require review and action by the COR.



### 9.3 SUBMITTALS

- A. Submit in accordance with Division 01 and Section 23 05 00.
- B. Manufacturer's technical product data, including installation instructions, performance data, accessories, supports, fittings, finishes, construction details, and dimensions of components for the following:

Refrigeration System Specialties  
VRF System Equipment and Piping

### 9.4 APPLICABLE PUBLICATIONS

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

### 9.5 PROJECT CONDITIONS

- A. Provide all material and equipment specified in this section with performance requirements as stated herein or on the drawings.
- B. Except where specified, equipment and system capacities and performance requirements are scheduled on the drawings.

### 9.6 WARRANTY

- A. Provide manufacturers standard warranty unless noted otherwise.
- B. Variable Refrigerant System:
  - 1. The units shall be covered by an extended manufacturer's limited warranty for a period of five (5) years from date of installation.
  - 2. The compressor shall have a manufacturer's limited warranty for a period of ten (10) years from date of installation.

## PART 2 - PRODUCTS

### 2.1 REFRIGERATION SYSTEM SPECIALTIES

- A. Refer to drawings for component sizes, piping arrangement and pressure settings.
- B. Comply with ASHRAE Standard 15-2016 "Safety Code for Mechanical Refrigeration" and ANSI/ASME B31.5.
- C. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL listed, 350 psi working pressure.

- D. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL listed, 200 degrees F temperature rating, 500 psi working pressure.
- E. Refrigerant Filter-Dryers: Steel shell, ceramic fired desiccant core, solder connections, UL listed, 500 psi working pressure.
- F. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure as required with copper connections.
- G. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL listed.
- H. Manufacturers: Alco Controls, Henry Valve, Parker Hannifin, Sporlan Valve.

## 2.2 VARIABLE REFRIGERANT FLOW (VRF) SYSTEM

- A. Manufacturers: Daikin (Basis of Design), Mitsubishi, LG.
- B. Heat Pump
  - 1. System Description: The variable capacity, heat pump air conditioning system shall be a Daikin Variable Refrigerant Volume (VRV) Series (heat/cool model) split system. The system shall consist of multiple evaporators using PID control, and condensing unit of same manufacturer. The outdoor units shall be a direct expansion (DX), air-cooled heat pump air-conditioning system, inverter driven variable speed compressor, multi-zone split system, using R-410A refrigerant. The outdoor unit may connect an indoor evaporator capacity up to 100 percent to that of the outdoor condensing unit capacity. All indoor units shall each be capable of operating separately with individual temperature control.
  - 2. The outdoor unit shall be interconnected to indoor unit of same manufacturer in accordance with manufacturer's requirements. The indoor units shall be connected to the condensing unit utilizing manufacturer's specified piping joints and headers to ensure correct refrigerant flow and balancing. T style joints are not acceptable.
  - 3. Operation of the system shall permit either cooling or heating of all of the indoor units. Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, an Intelligent Touch Controller (ITC), or an Intelligent Touch Manager (ITM) or a BMS interface.
  - 4. VRVIV-S Features and Benefits
    - a. Voltage Platform – Heat pump condensing units shall be available in 240V/1/60 configurations.
    - b. Advanced Zoning – A single system shall provide for up to 10 zones.
    - c. Independent Control – Each indoor unit shall use a dedicated electronic expansion valve for independent control.
    - d. VFD Inverter Control – Each condensing unit shall use a high efficiency, variable speed “inverter” compressor coupled with inverter fan motors for superior part load performance. Compressor capacity shall be modulated automatically to maintain a constant suction pressure, while varying the refrigerant volume for the needs of the cooling or heating loads. Indoor units

- shall use PID control to control superheat to deliver a comfortable room temperature condition.
- e. Variable Refrigerant Temperature (VRT) Control – Each condensing unit shall utilize an algorithm to automatically adjust the refrigerant suction and condensing temperatures in response to the heating and cooling loads, and in response to the current weather conditions. The VRT control shall be capable of being customized in the following modes and sub-modes:
    - 1) Automatic (factory preset) - The Automatic VRT mode shall allow the target evaporator temperature (Te) and target condensing temperature (Tc) to float based on outdoor ambient temperature conditions, and shall incorporate the following sub-modes:
      - i. Powerful
      - ii. Quick
      - iii. Mild (factory preset)
    - 2) High Sensible – The High Sensible mode shall allow the system Te and Tc values to be programmed to series of fixed Te and Tc values. The High Sensible mode shall also be capable of incorporating the following sub-modes:
      - i. Eco
    - 3) Basic – The Basic mode shall disable the VRT control of the outdoor unit and allow the system to operate with constant Te and Tc values.
  - f. Flexible Design –
    - 1) Systems shall be capable of up to 230ft of linear piping (295ft equivalent length) between the condensing unit and furthest located indoor unit.
    - 2) Systems shall be capable of up to 984ft total “one-way” piping in the piping network.
    - 3) Systems shall have a vertical (height) separation of up to 98 ft between the condensing unit and the indoor unit units.
    - 4) The outdoor unit shall connect an indoor evaporator capacity up to 100 percent of the outdoor condensing unit capacity.
  - g. Simple Wiring – Systems shall use 2 wire, multi-stranded, non-shielded and non-polarized daisy chain control wiring.
  - h. Advanced Diagnostics – Systems shall include a self-diagnostic, auto-check function to detect a malfunction and display the type and location.
  - i. Advanced Controls – Each system shall have at least one remote controller capable of controlling up to 16 indoor unit units.
5. Quality Assurance
    - a. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.
    - b. All wiring shall be in accordance with the National Electrical Code (NEC).
    - c. Each combination shall be rated in accordance with Air Conditioning, Heating and Refrigeration Institute’s (AHRI) Standard 210/240 and bear the AHRI label.
    - d. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
    - e. The outdoor unit will be factory charged with R-410A.
  6. Delivery, Storage and Handling

- a. Unit shall be stored and handled according to the manufacturer's recommendations.
7. Standard Limited Warranty: Applies to compressor and all parts and is limited in duration to ten (10) years starting from the "installation date".
8. Operating Range: The operating range in cooling will be 23°F DB to 122°F DB. The operating range in heating will be -5°F WB to 60°F WB. Cooling mode indoor room temperature range will be 57°F-77°F WB. Heating mode indoor room temperature range will be 59°F-80°F DB
9. Refrigerant Piping: The system shall be capable of refrigerant piping up to 164 actual feet or 213 equivalent feet from the outdoor unit to the furthest indoor unit, a total combined liquid line length of 820 feet of piping between the condensing and indoor units, and with 98 feet maximum vertical difference between the outdoor unit and indoor units without any oil traps. The system shall be capable of 33 feet vertical separation between indoor units on the same system. REFNET™ piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance. T style joints shall not be acceptable as this will negatively impact proper refrigerant balance and flow for optimum system capacity and performance.
10. Design Basis: The HVAC equipment basis of design is Daikin. In any event, the contractor shall be responsible for all specified items and intents of this document without further compensation.
11. Outdoor Unit
  - a. General: The outdoor unit is designed specifically for use with Daikin VRV series components.
    - 1) The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a Daikin swing compressor, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separator, service ports and suction line accumulator. Liquid and suction lines must be individually insulated between the outdoor and indoor units.
    - 2) The outdoor unit can be wired and piped with outdoor unit access from the left, right, rear or bottom.
    - 3) The connection ratio of indoor units to outdoor unit shall be permitted up to 100 percent.
    - 4) The outdoor system shall be able to support the connection of up to 10 indoor unit's dependant on the model of the outdoor unit.
    - 5) The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit. The outdoor unit shall be capable of operating automatically at further reduced noise during night time.
    - 6) The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
    - 7) The outdoor unit shall allow for side-by-side installation with minimum spacing.
    - 8) The following safety devices shall be included on the condensing unit; high pressure switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal

- protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
- 9) To ensure the liquid refrigerant does not flash when supplying to the various indoor unit units, the circuit shall be provided with a sub-cooling feature.
  - 10) Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.
  - 11) The outdoor unit shall be capable of heating operation at 0°F dry bulb ambient temperature without additional low ambient controls.
- b. Unit Cabinet: The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.
- c. Fan:
- 1) The condensing unit fan(s) shall consist of propeller type, direct-drive fan motors that have multiple speed operation via a DC (digitally commutating) inverter.
  - 2) The fan shall be a horizontal discharge configuration with a nominal airflow maximum range of 3,740 CFM.
  - 3) Nominal sound pressure levels shall be 58 dB(A) cooling.
  - 4) The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
  - 5) The fan motor shall be provided with a fan guard to prevent contact with moving parts.
- d. Condenser Coil:
- 1) The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
  - 2) The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
  - 3) The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube.
  - 4) The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.
- e. Compressor:
- 1) The inverter scroll compressor shall be variable speed (PAM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity shall be controlled to eliminate deviation from target value.
  - 2) The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed swing type.
  - 3) Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
  - 4) The capacity control range shall be 14% to 100%.

- 5) The compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
  - 6) Oil separators shall be standard with the equipment together with an intelligent oil management system.
  - 7) The compressor shall be spring mounted to avoid the transmission of vibration.
- f. Electrical:
- 1) The power supply to the outdoor unit shall be 240 volts, 1 phase, 60 hertz +/- 10 percent.
  - 2) The control voltage between the indoor and outdoor unit shall be 18VDC non-shielded, stranded 2 conductor cable.
  - 3) The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation.
  - 4) The control wiring lengths shall be as shown below.

	Outdoor to Indoor Unit	Outdoor to Central Controller	Indoor Unit to Remote Control
<b>Control Wiring Length</b>	6,665 ft	3,330 ft	1,665 ft
<b>Wire Type</b>	18 AWG, 2 wire, non-polarity, non-shielded, stranded		

C. Heat Pump Indoor Units

1. Quality Assurance
  - a. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995/CAN/CSA-C22.2 No. 236-05 (R2009) – Heating and Cooling Equipment and bear the Listed Mark.
  - b. All wiring shall be in accordance with the National Electrical Code (NEC)/Canadian Electrical Code (CEC).
  - c. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
  - d. The outdoor unit will be factory charged with R-410A.
2. Delivery, Storage and Handling: Unit shall be stored and handled according to the manufacturer's recommendations.
3. Standard Limited Warranty: This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the "installation date".
4. Design Basis: The HVAC equipment basis of design is Daikin. The contractor shall be responsible for all specified items and intents of this document without further compensation.
5. FXMQ – Horizontal Air Handling Unit
  - a. General: The indoor unit (Daikin Model FXMQ) shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, direct-drive DC (ECM) type fan with auto CFM adjustment at commissioning, for installation into the ceiling cavity. It shall be constructed of a galvanized steel casing. Horizontal discharge air with horizontal return air configuration. Low height cabinet suitable for installation above ceiling. Computerized PID control shall be used to control superheat to deliver a

comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. Included as standard equipment, a condensate drain pan and drain pump kit that pumps to 18-3/8" from the drain pipe opening. The indoor units sound pressure shall range from 29 dB(A) to 40 dB(A) at low speed measured 5 feet below the ducted unit.

b. Indoor Unit:

- i. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipped with an automatically adjusting external static pressure logic selectable during commissioning. This adjusts the airflow based on the installed external static pressure.
- ii. Indoor unit and refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.
- iii. Both refrigerant lines shall be insulated from the outdoor unit.
- iv. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 18-3/8 inches of lift from the center of the drain outlet.
- v. The indoor units shall be equipped with a return air thermistor.
- vi. The indoor unit shall be separately powered with 208~230V/1-phase/60Hz.
- vii. The voltage range will be 253 volts maximum and 187 volts minimum.

c. Unit Cabinet:

- i. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
- ii. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

d. Fan:

- i. The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
- ii. The unit shall be equipped with an automatically adjusting external static pressure logic selectable during commissioning.
- iii. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range of 0.12 to 0.47 HP respectively.
- iv. The airflow rate shall be available in three settings.
- v. The fan motor shall be thermally protected.
- vi. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
- vii. Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. WG)
FXMQ07PBVJU	0.40 – 0.12

FXMQ09PBVJU	0.40 – 0.12
FXMQ12PBVJU	0.40 – 0.12
FXMQ15PBVJU	0.80 – 0.20
FXMQ18PBVJU	0.80 – 0.20
FXMQ24PBVJU	0.80 – 0.20
FXMQ30PBVJU	0.80 – 0.20
FXMQ36PBVJU	0.80 – 0.20
FXMQ48PBVJU	0.80 – 0.20
FXMQ54PBVJU	0.56 – 0.20

e. Coil:

- i. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
- ii. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
- iii. The coil shall be a 3 row cross fin copper evaporator coil with 13 fpi design completely factory tested.
- iv. The refrigerant connections shall be flare connections and the condensate will be 1-1/4 inch outside diameter PVC.
- v. A condensate pan shall be located under the coil.
- vi. A condensate pump with a 18-3/8" lift shall be located below the coil in the condensate pan with a built in safety alarm.
- vii. A thermistor will be located on the liquid and gas line.

f. Electrical:

- i. A separate power supply shall be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
- ii. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
- iii. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

g. Control:

- i. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
- ii. The unit shall be compatible with an intelligent advanced multi-zone controller.

6. Variable Refrigerant Volume (VRV) HVAC System Remote Controllers

a. Basic Operation:

- 1) Capable of controlling a group of up to 16 indoor units.
- 2) Controller shall control the following group operations:
  - a) On/Off, Operation Mode (Cool, Heat, Fan, Dry and Auto\* (\*with VRV Heat Pump Systems))
    - i. Configure only the essential modes to be selectable – remove unnecessary mode selection(s) from display



- b) Independent Cooling and Heating setpoints in the occupied mode. Dual setpoints (individual Cool and Heat setpoints with minimum setpoint differential 0 – 7°F default 2°F or Single setpoint)
  - c) Independent Cooling Setup and Heating Setback setpoints in the unoccupied mode
  - d) Fan Speed: Up to 5 speeds (dependent on indoor unit type)
- 3) The controller shall be able to limit the user adjustable setpoint ranges individually for cooling and heating in the occupied period
- 4) Function button lockout (On/Off, Mode, Fan Speed, Up/Down, Left, Right Arrows)
- 5) Filter indicator: Filter service indicator shall be displayed after 100, 1250 or 2500 (default) hours of run time configurable via field setting.
- 5) Clock (12/24 hour) and Day display
- 6) Automatic adjustment for Daylight Savings Time (DST): Set changeover period (second Sunday in March / first Sunday in November)
- b. Programmability:
  - 1) Controller shall support schedule settings with selectable weekly pattern options.
    - a) 7-day
    - b) Weekday + Weekend
    - c) Weekday + Saturday + Sunday
    - d) Everyday
    - e) The schedule shall support unit On/Off
    - f) Independent settings for Cooling and/or Heating setpoints when unit is on (occupied)
    - g) Independent Setup (Cooling) and Setback (Heating) setpoints when unit is off (unoccupied)
    - h) A maximum of 5 operations can be schedulable per day
    - i) Time setting in 1-minute increments
  - 2) The Controller shall support Auto-changeover mode for Heat Pump systems, therefore, allowing the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat according to the room temperature and temperature setpoint.
    - a) Changeover to cooling mode shall occur at cooling setpoint + 1°F as the primary changeover deadband and takes the guard timer into consideration Configurable from 1 – 4°F
    - b) Changeover to cooling mode shall occur at the primary changeover deadband to cooling + 1°F as the secondary changeover deadband. Configurable from 1 – 4°F.
    - c) Changeover to heating mode shall occur at heating setpoint - 1°F as the primary changeover deadband and takes the guard timer into consideration. Configurable from 1 – 4°F
    - d) Changeover to heating mode shall occur at the primary changeover deadband to heating - 1°F as the secondary changeover deadband. Configurable from 1 – 4°F.
    - e) 1 hour guard timer
      - i. Upon changeover, guard timer will prevent another changeover during this period.
      - ii. Guard timer is ignored by a change of setpoint manually from either the Multi-zone Controller, Remote Controller, or by schedule.

- iii. The Guard timer is also ignored if the space temperature reaches the secondary changeover deadband (configurable from 1 - 4°F from the primary changeover deadband, and the guard timer has been activated
    - iv. 60 minutes as default, configurable to 15, 30, or 90 minutes
- 3) The controller shall support the Auto-setback by sensor function dependent on indoor unit type)
  - a) The cooling and heating setpoints shall gradually relax (configurable) internally when the room is determined to be unoccupied
    - i. The internal setpoint shall return to the original setpoint when room occupancy is detected
- 4) The controller shall support the Auto-off by sensor function (dependent on indoor unit type)
  - a) The indoor unit shall turn off when it is determined that the room is unoccupied after a specified time has elapsed
    - i. The indoor unit shall be turned on manually when occupancy is detected.
- 5) The controller shall support the Filter Auto Clean function to be performed once a day (dependent on indoor unit type)
  - a) Eight (8) time periods (00:00-03:00, 03:00-06:00, 06:00-09:00, 09:00-12:00, 12:00-15:00, 15:00-18:00, 18:00-21:00, 21:00-00:00) shall be available to select from to enable the automatic filter cleaning function
    - i. Default time period (00:00 to 3:00) shall be used if the period for filter auto cleaning is not specified
  - b) The indoor unit shall be stopped during auto filter cleaning function operation
- 6) The Controller shall support an Auto Off Timer for temporarily enabling indoor unit operation during the unoccupied period.
  - a) When the Off Timer is enabled and when the unit is manually turned on at the remote controller
  - b) The controller shall shut off the unit after a set time period
  - c) The time period shall be configurable in the controller menu with a range of 30-180 minutes in 10 minute increments
- 7) The room temperature shall be capable of being sensed at either the NAV Remote Controller, the Indoor Unit return air temperature sensor (default), or Remote Temperature Sensor (KRCS01-1B) configured through the field settings.

## PART 3 EXECUTION

### 3.1 REFRIGERATION SYSTEM SPECIALTIES

- A. Install in accordance with manufacturer's instructions.
- B. Set pressure regulators as required.
- C. Slope refrigerant lines in accordance with the manufacturer's requirements.

### 3.2 VARIABLE REFRIGERANT FLOW SYSTEM

- A. Install the units as indicated on the drawings and in accordance with manufacturer's recommendations, and provide initial start-up. The system installation and startup shall be completed by a factory trained contractor/dealer.
- B. Provide protection for units during construction.
- C. Provide secondary condensate drain pan under each concealed air handling unit, and elsewhere as indicated on drawings.
- D. Controls: Provide all necessary labor, materials, equipment, software, etc. as required to integrate all equipment into a single complete operational system.
- E. Instruction: Representatives shall instruct Contracting Officer's Representative's designee for a total of three 8-hour days of which at least one day will occur after 30 days' operation by the designee. At conclusion of instructions, manufacturer shall advise Contracting Officer's Representative, in writing, whether designee is qualified to have charge of the installation.
- F. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- G. Perform tests and inspections. Manufacturer's Field Service. Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- H. Tests and Inspections
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- I. Remove and replace malfunctioning units and retest as specified above.
- J. Prepare test and inspection reports.
- K. Field Quality Control is applicable to all HVAC equipment in Section 23 70 00.

END OF SECTION

## SECTION 26 00 50 - COMMON WORK RESULTS FOR ELECTRICAL

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Electrical equipment coordination and installation.
  - 2. Common electrical installation requirements.

#### 1.2 DESCRIPTION OF WORK

- A. Requirements of this Section are applicable to work in Divisions 26 and 27.
- B. Contract Documents
  - 1. Contract drawings for electrical work are diagrammatic, intended to convey scope and general arrangement.
  - 2. Refer questions involving document interpretation or discrepancies to Contracting Officer for review and direction.
  - 3. Correct faulty work due to resolving discrepancies without proper approval.
  - 4. Specifications establish quality of materials, equipment, workmanship and methods of construction.
  - 5. Follow drawings and specifications in laying out work. Consult other applicable contract drawings and specifications. Become familiar with conditions affecting work.
- C. Scope
  - 1. Furnish and install the electrical work complete and ready for satisfactory service.
- D. Definitions: The following are definitions of terms and expressions used in Divisions 26 and 27.
  - 1. "Accessible" – Capable of being removed or exposed without damaging the building or structure or finish or not permanently closed in by other equipment or by the structure or finish of the building.
  - 2. "Approve" - To permit use of material, equipment or methods conditional upon compliance with contract document requirements.
  - 3. "Concealed" - Hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.
  - 4. "Directed" - directed by Contracting Officer.
  - 5. "Equal, equivalent" - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.
  - 6. "Exposed" - not concealed.
  - 7. "Furnish" - Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.
  - 8. "Indicated" - indicated in Contract Documents.
  - 9. "Install" - Operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimensions, finishing, curing, protecting, cleaning and similar operations.
  - 10. "Provide" - furnish and install, complete and ready for the intended use.
  - 11. "Removable" - detachable from the structure or system without physical alteration of materials or equipment and without disturbance to other construction.

12. "Review" - limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

### 1.3 QUALITY ASSURANCE

- A. Applicable Codes and Regulations:
  1. National Electrical Safety Code 2017 (NESC)
  2. National Electrical Code 2020 (NFPA 70)
  3. International Building Code, 2021 (IBC)
  4. ASHRAE 90.1-2016
  5. IEEE Standards
  6. Illuminating Engineering Society Lighting Handbook, 10<sup>th</sup> Edition (IES)
  7. OSHA Standards and Requirements
  8. Other applicable NFPA regulations.
- B. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by the local authority as equivalent in safety to UL labeled equipment.
- C. Material and Equipment Requirements
  1. All materials and equipment shall be new and free from defects.
  2. Use products of one manufacturer where two or more items of same kind of equipment are required.
  3. For certain items of equipment, the specification and the project design are based upon the specified manufacturer's product. Other manufacturers' names are listed. Contractor may purchase, conditional upon meeting project requirements, equipment from the listed manufacturers.
  4. Only the manufacturer's equipment upon which the specification and the project design has been based, has been checked for this project. Check allocated space and structure for suitability of equipment of other listed manufacturers, including parts replacement and servicing.
- D. Workmanship
  1. Remove and replace, at no extra cost, work not in conformance with contract requirements.
  2. Coordinate with Other Trades
    - a. Coordinate work and cooperate with other trades to facilitate execution of work.
    - b. Give full cooperation and coordination with other trades and furnish information necessary to permit the work of all trades to be installed satisfactorily with the least possible interference or delay.
    - c. Furnish to other trades, as required, necessary templates, patterns, setting plans and shop details for the proper installation of the work and for the purpose of coordinating adjacent work.
  3. Accessible Equipment and Systems: Consider all materials and equipment installations and coordinate with the work of other trades to ensure equipment or systems are accessible for operations, maintenance, repairs, and replacement. Install materials and equipment, including but not limited to, supports and electrical conduit, to permit complete unobstructed access to panelboards, transformers, and other items requiring access for inspection, maintenance, and operations. The installation of new equipment or

materials which renders new or existing equipment inaccessible will be disapproved by the Contracting Officer and shall be corrected by the Contractor.

#### 1.4 COORDINATION

- A. Coordinate all shutdowns and power-ups with Contracting Officer. Computer and phone servers shall remain powered and operational throughout the duration of the Contract.
  - 1. Do not interrupt electrical service to facility unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
    - a. Coordinate power outages with Contracting Officer. Notify Contracting Officer no fewer than five days in advance of proposed interruption of electrical service.
    - b. Do not proceed with interruption of electrical service without Contracting Officer's written permission.
    - c. Maintain continuity of power for IT system equipment including but not limited to servers, telecom/data and similar equipment. Provide temporary power for equipment to ensure continuous operation.
- B. Coordinate arrangement, mounting, and support of electrical equipment as follows:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So that connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

#### 1.5 SHOP DRAWINGS AND SUBMITTALS

- A. Refer to Division 01 for complete requirements.
- B. Submit all products for a single specification section as a complete submittal. All products specified within a division shall be included, otherwise submittal will be returned as incomplete.
- C. Clearly mark submittals to indicate actual intended products to be utilized. Marks may include highlighting, circling, boxing, checking, etc. Do not provide submittal data which lists multiple product's options and features without clearly indicating which data applies to the products intended to be used on project.
- D. Coordinate drawings and data before submitting and certify that provisions of the contract documents have been met.
- E. Call attention, in writing, to deviations from contract requirements.

- F. Do not fabricate, deliver to site, or install items requiring shop drawing review, until the review has been completed by the Contracting Officer and the shop drawing has been marked to indicate "No Exception Taken" or "Make Corrections Noted."
- G. Use only final or corrected drawings and data for construction. This includes all Addendums, Contracting Architectural Supplemental Information (ASIs), and Change Bulletins.
- H. The Contracting Officer's review of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

## 1.6 COORDINATION DRAWINGS

- A. Submit coordination drawings to Contracting Officer for review and approval.
- B. If requested by the Contracting Officer, provide separate coordination drawings for power, lighting and Tel/Data systems.
- C. Shop drawings shall indicate the following in coordination with Contracting Officer and work of other trades:
  - 1. Proposed routes for electrical feeders and branch circuits.
  - 2. Proposed locations of luminaires.
  - 3. Proposed routes for Tel/Data cabling.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounted items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

END OF SECTION



## SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Copper building wire rated 600 V or less.
  - 2. Metal-clad cable, Type MC, rated 600 V or less.
  - 3. Connectors, splices, and terminations rated 600 V and less.

#### 1.2 DEFINITIONS

- A. RoHS: Restriction of Hazardous Substances.
- B. VFC: Variable-frequency controller.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer's authorized service representative.
- B. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. 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. General Cable Technologies Corporation.
  - 2. Service Wire Co.
  - 3. Southwire Company.
- C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. RoHS compliant.
  3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- E. Conductor Insulation:
1. Type THHN and Type THWN-2: Comply with UL 83.

## 2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. 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. Alpha Wire Company.
  2. American Bare Conductor.
  3. General Cable Technologies Corporation.
  4. Okonite Company (The).
  5. Service Wire Co.
  6. Southwire Company.
- C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. Comply with UL 1569.
  3. RoHS compliant.
  4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
1. Single circuit.
  2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- F. Ground Conductor: Insulated.
- G. Conductor Insulation:
1. Type THHN/THWN-2: Comply with UL 83.
- H. Armor: Steel or Aluminum, interlocked.
- I. Jacket: PVC applied over armor.

## 2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. 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. 3M Electrical Products.
  - 2. AFC Cable Systems; a part of Atkore International.
  - 3. Gardner Bender.
  - 4. Hubbell Power Systems, Inc.
  - 5. Ideal Industries, Inc.
  - 6. ILSCO.
  - 7. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 8. Service Wire Co.
  - 9. Thomas & Betts Corporation; A Member of the ABB Group.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway. Where raceway is unable to be installed without damaging historic fabric, the Contracting Officer may authorize the use of metal-clad cable, Type MC. Metal-clad cable may only be used when written authorization is given from the Contracting Officer.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THWN-2/XHHW, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway. Where raceway is unable to be installed without damaging historic

fabric, the Contracting Officer may authorize the use of metal-clad cable, Type MC. Metal-clad cable may only be used when written authorization is given from the Contracting Officer.

- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. All wiring shall be installed in metal raceway and junction box systems. All penetrations through walls, floors, ceilings, etc. shall be sealed.
- B. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- C. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- G. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each of the following visual and electrical tests:
    - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    - b. Test bolted connections for high resistance using one of the following:
      - 1) A low-resistance ohmmeter.
      - 2) Calibrated torque wrench.
      - 3) Thermographic survey.
    - c. Inspect compression-applied connectors for correct cable match and indentation.
    - d. Inspect for correct identification.
    - e. Inspect cable jacket and condition.
    - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    - g. Continuity test on each conductor and cable.
    - h. Uniform resistance of parallel conductors.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
  - 1. Procedures used.
  - 2. Results that comply with requirements.
  - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

## SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Intersystem bonding termination devices for the connection of communications systems bonding conductors.
  - 2. Foundation steel electrodes. (Ufer ground)
- B. Provide grounding and bonding in accordance with NEC Article 250 for the service entrance equipment. Provide rod-type grounding electrodes and foundation steel electrodes.

#### 1.2 ACTION SUBMITTALS

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

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
- B. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

- 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. Comply with UL 467 for grounding and bonding materials and equipment.

#### 2.2 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. Burndy; Part of Hubbell Electrical Systems.
  - 2. ERICO International Corporation.
  - 3. Harger Lightning & Grounding.
  - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 5. Thomas & Betts Corporation; A Member of the ABB Group.

## 2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
  - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- H. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- I. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- J. Water Pipe Clamps:
  - 1. Mechanical type, two pieces with stainless steel bolts.
    - a. Material: High-strength corrosion-resistant copper alloy.
    - b. Listed for direct burial.
  - 2. U-bolt type with malleable-iron clamp and copper ground connector.

## 2.5 INTERSYSTEM BONDING TERMINATION DEVICE

- A. Lay-in connection clamp accepts 6 AWG through 2 AWG grounding electrode conductor.
- B. Accommodates minimum of five 14 AWG through 4 AWG bonding conductors.
- C. Housing and integral mounting base:
  - 1. 4-inch wide by 2-inch high by 1 1/2-inch deep.
  - 2. Polymeric, impact resistant, and UV-stabilized.
  - 3. Corrosion resistant, stainless steel mounting hardware.

## 2.6 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4-inch diameter by 10 feet.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
  - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inch long.
  - 2. Backfill Material: Electrode manufacturer's recommended material.

# PART 3 - EXECUTION

## 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Electrode Conductors: Install bare copper conductor, No. 4 AWG minimum.
  - 1. Bury at least 24 inches below grade.
- C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
- D. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors.
  - 3. Connections to Ground Rods: Exothermic welds.
  - 4. Connections to Structural Steel: Welded connectors.



### 3.2 GROUNDING AND BONDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

### 3.3 GROUNDING DISTRIBUTION SYSTEM COMPONENTS

- A. Install new grounding electrode systems where indicated.
- B. Comply with IEEE C2 grounding requirements.

### 3.4 EQUIPMENT GROUNDING AND BONDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.
- D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
  - 1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, or wiring closet.
  - 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
  - 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

### 3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  - 2. Use exothermic welds for all below-grade connections.

3. Bonding For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Intersystem Bonding Termination Devices:
1. Install in close proximity to electrical and communications service entrances and in locations accessible for inspection and maintenance.
  2. Connect to equipment enclosure or grounding electrode conductor in accordance with NEC requirements.
- E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.
- H. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

### 3.6 LABELING

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. After installing grounding and bonding system, but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  3. Test completed grounding and bonding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding and bonding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
  1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Contracting Officer promptly. Obtain Contracting Officer's approval to install chemical-enhanced grounding electrodes to reduce ground resistance.

END OF SECTION

## SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Hangers and supports for electrical equipment and systems.

### PART 2 - PRODUCTS

#### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
  - 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. Allied Tube & Conduit; a part of Atkore International.
    - b. B-line, an Eaton business.
    - c. ERICO International Corporation.
    - d. Flex-Strut Inc.
    - e. Thomas & Betts Corporation; A Member of the ABB Group.
    - f. Unistrut; Part of Atkore International.
  - 2. Material: Galvanized steel.
  - 3. Channel Width: 1-5/8 inches.
  - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
  - 6. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Hanger Rods: Threaded steel.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacing that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  1. To Wood: Fasten with lag screws or through bolts.

2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  3. To Existing Concrete: Expansion anchor fasteners.
  4. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation to support electrical materials and equipment.
- B. Finish exposed surfaces smooth and blended so no roughness shows.
- C. Set metal fabrications with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- D. Field Welding: Comply with AWS D1.1/D1.1M.
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.
- E. 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.

### 3.4 PAINTING

- A. Touchup: Comply with requirements in Section 09 91 00 "Painting and Finishing" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

## SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Metal conduits, tubing, and fittings.
  - 2. Nonmetal conduits, tubing, and fittings.
  - 3. Metal wireways and auxiliary gutters.
  - 4. Surface raceways.
  - 5. Boxes, enclosures, and cabinets.
- B. Related Requirements:
  - 1. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks and underground utility construction.

#### 1.2 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

### PART 2 - PRODUCTS

#### 2.1 METAL CONDUITS, TUBING, AND FITTINGS

- 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. Allied Tube & Conduit; a part of Atkore International.
  - 2. Anamet Electrical, Inc.
  - 3. Calconduit.
  - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 5. Picoma Industries, Inc.
  - 6. Republic Conduit.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Fittings for EMT:
    - a. Material: Steel or die cast.
    - b. Type: Setscrew or compression.
  - 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
  - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- 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. AFC Cable Systems; a part of Atkore International.
  - 2. Anamet Electrical, Inc.
  - 3. Arnco Corporation.
  - 4. CANTEX INC.
  - 5. CertainTeed Corporation.
  - 6. Condux International, Inc.
  - 7. Electri-Flex Company.
  - 8. Lamson & Sessions.
  - 9. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.



- D. Rigid HDPE: Comply with UL 651A.
- E. Continuous HDPE: Comply with UL 651B.
- F. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- G. RTRC: Comply with UL 1684A and NEMA TC 14.
- H. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- I. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- 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. B-line, an Eaton business.
  - 2. Hoffman; a brand of Pentair Equipment Protection.
  - 3. MonoSystems, Inc.
  - 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.
  - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- 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. Adalet.
  - 2. Erickson Electrical Equipment Company.
  - 3. Hoffman; a brand of Pentair Equipment Protection.
  - 4. Milbank Manufacturing Co.
  - 5. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 6. RACO; Hubbell.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep).
- I. Gangable boxes are prohibited.
- J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

## 2.5 Metallic Floor Boxes and Floor Box Covers:

- A. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.
- B. 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. Leviton 25349-TFB.
  - 2. Legrand
  - 3. Thomas & Betts

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed Conduit: Galvanized rigid steel.
  - 2. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
  - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  5. Damp or Wet Locations: GRC or IMC.
  6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
  4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.

- I. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Contracting Officer for each specific location.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
  - 1. Where an underground service raceway enters a building or structure.
  - 2. Where otherwise required by NFPA 70.
- T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

- U. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Attics: 135 deg F temperature change.
  3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC in damp or wet locations not subject to severe physical damage.
- W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- Y. Locate boxes so that cover or plate will not span different building finishes.
- Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- BB. Set metal floor boxes level and flush with finished floor surface.

### 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.4 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

## SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
  - 2. Sleeve-seal systems.
  - 3. Sleeve-seal fittings.
  - 4. Grout.
  - 5. Silicone sealants.

### PART 2 - PRODUCTS

- A. Wall Sleeves:
  - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
  - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
  - 1. Material: Galvanized sheet steel.
  - 2. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

#### 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.

3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, water stop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber water stop collar with center opening to match piping OD.

## 2.4 GROUT

- A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

# PART 3 - EXECUTION

## 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.



2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
  4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- C. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- D. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe 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.
- F. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water stop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

## SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Identification of power and control cables.
2. Identification for conductors.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

#### 1.2 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.

#### 1.3 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.

### PART 2 - PRODUCTS

#### 2.1 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

- B. Write-On Tags: Polyester tag, 0.010-inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

- 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

## 2.2 UNDERGROUND-LINE WARNING TAPE

- A. Manufacturers:

- 1. Brady Corporation.
  - 2. Ideal Industries
  - 3. LEM Products, Inc.
  - 4. Reef Industries, Inc.
  - 5. Seton Identification Products

- B. Tape:

- 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
  - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
  - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

- C. Color and Printing:

- 1. Comply with ANSI Z535.1 through ANSI Z535.5.
  - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
  - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

- D. Conductive Type:

- 1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, compounded for direct-burial service.
  - 2. Overall Thickness: 5 mils.
  - 3. Foil Core Thickness: 0.35 mil.
  - 4. Weight: 28 lb/1000 sq. ft.
  - 5. 3-Inch Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

## 2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.

- B. Baked-Enamel Warning Signs:

- 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.
  - 3. Nominal size, 7 by 10 inches.

- C. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
2. Arc Flash Hazard Warning: "WARNING – POTENTIAL ARC FLASH HAZARD – APPROPRIATE PPE AND TOOLS REQUIRED WHEN WORKING ON THIS EQUIPMENT."

## 2.4 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16-inch thick for signs up to 20 sq. inches and 1/8-inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.5 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

## 2.6 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

## 2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
- F. Underground-Line Warning Tape: Bury underground-line warning tape no less than 12 inches above all duct banks and approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.
- G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

### 3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull boxes, junction boxes, and handholes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
  - 2. Color shall be factory applied.
  - 3. Colors for 240/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
  - 4. Color for neutral: White.
  - 5. Color for Equipment Grounds: Green.
- B. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

- C. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting:
1. Comply with 29 CFR 1910.145.
  2. Identify system voltage with black letters on an orange background.
  3. Apply to exterior of door, cover, or other access.
- D. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- E. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  2. Equipment to Be Labeled:
    - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
    - b. Enclosures and electrical cabinets.
    - c. Access doors and panels for concealed electrical items.
    - d. Emergency system boxes and enclosures.
    - e. Enclosed switches.
    - f. Enclosed circuit breakers.
    - g. Enclosed controllers.
    - h. Variable-speed controllers.
    - i. Contactors.
    - j. Remote-controlled switches, dimmer modules, and control devices.
    - k. Monitoring and control equipment.
- F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, and communication wiring.

END OF SECTION

## SECTION 26 09 23 - LIGHTING CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Line-voltage wall-box occupancy sensors.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for all devices.
  - 1. Interconnection diagrams showing field-installed wiring.
  - 2. Include diagrams for power, signal, and control wiring.
- C. Example Contractor Startup/Commissioning Worksheet.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's warranties.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

- 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. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
- C. Comply with UL 916.

## 2.2 LINE-VOLTAGE WALL-BOX MOUNTED OCCUPANCY SENSORS

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. Sensor Switch, Inc.
  - 2. Wattstopper.
  - 3. Leviton.
  - 4. Hubbell.
  - 5. Cooper.
  - 6. Pass & Seymour.
- B. 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 fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- C. Wall-Switch Sensor (Tag OS):
  - 1. Standard Range: 180-degree field of view; with a minimum coverage area of 20 ft radius from sensor.
  - 2. Sensing Technology: Dual technology - PIR and ultrasonic.
  - 3. Switch Type: Single pole, field selectable automatic "on," or manual "on", automatic "off".
  - 4. Voltage: Match the circuit voltage.
  - 5. Field-adjustable, "off" time-delay selector from 30 seconds to 30 minutes.
  - 6. Coordinate finish and wall plate with Section 26 2726 "Wiring Devices."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- D. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- E. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.



- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### 3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. 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.
- C. Lighting control devices will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.5 ADJUSTING

- A. 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.
  - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Contracting Officer's operations.

### 3.6 DOCUMENTATION

- A. Provide Operation and Maintenance manuals in accordance with Division 01.

END OF SECTION

## SECTION 26 24 16 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.

B. Related Requirements:

1. Section 26 43 13 "Surge Protection for Low-Voltage Electrical Power Circuits" for field-installed Surge Protective Device(s) for panelboards.

#### 1.2 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protective Device.

C. TVSS: Transient voltage surge suppressor.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
  1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Keys: Six spares for each type of panelboard cabinet lock.

#### 1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- 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.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

## 1.9 PROJECT CONDITIONS

### A. Environmental Limitations:

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - a. Ambient Temperature: Not exceeding 50 deg F to plus 104 deg F.

### B. Service Conditions: NEMA PB 1, usual service conditions.

### C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Contracting Officer no fewer than seven days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Contracting Officer's written permission.
3. Comply with NFPA 70E.

## 1.10 COORDINATION

- ### A.
- Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## 1.11 WARRANTY

- ### A.
- Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices 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 GENERAL REQUIREMENTS FOR PANELBOARDS

#### A. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
  - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

3. Finishes:
    - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pre-treating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Same finish as panels and trim.
  4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
  2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Main and Neutral Lugs: Mechanical type.
  2. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

## 2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Square D; a brand of Schneider Electric (Basis of Design)
  2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  4. Siemens Energy & Automation, Inc.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D; a brand of Schneider Electric (Basis of Design)
  - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 4. Siemens Energy & Automation, Inc.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
  - 4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 90 inches above finished floor unless otherwise indicated.

- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
- E. Install filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- G. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Government's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in 26 05 53 "Identification for Electrical Systems."
- D. Device Nameplates: Label each new branch circuit device in existing distribution panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  - 1. Measure as directed during period of normal system loading.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

### 3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION



## SECTION 26 28 13 - FUSES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Cartridge fuses rated 600-V ac and less for use in enclosed switches and enclosed controllers.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
  - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
  - 1. Ambient temperature adjustment information.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. 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.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.

## 1.6 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

## 1.7 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

# 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. Cooper Bussmann, Inc.
  - 2. Edison Fuse, Inc.
  - 3. Ferraz Shawmut, Inc.
  - 4. Littelfuse, Inc.

## 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
  - 1. Motor Branch Circuits: Class RK1 time delay.
  - 2. Other Branch Circuits: Class RK1, time delay.

### 3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

### 3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

## SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Molded-case circuit breakers (MCCBs).
  - 4. Enclosures.

#### 1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Wiring Diagrams: For power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
  - 2. Fuse Pullers: Two for each size and type.

## 1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. 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.
- C. Comply with NFPA 70.

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Contracting Officer no fewer than seven days in advance of proposed interruption of electric service.
  - 2. Indicate method of providing temporary electric service.
  - 3. Do not proceed with interruption of electric service without Contracting Officer's written permission.
  - 4. Comply with NFPA 70E.

## SECTION 26 27 26 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. General-use switches, dimmer switches, and fan-speed controller switches.
2. Receptacles, receptacles with integral GFCI, and associated device plates.
3. Weather-resistant receptacles.
4. Snap switches and wall-box dimmers.
5. Floor service outlets.

##### B. Related Requirements:

1. Section 26 09 23 "Lighting Control Devices" for time switches, outdoor photoelectric switches, indoor wall box occupancy sensors, and lighting contactors.

#### 1.2 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. UTP: Unshielded twisted pair.

#### 1.3 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. Receptacles for Government-Furnished Equipment: Match plug configurations.

#### 1.4 ACTION SUBMITTALS

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

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## PART 2 - PRODUCTS

### 2.1 GENERAL-USE SWITCHES, DIMMER SWITCHES, AND FAN-SPEED CONTROLLER SWITCHES

- A. Toggle Switch
  - 1. Regulatory Requirements:
    - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
  - 2. General Characteristics:
    - a. Reference Standards: UL CCN WMUZ and UL 20.
  - 3. Options:
    - a. Device Color: White.
    - b. Configuration:
      - 1) General-duty, 120-277 V, 20 A, single pole, three way, four way.
  - 4. Accessories:
    - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
    - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

### 2.2 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## 2.3 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

## 2.4 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
  - 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. Cooper: CR5362 (Duplex) with Cooper: TRBR20 (Duplex).
    - b. Hubbell: 5352 (Duplex) with Hubbell: BR20TR (Duplex)
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5361 (single), 5362 (duplex).

## 2.5 GFCI RECEPTACLES

- A. General Description:
  - 1. Straight blade, non-feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 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. Cooper: VGF20 with Cooper: TRVGF20-W.
    - b. Hubbell: GFR5352L with Hubbell: GFTRST20.
    - c. 2095 with Pass & Seymour: 2097TRW.
    - d. 7590 with Leviton X7899-W.
- C. Weather Resistant GFCI Convenience Receptacles, 125 V, 20A:
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following SPECIFICATION GRADE receptacles:
    - a. Hubbell; GFTR20W with Hubbell: GFWRST20.
    - b. Pass & Seymour; WR5362W.
  - 2. Comply with requirements of UL 498 for weather resistant receptacles.
  - 3. Receptacle must bear the “WR” letters on front of receptacle.
- D. Tamper-Resistant Duplex Straight-Blade Receptacle (TR):
  - 1. Regulatory Requirements:
    - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.



2. General Characteristics:
    - a. Reference Standards: UL CCN RTRT and UL 498.
  3. Options:
    - a. Device Color: White.
    - b. Configuration:
      - 1) General-duty, smooth face, NEMA 5-20R.
  4. Accessories:
    - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
    - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.
- E. Tamper-Resistant, Floor-Mounted Straight-Blade Receptacle:
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. Leviton: 25349-TFB, or equal.
  2. Regulatory Requirements:
    - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
  3. General Characteristics:
    - a. Reference Standards: UL CCN RTRT and UL 498.
    - b. Configuration: NEMA 5-20R.
  4. Options:
    - a. Finish: Brass.

## 2.6 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
  1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: Smooth, high-impact thermoplastic 0.035-inch-thick.
  3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

## 2.7 FINISHES

- A. Device Color:
  1. Wiring Devices Connected to Normal Power System: To be confirmed by government, unless otherwise indicated or required by NFPA 70 or device listing.

- B. Wall Plate Color: For plastic covers, match device color.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
  - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  - 4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
  - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
  - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
  - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  - 8. Tighten unused terminal screws on the device.
  - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

- E. Receptacle Orientation:
  - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
  - 1. Install dimmers within terms of their listing.
  - 2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles.

### 3.3 IDENTIFICATION

- A. Comply with Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use durable wire markers or tags inside outlet boxes.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

## 1.9 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## PART 2 - PRODUCTS

### 2.1 FUSIBLE SWITCHES

- 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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position. Entire assembly shall have a short-circuit rating of 14,000 A.
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 4. Lugs: Mechanical type, suitable for number, size, and conductor material.

### 2.2 NONFUSIBLE SWITCHES

- 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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.3 MOLDED-CASE CIRCUIT BREAKERS

- 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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- E. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- F. Features and Accessories:
  1. Standard frame sizes, trip ratings, and number of poles.
  2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  3. Application Listing: Appropriate for application.

## 2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
  1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  2. Outdoor Locations: NEMA 250, Type 3R.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Install fuses in fusible devices.
- C. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

## SECTION 26 43 13 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.
- B. Related Requirements:

#### 1.2 DEFINITIONS

- A. Inominal: Nominal discharge current.
- B. MCOV: Maximum continuous operating voltage.
- C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
- D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
- E. OCPD: Overcurrent protective device.
- F. SCCR: Short-circuit current rating.
- G. SPD: Surge protective device.
- H. VPR: Voltage protection rating.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.



## 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For SPDs to include in maintenance manuals.

## 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs 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 GENERAL SPD REQUIREMENTS

- A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Comply with UL 1449.
- D. MCOV of the SPD shall be the nominal system voltage.

### 2.2 SERVICE ENTRANCE SUPPRESSOR

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Surge Suppression Incorporated.
  - 2. Advanced Protection Technologies Inc. (APT)
  - 3. Liebert a division of Emerson Network Power.
- B. SPDs: Comply with UL 1449, Type 1.
  - 1. SPDs with the following features and accessories:
    - a. Integral disconnect switch.
    - b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
    - c. Indicator light display for protection status.
    - d. Form-C dry contacts.
    - e. Surge counter.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120V, three-phase, four-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 700 V.

- 2. Line to Ground: 1200 V.
- 3. Line to Line: 1000 V.
- E. SCCR: Equal or exceed 200 kA.
- F. Inominal Rating: 20 kA.

## 2.3 PANEL SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Surge Suppression Incorporated.
  - 2. Advanced Protection Technologies Inc. (APT)
  - 3. Liebert a division of Emerson Network Power.
- B. SPDs: Comply with UL 1449, Type 2.
  - 1. Include LED indicator lights for power and protection status.
  - 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
  - 3. Include Form-C contacts.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA>. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Comply with UL 1283.
- E. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 700 V for 208Y/120 V.
  - 2. Line to Ground: 700 V for 208Y/120 V.
  - 3. Neutral to Ground: 700 V for 208Y/120 V.
  - 4. Line to Line: 1200 V for 208Y/120 V
- F. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 700 V.
  - 2. Line to Ground: 700 V.
  - 3. Neutral to Ground: 700 V.
  - 4. Line to Line: 1200 V.
- G. SCCR: Equal or exceed 200 kA.
- H. Inominal Rating: 20 kA.

## 2.4 ENCLOSURES

- A. Enclosures: NEMA 250, Type 3R.

## 2.5 CONDUCTORS AND CABLES

- A. Power Wiring: Same size as SPD leads, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
- C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- D. Use crimped connectors and splices only. Wire nuts are unacceptable.
- E. Wiring:
  - 1. Power Wiring: Comply with wiring methods in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
  - 2. Controls: Comply with wiring methods in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
  - 1. Compare equipment nameplate data for compliance with Drawings and Specifications.
  - 2. Inspect anchorage, alignment, grounding, and clearances.
  - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. An SPD will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.3 STARTUP SERVICE

- A. Complete startup checks according to manufacturer's written instructions.
- B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

- C. Energize SPDs after power system has been energized, stabilized, and tested.

#### 3.4 DEMONSTRATION

- A. Train Contracting Officer's maintenance personnel to operate and maintain SPDs.

END OF SECTION

## SECTION 26 51 00 – LED INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. LED Interior lighting fixtures.
  - 2. Lighting fixture supports.

#### 1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. Fixture: See "Luminaire."
- D. IP: Ingress Protection Rating.
- E. LED: Light emitting diode.
- F. LER: Luminaire efficacy rating.
- G. Lumen: Measured output of lamp and luminaire, or both.
- H. Luminaire: Complete lighting unit, including LED lamp or LED board(s), reflector, driver and housing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units including batteries and chargers.
  - 5. Include energy-efficiency data.
  - 6. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  - 7. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, drivers, and accessories identical to those indicated for the lighting fixture as applied in this Project.
    - a. Manufacturer's Certified Data: Photometric data certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Luminaires.
  - 2. Suspended ceiling components.
  - 3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
  - 4. Structural members to which suspension systems for lighting fixtures will be attached.
  - 5. Other items in finished ceiling including the following:
    - a. Other luminaires
    - b. Air outlets and inlets.
    - c. Sprinklers.
    - d. Smoke and heat detectors.
    - e. Occupancy sensors.
    - f. Access panels.
- B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- C. Product Certificates: For each type of luminaire.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
  - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### 1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NFPA 70.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

## 1.8 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

## 1.9 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
  - 2. Warranty Period for Emergency LED Driver: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

### 2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
    - b. UV stabilized.
  2. Glass: Annealed crystal glass unless otherwise indicated.
- F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and drivers. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp and LED driver characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. CCT and CRI for all luminaires.

## 2.3 LED DRIVERS AND POWER SUPPLIES

- A. Description: Electronic solid state type.
1. Ten-year operational life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
  2. Designed and tested to withstand electrostatic discharges up to 15,000
  3. Electrolytic capacitors shall operate at least 20 degrees C below the capacitor's maximum temperature rating when the driver is under fully-loaded conditions and under maximum case temperature.
  4. Maximum inrush current of 2 amperes for 120V and 277V drivers.
  5. Withstand up to a 4,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
  6. Manufactured in a facility that employ ESD reduction practices in compliance with ANSI/ESD S20.20.
  7. Inaudible in a 27 dBA ambient.
  8. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
  9. Total Harmonic Distortion less than 20 percent and meet ANSI C82.11 maximum allowable THD requirements.
  10. Drivers shall track evenly across multiple fixtures and all light levels.
  11. Constant current drivers shall provide models shall support from 200mA to 2.1Amps (in 10mA steps) to ensure a compatible driver exists and support LED arrays up to 40W.
  12. Constant voltage drivers shall provide models to support from 10Volts to 40Volts (in 0.5V steps) to ensure a compatible driver exists and support LED arrays up to 40W.
  13. Configuration tool shall be available to optimize light level, efficacy, and thermal performance for LED fixtures.
  14. Driver shall be capable of operating from a supply voltage of 120 through 277VAC at 60Hz for 3-wire models.

## 2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.



- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 TEMPORARY LIGHTING

- A. If it is necessary, and approved by Contracting Officer, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, and reinstall.

### 3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
  - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.

2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
  3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
  4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- E. Suspended Lighting Fixture Support:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
  3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
  4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

### 3.6 STARTUP SERVICE

- A. Comply with requirements for startup specified for lighting controls.

### 3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
  - 1. Adjust aimable luminaires in the presence of Contracting Officer.

END OF SECTION

## SECTION 28 31 11 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. The installation of the following fire alarm devices for connection to the existing Firelite ES-200X addressable fire alarm control panel currently located in the basement.
    - a. Audible and visual notification appliances.
    - b. Initiating devices.
    - c. Addressable interface devices.
  - 2. Fire alarm system document storage box (cabinet).

#### 1.2 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

#### 1.3 SYSTEM DESCRIPTION

- A. Existing noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.
- B. The installation of new fire alarm initiating devices will be limited to the renovated lobby area constructed under this project.
- C. The new fire alarm devices shall be connected to the existing fire alarm system.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. General Submittal Requirements:
  - 1. Shop Drawings shall be prepared by persons with the following qualifications:
    - a. NICET-certified fire-alarm technician, Level III minimum.
- C. Shop Drawings: For fire-alarm system.
  - 1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
  - 2. Include plans, elevations, sections, and details, including details of attachments to other Work.

3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Annunciator panel details as required by authorities having jurisdiction.
5. Detail assembly and support requirements.
6. Include voltage drop calculations for notification-appliance circuits.
7. Include battery-size calculations.
8. Include input/output matrix.
9. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
10. Include performance parameters and installation details for each detector.
11. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
  1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
  2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
  3. Record copy of site-specific software.
- B. Software and Firmware Operational Documentation:
  1. Program Software Backup: On magnetic media or compact disk, complete with data files.
  2. Device address list.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician or higher.

- B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm devices from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- 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 ADDRESSABLE FIRE-ALARM SYSTEM

- A. Description:
  - 1. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn-and-strobe notification for evacuation.
- B. Performance Criteria:
  - 1. Regulatory Requirements:
    - a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.
  - 2. General Characteristics:
    - a. Automatic sensitivity control of certain smoke detectors.
    - b. Fire-alarm signal initiation must be by one or more of the following devices[ **and systems**]:
      - 1) Manual stations.
      - 2) Smoke detectors.
      - 3) Carbon monoxide detectors.
      - 4) Automatic sprinkler system water flow.
    - c. Fire-alarm signal must initiate the following actions:
      - 1) Continuously operate alarm notification appliances.
      - 2) Identify alarm and specific initiating device at FACU.
    - d. Supervisory signal initiation must be by one or more of the following devices and actions:
      - 1) Valve supervisory switch.
      - 2) High- or low-air-pressure switch of dry-pipe or preaction sprinkler system.
    - e. System trouble signal initiation must be by one or more of the following devices and actions:
      - 1) Open circuits, shorts, and grounds in designated circuits.

- 2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
- 3) Loss of primary power at FACU.
- 4) Ground or single break in internal circuits of FACU.
- 5) Abnormal ac voltage at FACU.
- 6) Break in standby battery circuitry.
- 7) Failure of battery charging.
- 8) Abnormal position of switch at FACU or annunciator.

f. System Supervisory Signal Actions:

- 1) Initiate notification appliances.
- 2) Display system status on graphic annunciator.

## 2.2 FIRE-ALARM CONTROL UNIT (FACU)

A. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.

B. Performance Criteria:

1. Regulatory Requirements: Comply with NFPA 72 and UL 864.
2. General Characteristics:
  - a. System software and programs must be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining information through failure of primary and secondary power supplies.
  - b. Include real-time clock for time annotation of events on event recorder and printer.
  - c. Provide communication between FACU and remote circuit interface panels, annunciators, and displays.
  - d. Fire-Alarm Annunciator: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.
    - 1) Keypad: Arranged to permit entry and execution of programming, display, and control commands.
  - e. Alphanumeric Display and System Controls: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.
    - 1) Keypad: Arranged to permit entry and execution of programming, display, and control commands.
  - f. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
    - 1) Install no more than 50 addressable devices on each signaling-line circuit.
    - 2) Install fault circuit isolators to comply with circuit performance requirements of NFPA 72 or with manufacturer's written instructions, whichever is more conservative.

- g. Smoke-Alarm Verification:
  - 1) Initiate audible and visible indication of "alarm-verification" signal at FACU.
  - 2) Activate approved "alarm-verification" sequence at FACU and detector.
  - 3) Record events by system printer.
  - 4) Sound general alarm if alarm is verified.
  - 5) Cancel FACU indication and system reset if alarm is not verified.
- h. Notification-Appliance Circuit:
  - 1) Audible appliances must sound in three-pulse temporal pattern, as defined in NFPA 72.
  - 2) Where notification appliances provide signals to sleeping areas, alarm signal must be 520 Hz square wave with intensity 15 dB above average ambient sound level or 5 dB above maximum sound level, or at least 75 dB(A-weighted), whichever is greater, measured at pillow.
  - 3) Visual alarm appliances must flash in synchronization where multiple appliances are in same field of view, as defined in NFPA 72.
- i. Alarm current draw of entire fire-alarm system must not exceed 80 percent of power-supply module rating.
- j. Secondary Power: 24 V(dc) supply system with batteries, automatic battery charger, and automatic transfer switch.

## 2.3 SYSTEM SMOKE DETECTORS

### A. Photoelectric Smoke Detectors:

#### 1. Performance Criteria:

##### a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 268.

##### b. General Characteristics:

- 1) Detectors must be four or two-wire type.
- 2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- 3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
- 4) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- 5) Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
- 6) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
- 7) Operator at FACU, having designated access level, must be able to manually access the following for each detector:



- a) Primary status.
- b) Device type.
- c) Present average value.
- d) Present sensitivity selected.
- e) Sensor range (normal, dirty, etc.).
- 8) Detector must have functional humidity range within 10 to 90 percent relative humidity.
- 9) Color: White.
- 10) Multiple levels of detection sensitivity for each sensor.
- 11) Sensitivity levels based on time of day.

## 2.4 DOCUMENT STORAGE BOX (CABINET)

- A. Description: Enclosure to accommodate standard 8-1/2-by-11-inch manuals and loose document records. Legend sheet must be permanently attached to cabinet door for system required documentation, key contact personnel, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.
  - 1. Size documentation cabinet so that all necessary documentation will fit inside it.
  - 2. Documentation includes, but is not limited to Owner's manual, record drawings, record of completion form, equipment technical and product data sheets, emergency response plan, record copy of site-specific software and firmware control documentation, annual inspection testing and maintenance records, etc.
- B. Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
- C. Color: Red powder-coat epoxy finish.
- D. Labeling: Permanently screened with 1-inch high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
- E. Security: Locked with 3/4-inch barrel lock. Provide solid 12-inch stainless steel piano hinge.

## 2.5 WIRE AND CABLE

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

- A. All fire alarm system wiring shall be installed in metal raceway and junction box systems to prevent potential impacts from rodents. All penetrations through walls, floors, ceilings, etc. shall be sealed to prevent potential rodent migration
- B. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

### 3.2 SURGE PROTECTION

- A. Install surge protection on normal ac power for the FACP, Auto-Dialer, Booster/NAC Panels, Amplifiers and its accessories. Comply with Division 26 Section "Surge Protective Devices for Low-Voltage Electrical Power Circuits" for auxiliary panel suppressors.
  - 1. Surge suppressors shall be listed for use with fire alarm systems.
  - 2. Install surge suppressors adjacent to fire alarm equipment cabinet(s). Do not install surge suppressors inside fire alarm equipment cabinets.
- B. Provide surge suppressors for all telephone or DSL connections to the fire alarm system.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

### 3.4 PATHWAYS

- A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.
  - 1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.
- B. Pathways shall be installed in EMT.

### 3.5 DOCUMENT STORAGE BOX (CABINET)

- A. Install documentation cabinet at the fire alarm control panel.
- B. At project completion, place documentation inside the documentation cabinet in accordance with NFPA 72.

### 3.6 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by Contracting Officer and National Park Service AHJ.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Prepare for final test and commissioning by the National Park Service AHJ. Ensure all components of the project's fire protection systems are inspected and pre-tested prior to requesting a final inspection, test and commissioning visit by the NPS AHJ. Inspection deficiencies will be referenced to NFPA requirements, and Contract Specification requirements. Use, as a minimum, the following pre-commissioning check list:
    - ☐ NFPA 72" Fire Alarm System Record of Completion" form completed by contractor.
    - ☐ System meets contract specification requirements

- ☐ System has been inspected and pre-tested
  - ☐ Proper batteries installed
  - ☐ System is free of all trouble conditions
  - ☐ System has been programmed to meet specification requirements
  - ☐ Systems device text programming has been coordinated with the Park to ensure proper device identity and location.
  - ☐ All devices and components installed per approved shop drawings
  - ☐ All devices properly labeled and properly identified on as-builts
  - ☐ All conduit box covers in place
  - ☐ No T-Tap connections or splices in circuits
  - ☐ No flexible conduit exceeds 6 foot in length
  - ☐ All control relays located within 3 feet of controlled equipment
  - ☐ All required surge suppressors properly installed (including required suppressors for F/A circuits leaving and entering buildings)
2. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  3. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
  4. Prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of fire alarm system, including, but not limited to added, replaced, and relocated devices and appliances.
  - E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
  - F. Prepare test and inspection reports.

END OF SECTION

## SECTION 31 00 00 – EARTHWORK

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. This work consists of excavating material and performing site grading in conformance with the Contract Drawings. This includes furnishing, hauling, stockpiling, placing, disposing, sloping, shaping, compacting, and finishing material.

#### 1.2 JOB CONDITIONS

- A. Classification of Excavation.
  - 1. All site excavation work performed under this Contract is unclassified and includes excavation and removal of all soils, shale, rock, boulders, fill, and all other materials encountered of whatever nature.

### PART 2 – PRODUCTS

#### 2.1 ACCEPTABLE MATERIALS

For the purpose of construction control, the following materials are deemed acceptable for use in placement of fills.

- A. Soil. Soil shall include all inorganic material having a maximum size that can be readily placed and compacted in loose 8 inch layers and of which more than 35 percent shall pass the No. 200 sieve. Soil shall have a minimum dry weight density of 98 pounds per cubic foot as determined in accordance with PTM No. 106, Method B and a maximum liquid limit of 65 as determined in accordance with AASHTO Designation T89. The plasticity index, as determined by AASHTO Designation T90 for soils having liquid limits of 41 to 65 inclusive, shall be not less than that determined by the formula: Plasticity Index = Liquid Limit - 30.
- B. Granular Material. Granular material shall include all natural or synthetic mineral aggregates having a maximum size that can be readily placed and compacted in loose 8 inch layers and of which 35 percent or less shall pass the No. 200 sieve.
- C. Shale. Shale shall include all rock-like materials formed by the natural consolidation of mud, clay, silt and fine sand and usually thinly laminated, comparatively soft and easily split, having a maximum size that can be readily placed and compacted in loose 8 inch layers.
- D. Rock. Rock shall include all igneous, metamorphic and sedimentary rock having a maximum size that can be readily placed and compacted in loose 8 inch layers and which generally has sufficient fines to normally fill all the voids in each layer.
- E. The Contractor shall provide the proposed source(s) for all imported materials prior to initiation of work. Provide a certification from the borrow source that the material is clean relative to environmental contaminants.

1. The Park is concerned with import of invasive, exotic, or non-native species of plants and weeds within borrow sources. The Contractor shall not secure borrow material sources that knowingly contain invasive species of plants and weeds.
2. The Contractor will allow NPS the option of inspecting borrow site sources prior to material acquisition or import to the Park. NPS shall be provided 2 weeks notice of proposed borrow source for weed free site inspection. If site is found to contain invasive weeds NPS will reject the proposed source.
3. If vendor inspection certificates or weed free assessment reports are available for proposed borrow sources, the Contractor shall provide copies to the NPS.

## PART 3 – EXECUTION

### 3.1 CONSTRUCTION REQUIREMENTS

#### A. Salvaged Topsoil

1. Salvage topsoil from excavated areas. Stockpile salvaged topsoil at an approved location.

#### B. Perform excavation of borrow material in a manner satisfactory to the Owner. Strip borrow pits of brush, trees, roots, grass and other vegetation prior to removal of material for use in fill. During the excavation operation, grade the borrow area to ensure free drainage of water from the area. Place and maintain erosion control devices after completion of the excavation, grade the excavated area, including side slopes, to drain and present a uniformly trim appearance merging into the surrounding terrain. After borrowing operations are complete, re-grade area, if necessary, to prevent erosion.

#### C. Placement of Fill Material

1. After removal of topsoil, areas to receive fill shall be thoroughly rolled, and any soft spots disclosed by rolling shall be excavated and the unsuitable material removed and disposed of in a waste area. The excavated area shall be filled with suitable fill material approved by the Owner and recompacted. Suitable fill material shall be spread in layers of not more than 8 inches (loose) over the full area of the fill, and compacted to the required density by the use of compaction equipment. All fill material shall be compacted to not less than 95% of its maximum dry weight density at its optimum moisture content, plus or minus 2%, as determined by ASTM D698, under roadways, shoulders, driveways, curbs, sidewalks, gravel and sand parking areas and not less than 90% in yards, fields and sand areas.

When the material is too coarse to satisfactorily use these methods, compaction will be determined by the Owner based on non-movement of the material under the compaction equipment.

2. Fill material placed in areas inaccessible to the compaction equipment shall be placed in uniform loose layers not exceeding 4 inches in depth and compacted by means of approved mechanical tampers to the density requirements herein specified.

3. When a previously constructed fill requires additional material to bring it to required elevation, the top of the fill shall be thoroughly scarified before the required additional material is placed.
4. Material containing moisture in excess of that percentage which will ensure satisfactory compaction shall not be placed in the fill and fill material shall not be placed on material that has become unstable due to excessive moisture.
5. Frozen fill material shall not be placed in fills, and fill material shall not be placed on frozen material. If during construction the top of the fill freezes, all frozen material shall be removed before additional material is placed.

D. Disposal of Unsuitable or Excess Material

1. Dispose of unsuitable or excess material legally off the project.

END OF SECTION

## SECTION 31 11 00 – CLEARING AND GRUBBING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. This work consists of clearing and grubbing within the limits designated on the plans.

### PART 2 – PRODUCTS

#### 2.1 MATERIALS

- A. Backfill Material – Furnish a well-graded, compactable material free of excess moisture, muck, frozen lumps, roots, sod, or other deleterious material conforming to the following:
  - 1. Maximum particle size 3 inches
  - 2. Soil classification, AASHTO M 145 A-1, A-2, or A-3

### PART 3 – EXECUTION

#### 3.1 CONSTRUCTION REQUIREMENTS

##### A. General

- 1. Construct erosion control measures according to Section 31 25 00. Perform work within designated limits of excavation, as shown on the plans. Do not damage vegetation and trees designated to remain. If vegetation designated to remain is damaged or destroyed, repair or replace the vegetation in an acceptable manner. Treat cuts or scarred surfaces of trees and shrubs with tree wound dressing.

##### B. Clearing

- 1. Within the clearing limits, clear brush, downed timber, and other vegetation.
- 2. Downed timber less than 12" diameter at clearing limits: Downed timber shall be cut at clearing limits. Remove all portions of downed timber within the clearing limits.
- 3. Downed timber 12" diameter or greater: Contracting Officer shall determine, on an individual basis, whether downed timber may be cut and removed within clearing limits or if entire length of downed timber shall be removed
- 4. Contractor shall notify Contracting Officer prior to clearing downed timber and shall coordinate government inspection of all downed timber 12" diameter or greater that is not specifically indicated for removal on the Contract Drawings before removal.
- 5. Contractor shall cut and remove all stumps within clearing limits. Contractor shall remove stump and root wad in locations where new work will interfere or expose the root wad. All other stumps within clearing limits shall be cut at or below proposed finish grade.

6. All timber removed from the site shall become the contractor's property and shall be disposed of outside the park.
- C. Grubbing
1. Grub areas within the construction limits to remove roots and other objectionable material to a minimum depth of 18 inches.
  2. Backfill all stump holes and other grubbing holes with backfill material to the level of the surrounding ground and compact. Backfill shall be placed in 6-inch maximum lifts.

END OF SECTION



## SECTION 31 23 33 - TRENCHING, BACKFILLING AND COMPACTING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Trench excavation, backfill and compaction
2. Support of excavation
3. Pipe bedding requirements
4. Control of excavated material
5. Rough grading
6. Restoration of unpaved surfaces

#### 1.2 SUBMITTALS

A. Certificates:

1. Submit certification from aggregate suppliers attesting that the pipe bedding and select material stone backfill materials conform to the specifications herein.
2. Submit methods to be used to prevent damage to existing monuments, markers, and structures.

#### 1.3 JOB CONDITIONS

A. Classification of Excavation:

1. All excavation work performed under this contract is UNCLASSIFIED, and includes excavation and removal of all soil, shale, rock, boulders, fill, and all other materials encountered of whatever nature.

B. Protection of Existing Utilities and Structures:

1. Take all precautions and utilize all facilities required to protect existing utilities and structures. Comply with the requirements of the Pennsylvania Underground Utility Protection Law. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.
2. Advise each person in physical control of powered equipment used in excavation or demolition work of the type and location of utility lines at the job site, the utility assistance to expect, and procedures to follow to prevent damage.

### PART 2 - PRODUCTS

#### 2.1 BACKFILL MATERIAL

A. Suitable Backfill Material (Highways, driveways and shoulders)

1. From top of pipe bedding to subgrade elevation:
  - a. Suitable backfill material shall consist of crushed stone or gravel aggregate conforming to Pennsylvania State Department of Transportation 2RC or 2A gradation requirements. (PennDOT Publication 408 section 703.3)
- B. Suitable Backfill Material (Other than highways, driveways, and shoulders):
  1. From top of pipe bedding to subgrade elevation:
    - a. Material excavated from the trench if free of stones larger than 8" in size and free of wet, frozen, or organic materials.

## PART 3 - EXECUTION

### 3.01 TRENCH EXCAVATION

#### A. Depth of Excavation:

1. Pressure Pipelines:
  - a. Excavate trenches to the minimum depth necessary to place required pipe bedding material. Contractor shall locate and remove existing waterline and place proposed line at same location and elevation, except where specific depths are otherwise shown on the Contract Drawings.
2. Where unsuitable bearing material is encountered in the trench bottom, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete cradle can be placed. If no concrete cradle is to be installed, refill the trench to required pipeline grade with pipe bedding material.
3. Where the CONTRACTOR, by error or intent, excavates beyond the minimum required depth, backfill the trench to the required pipeline grade with pipe bedding material.

#### B. Width of Excavation:

1. Excavate trenches to a width necessary for placement and jointing of the pipe, and for placing and compacting pipe bedding and trench backfill around the pipe, but not less than 16" or more than 30" plus the pipe outside diameter from the bottom of the trench to a point 12" above the crown of the pipe.
2. Shape trench walls completely vertical from trench bottom to at least 2' above the top of the pipe. Trench walls from 2' above the top of the pipe to grade to be benched and sloped, or shaved, to comply with Federal and State laws and codes.
3. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.

### 3.02 SUPPORT OF EXCAVATION

- A. The adequacy of the design of sheeting, shoring and bracing installations relative to the nature of the material to be encountered and retained is the sole responsibility of the CONTRACTOR.
- B. Support excavations with sheeting, shoring, and bracing or a "trench box" as required to comply with Federal and State laws and codes.
- C. Install adequate excavation supports to prevent ground movement or settlement of adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of the CONTRACTOR in any other manner, shall be repaired at the CONTRACTOR's expense.
- D. Removal of sheeting, shoring and bracing as backfilling proceeds is the CONTRACTOR's responsibility.

### 3.03 CONTROL OF EXCAVATED MATERIAL

- A. Keep the ground surface on both sides of the excavation free of excavated material to comply with Federal and State laws and codes.
- B. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural water courses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.
- C. In areas where pipelines parallel or cross streams, ensure that no material slides, is washed, or is dumped into the stream course. Remove cofferdams immediately upon completion of pipeline construction.

### 3.04 DEWATERING

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water. Surface drainage system shall be reviewed and approved of by the COR prior to implementation.
- D. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

### 3.05 PIPE BEDDING REQUIREMENTS

#### A. Pipe Bedding:

1. Depth of pipe bedding as shown on Contract Drawings.
- B. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant (under “haunches”) and the pipe bottom for the entire length of the barrel.

### 3.06 THRUST RESTRAINT

- A. Provide pressure pipe with concrete thrust blocking or use restrained joint fittings at all bends, tees, valves, and changes in direction, in accordance with the Contract Drawings.

### 3.07 BACKFILLING TRENCHES

- A. After pipe installation and inspection, backfill trenches to 12" above the crown of the pipe with specified backfill material placed and carefully compact with approved compaction equipment in layers of suitable thickness to provide specified compaction. Backfill and compact the remainder of the trench with specified backfill material.
- B. Lift Thickness Limitations:
  1. Submit a list of the compaction equipment to be utilized on the project, the recommendations of the equipment manufacturer as to the maximum lift thickness which can be placed, and the method of compaction to be used with this equipment to achieve the required compaction. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations. However, if the equipment manufacturer's lift thickness recommendation is followed and the specified compaction is not obtained, the CONTRACTOR shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified compaction.
  2. Lift thickness limitations specified for state highways, shoulders, or embankments shall govern over the compaction equipment manufacturer's recommendations.
- C. Unsuitable Backfill Material:
  1. Where the Contracting Officer deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with select material backfill.

### 3.08 DISPOSAL OF EXCAVATED MATERIAL

- A. Excavated material remaining after completion of backfilling shall remain the property of the CONTRACTOR, removed from the construction area, and legally disposed of.

### 3.09 ROUGH GRADING

- A. Rough subgrade areas disturbed by construction to a uniform finish. Form the bases for terraces, banks, and lawns.
- B. Rough grade areas to be topsoiled and seeded to 4" below indicated finish contours.

### 3.10 RESTORATION OF UNPAVED SURFACES

- A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.

END OF SECTION 31 23 33

## SECTION 31 25 00 - EROSION & SEDIMENTATION CONTROLS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. This work includes the installation and maintenance of soil erosion and sedimentation control (SESC) measures. Additionally, it includes the restoration of the area and removal of any interim SESC measures placed to protect areas from erosion during stabilization period.

#### 1.2 QUALITY ASSURANCE

##### A. Reference Standards:

1. Pennsylvania Department of Environmental Protection (PA DEP):  
Resources Soil Erosion and Sedimentation Control Manual
2. Asphalt Institute Specifications

### PART 2 MATERIALS

#### 2.1 EROSION CONTROL DEVICES

##### A. Silt Barrier Fence

1. Geotextiles, Class 3: with the following minimum fabric properties
  - a. Grab Tensile Strength (ASTM D4632) – 90 lbs
  - b. Burst Strength (ASTM D3786) – 140 psi
  - c. Puncture (ASTM D4833) – 40 lbs
  - d. Trapezoid Tear Strength (ASTM D4533) – 30 lbs
  - e. UV Resistance Strength Retention % (ASTM D4355) – 70 @ 150 hours
2. Mesh Support: metallic coated steel, 14.5 gauge wire mesh, arranged in a maximum grid of 6 inches by 6 inches or an acceptable equivalent plastic mesh.
3. Post
  - a. Wood or steel or acceptable plastic with equivalent section and sufficient length for height of fence required.
4. Fasteners: No. 9 staples, 1.5 inch long or tie wires, 17 gauge steel.
5. Ground Anchors, Guy Wires: 1-inch by 2-inch by 12-inch wooden stakes or steel equivalent to anchor guy wire.

##### B. Compost Filter Sock

1. Sock: Provide filter sock meeting the compost filter sock requirements of the Department of Environmental Protection Erosion and Sediment Pollution Control

Program Manual.

C. Compost: Well-decomposed, stable, weed-free, organic compost meeting AASHTO MP-9

1. Industrial residuals and biosolids are not acceptable.

D. Stakes: 2 inch x 2 inch wood or equivalent steel stakes, length provided to ensure a minimum embedded depth of 18 inches and 3-4 inches extended above the top of the sock.

2.2 TEMPORARY COVER

A. Seed: As specified in Section 32 92 19

B. Seed Mixtures: As specified in Section 32 92 19

2.3 MULCHING MATERIALS

A. Mulching materials shall be wood fiber mulch.

B. Mulch control netting will not be needed.

PART 3 EXECUTION

3.1 Soil erosion and sedimentation control measures shall be implemented by the CONTRACTOR before earthmoving activities are started. The plan shall be strictly adhered to, and the CONTRACTOR shall maintain all Soil Erosion and Sedimentation Control measures until permanent soil cover has been established.

3.2 The following minimum control measures shall be employed by the CONTRACTOR:

A. Reduce by the greatest extent practicable the area and duration of exposure of readily erodible soils;

B. Temporary vegetation will be used if needed in situations such as phased projects, long unanticipated delays and long-term storage of stockpiled topsoil. Temporary vegetation will not normally be needed following normal roadside disturbance as establishment of permanent vegetation will follow as soon as is consistent with construction schedules.

C. Retard the rate of runoff from the construction site and control the disposal thereof;

D. Trap sediment from the construction site in silt basins, including pump discharges from dewatering operations;

E. Utilize temporary measures to control soil erosion on construction operations suspended for more than 20 calendar days;

F. Provide protection against discharge of pollutants such as chemicals, fuel, lubricants, sewage, etc. into streams or storm water facilities;

G. Keep all construction debris, excavated material, rocks, and refuse incidental to the work out of any stream channel, gutter lines and drainage channels.

- H. All equipment and vehicles which will work off road will be thoroughly cleaned to remove soil, vegetation and other debris before the equipment or vehicle enters the park.
- 3.3 The CONTRACTOR shall not permit mud or silt-laden water to leave the construction site, and is responsible for any and all damages to downstream properties as a result of his failure to prevent such damages.
- 3.4 At such time permanent soil cover has been established, the CONTRACTOR shall remove all temporary Soil Erosion and Sedimentation Control measures.
- 3.5 Temporary control measures must be maintained, including disposal and replacement of damaged or filled devices.

END OF SECTION



## SECTION 32 12 16 - MINOR ASPHALT PAVEMENT

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Work under this Section shall consist of constructing minor asphalt pavement. Furnish all labor, material and equipment necessary to complete the work according to the contract.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Furnish asphalt composed of mineral aggregate, performance graded asphalt binder, recycled asphalt, mineral filler, anti-strip additives and, if applicable, manufactured warm mix asphalt (WMA) additive and/or WMA plant process modifications that are mixed in a central mixing plant and placed on a prepared surface(s) in accordance with these specifications. Use an aggregate mix and asphalt binder of a quality conforming to those normally used and approved locally by either Federal or State agencies for the type of work being constructed.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. The Contractor shall place Minor Asphalt Pavement (pavement) at the locations, widths, thickness and to the grades shown on the Drawings.
- B. Maintain all equipment in safe and satisfactory operating condition.
- C. Protection and Restoration of Property and Landscape follow the requirements of FAR Clause 52-236-9 Protection of existing Vegetation, Structures, Equipment, Utilities and Improvements. In addition:
  - 1. Protect adjacent work from contamination by paving materials and placement activities. Remove any stains or damage from adjacent work, structures, curbing, or other facilities, resulting from such contamination. Remove and dispose of all waste and spillage.
  - 2. Do not damage or disturb existing improvements, facilities, features or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.
  - 3. Restore damaged improvements, including existing paving on or adjacent to the site that has been damaged as a result of construction work.
  - 4. Check frames, covers, grates, water valve boxes and other miscellaneous castings that are located in the proposed pavement areas to ensure that they have been correctly positioned and set to the proper slope and elevation.

5. If pavement work extends to an area underlain by existing Telford base then care shall be taken to avoid disturbance to the Telford Base. If the Telford Base is exposed during construction work shall cease until the Archaeologist is notified and provides direction on how to proceed.

### 3.2 SUBMITTALS

#### A. Mix Design Submittal:

The job mix formula shall be submitted in writing by the Contractor at least 7 days prior to the start of paving operations. The submittal shall include the design parameters and related specifications for the asphalt concrete mix. Include copies of laboratory test reports that demonstrate the properties of the aggregates, asphalt binder, additives and mix meet the Federal or State agency requirements. Include the maximum specific gravity of the mix in accordance with AASHTO T209.

#### B. Hauling Equipment:

Use vehicles with tight, clean, and smooth metal beds for hauling asphalt mixture. Thinly coat the beds with an approved material to prevent the mix from adhering to the beds. Do not use petroleum derivatives or other coating material that contaminates or alters the characteristics of the mix. Drain the bed before loading. Equip each truck with a canvas cover or other suitable material of sufficient size to protect the mix from the weather and thermal segregation and during hauling on public roads. When necessary to maintain temperature, use insulated truck beds and securely fastened covers. Provide access ports or holes for checking temperature of asphalt mix in the truck.

#### C. Pavers:

Use pavers that are:

1. Self-contained, power-propelled units with adjustable vibratory screeds with full width screw augers, and capable of placing the mix uniformly and in accordance with the drawings and specifications.
2. Do not use diesel or other petroleum products during paving operations as a release agent on any parts that come in contact with the mix.

#### D. Rollers:

The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

The Contractor shall exercise caution when using vibratory rollers so as not to cause damage to buried infrastructure or adjacent infrastructure. Damage to buried or adjacent infrastructure will be the responsibility of the Contractor.

### 3.3 CONSTRUCTION

#### A. Preparation of the Underlying Surface:

Prepare the underlying course prior to placement of pavement. Ensure that the surface to receive the pavement has been approved by the CO, is properly compacted and, when placing pavement over existing pavement or other hard surfaces ensure that the surface is free from dust and debris or other deficiencies that might affect the quality of the final pavement course.

The Contractor shall furnish and set controls necessary to guide the paving equipment.

Prevent damage by construction operations to gutters, catch basins, curbs, concrete structures, pavement surfaces and other facilities adjacent to the work. If damage occurs, repairs shall be made to the satisfaction of the CO at no additional cost to the Government.

#### B. Weather Limitations:

Place hot mix asphalt (HMA) on a dry, unfrozen surface when the air temperature in the shade is above 35 °F and rising.

Place WMA, when proposed and approved, on a dry, unfrozen surface and only when weather conditions allow for proper production, placement, handling and compaction for the specific state approved WMA technology used.

Rain and Surface Conditions: Immediately cease transportation of asphalt mixtures from the plant when rain begins at the project. Do not place asphalt mixtures while rain is falling, or when there is water on the surface. Placing HMA may continue, when the rain has stopped and water has been removed from the tacked surface to the satisfaction of the CO and if the temperature of the asphalt mixture meets the specification requirements.

#### C. Asphalt Mixture Production:

Do not heat asphalt binder above 350°F unless approved by the manufacturer.

Weigh or meter aggregates, additives and asphalt binder material and introduce into the mixer in the proportions specified by the JMF.

Mix the combined materials until the aggregate are uniformly coated with asphalt binder and thoroughly distributed throughout the mixture.

#### D. Tack Coat:

Apply a uniform tack coat of asphalt emulsion to the contact surfaces of manholes, structures, existing pavement edges and surfaces and other abutting surfaces immediately prior to placing new pavement. This includes freshly placed layers of asphalt if one day has elapsed since placement, or if dust or debris has contaminated the fresh surface, or if traffic has been allowed on the surface to be paved.

The Contractor shall apply tack coat in a manner which will prevent traffic from driving on the applied tack coat material.

E. Transportation, Placing and Finishing:

Verify the depth of each layer behind the laydown machine, and make adjustments if the compacted thickness does not meet the specified thickness.

The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 6 inches. The joint in the top layer shall be at the designed centerline of the pavement. Transverse joints in one layer shall be offset by at least two (2) feet from transverse joints in the previous layer.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be placed using hand tools. Luting shall be performed in such a manner as to prevent segregation.

F. Asphalt Pavement Compaction:

1. Furnish rollers of sufficient size, number and type, to support the production rate and meet compaction requirements.

G. Pavement Uniformity and Smoothness:

1. Uniformity and Smoothness: The finished mat and surfaces of the pavement shall be smooth, dense and uniform in appearance, free from irregularities in contour and texture and shall present a smooth-riding surface.

Use a 10-foot (3.05 m) metal straight edge to measure at right angles and parallel to the centerline. Defective areas are deviations between the surface and the bottom of the straightedge in excess of 0.25 inches (6 millimeters), measured between any two contacts of the straightedge, or deviations in excess of 0.25 inches (6 millimeters) measured at the end of the straightedge.

2. Defective Area Correction:

Correct defective areas at no additional cost to the Government. Either grind, mill a minimum of one half the pavement depth and fill with an approved asphalt mix, or cut and remove the pavement and repave with an approved asphalt mix. When correction by any other method is proposed, submit a proposal to the CO for approval.

### 3.4 CONTRACTOR QUALITY CONTROL

A. Description:

The provisions of FAR Clause 52.246-12 Inspection of Construction shall apply

B. Quality Control Inspection:

The Contractor shall perform QC inspection of all work required by this contract

C. Quality Control Documentation and Reporting:

Document all QC inspection, sampling and testing activities on Inspectors Daily Report (IDR) forms and/or Test Report Forms (TRF), as appropriate. Deliver to the CO within one working day of those activities occurring.

3.5 ACCEPTANCE

- A. The CO will monitor the adequacy of the Contractor's QC activities during production and placement and may perform inspection, sampling and testing to verify conformance with contract requirements.
- B. The Contractor shall sample and test the mix for all properties at a minimum frequency of one test per production day. In addition, the Contractor will test the compacted pavement for density at a minimum frequency of one test per 300 tons. Deliver the results of the mix properties and compaction tests to the CO.
- C. The mix and constructed pavement will be accepted by visual inspection, verifying conformance to contract requirements and industry standards for workmanship and materials. In addition, it will be accepted by testing as described herein. At the sole discretion of the CO the Contractor's QC tests may be used for the purposes of acceptance.

END OF SECTION

## SECTION 32 14 16 – BRICK PAVER SIDEWALK

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Placement of Brick Paver Sidewalks.

#### 1.2 REFERENCES

- A. ASTM International (ASTM):

1. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
2. ASTM C902 - Standard Specification for Pedestrian and Light Traffic Paving Brick.

#### 1.3 SUBMITTALS

- A. Product Data:

1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.

- B. Verification Samples: Two representative units of each type, size, pattern and color.

- C. Shop Drawings: Include details of materials, construction and finish. Include relationship with adjacent construction.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.

- B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

- C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

- B. Protect from damage due to weather, excessive temperature, and construction operations.

#### 1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

## 1.7 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. 4,000 PSI Concrete
- B. AASHTO No. 57 Clean Stone
- C. Sand – clean, washed sand, free from silt and clay, ASTM C144-93
- D. Brick pavers – Provide 4"x8", beveled edge pavers that match the pavers used on Steinwehr Avenue sidewalks and have them approved by the NPS. Broken, chipped, cracked, warped or underburned pavers will be rejected. Color to be approved by the NPS.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. Excavate as required and form the foundation parallel with the finished surface of the sidewalk. Remove unsuitable material. Thoroughly compact the foundation, finish to a firm even surface, moisten if required.

### 3.3 INSTALLATION

- A. Placing aggregate bed – spread aggregate on the prepared foundation to form a thoroughly compacted bed 4 inches deep.
- B. Forms – Use acceptable wood or metal forms that extend the full depth of concrete.
- C. Concrete – Place concrete 4 inches deep. Strike to grade. Form outside edges and joints with ¼ inch radius edging tool. Provide control or construction joints at a maximum of 5' on center, approximately 1/8" wide and at least 1" deep. Provide expansion joints every 20'.
- D. Install edge restraints. Edge restraints may be steel, PVC, rock or another material designed to restrain concrete pavers. Wood edge restraints will not be acceptable.
- E. Place a 1" minimum thickness of sand over the concrete base to accept the brick pavers.
- F. Set bricks using tight joints (joints shall be no more than 3/16" wide). Brush fill all joints with polymeric sand. All brick paver cuts must be neat and without damaged edges.

- G. Check surface with a 10-foot straightedge. Correct deviances greater than 1/8"
- H. All Brick surfaces shall have positive drainage towards storm water collection systems and slope away from buildings.

#### 3.4 CLEANING AND PROTECTION

- A. Do not remove side forms until at least 12 hours after placing concrete. After removal of forms, fill minor honeycombed areas with mortar. As directed remove and replace defective major honeycombed areas.
- B. After concrete has cured for at least 72 hours backfill spaces adjacent to sidewalk with acceptable material.
- C. Clean dirt and mortar stains from brick with fiber brushes and water or other approved method. Wire brushed and solutions that might cause discoloration will not be permitted.
- D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION



## SECTION 32 17 23 - PAVEMENT MARKINGS

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. This work includes surface preparation and application of traffic lines, markers or legends on roadway surfaces. Additionally, it includes the removal of any conflicting pavement markings.

#### 1.02 QUALITY ASSURANCE

- A. All work under this section shall be done in accordance with the Pennsylvania Department of Transportation Specifications, Publication 408, latest edition. Where reference is made to a specific part of the PennDOT Specifications, such applicable part shall be considered as part of this section of the Specifications. In case of a conflict in the requirements of the PennDOT Specifications and the requirements stated herein, the more stringent requirement shall prevail. Only PennDOT Standards and Specifications relating to construction and materials will be used. All Publication 408 references relating to measurement and payment are hereby excluded from this Specification.

#### 1.03 SUBMITTALS

- A. Letter of certification from the manufacturer stating that traffic line marking materials meet PennDOT's specifications. This letter shall accompany the delivery of the material and be given to the CONTRACTING OFFICER prior to the installation of pavement markings.
- B. Submit Information to the CONTRACTING OFFICER indicating Application method, material and manufacturer's required mixing instruction and surface preparation details.

#### 1.04 JOB CONDITIONS

- A. Control of Traffic:
  - 1. Employ traffic control measures in accordance with Publication 213, Work Zone Traffic Control Guidelines.
- B. Temperature and Weather Restrictions:
  - 1. Cold plastic markers or legends shall be applied only when the surface temperature is 60 degrees Fahrenheit or higher unless otherwise directed by the CONTRACTING OFFICER.
- C. Protection of Markings:
  - 1. Protect markings during and after application using barrier cones or other devices to keep traffic off newly applied markings until track free.
- D. Environmental Requirements:
  - 1. Adhere to manufacturer's data on air and surface temperature limits and relative humidity during application and curing of coatings. Schedule coating work to avoid dust and airborne contaminants.

E. Material Storage:

1. If paint is stored for more than two (2) months, invert containers several days prior to use.
2. All products shall be protected from weather and freezing.
3. Store glass bead in a cool, dry place.

## PART 2 PRODUCTS

### 2.01 METHYL METHACRYLATE MARKINGS (MMA)

- A. A durable, cold applied, 2 component material composed of resins in reactive monomers, pigment, plasticizer, fillers and/or glass beads and is to be reacted just prior to application with benzoyl-peroxide catalyst. It shall be suitable for use as a roadway intersection, commercial or private delineation markings on asphaltic or Portland cement surfaces.
- B. Color shall be as required by project (white and/or yellow)
- C. MMA shall be lead free and cure to a minimum 99% solids when reacted as per the manufacturer's instructions. All mixed material shall cure to a no track condition within 15 minutes of application at min. 40 mils wet at 77°F.
- D. Applied markings shall not deteriorate due to ultraviolet light, water, oil, pavement oil, salt or adverse weather conditions.
- E. Material shall be capable of conforming to pavement contours, breaks and faults through action of traffic at normal pavement temperatures.

### 2.02 GLASS SPHERES

- A. Glass spheres shall meet the requirements of Publication 408, Section 1103.14(a)2. and all current supplements.
- A. Glass beads shall be in units of 50 lbs. and packed in moisture-proof bags. The beads shall be stored in a cool dry place.

## PART 3 EXECUTION

### 3.01 SURFACE PREPARATION

- A. Clean the surface of the roadway before application of traffic lines or pavement markings to provide a clean, dry roadway surface which is free of loose dirt and other debris, to the satisfaction of the ENGINEER.

### 3.02 APPLICATION OF METHYL METHACRYLATE MARKINGS

- A. Apply MMA markings using one method chosen from the three listed below, depending on project type and size:

Extrude using trowel, drag box, push cart or shoe. (applicable for all types of markings) Recommended film thickness is 90 mils, drop on glass rate of 10 lbs. /100 sq. ft.

Stencil spray using spray applicator (for all types of markings). Recommended film thickness for transverse markings and symbols is 90 mils; 60 mils for longitudinal markings.

Truck spray using driven vehicle and paint guns to apply longitudinal lines. Recommended film thickness is 40 mils with a double drop of glass beads.

END OF SECTION

K:\457230300\Contract Administration\Specs\DESIGN DEVELOPMENT SPECIFICATIONS\SECTION 32 17 23 - PAVEMENT MARKINGS.doc

## SECTION 32 92 19 - FINISH GRADING AND SEEDING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. This work includes placing topsoil, finish grading, seeding, mulching and maintenance.

#### 1.2 QUALITY ASSURANCE

##### A. Reference Standards:

- 1. American Association of State Highway Transportation Officials (AASHTO):

- T194 Determination of Organic Matter in Soils by Wet Combustion

- 2. Pennsylvania Department of Agriculture

- 3. Others:

- Agricultural Liming Materials Act of 1978, P.L.15

- Pennsylvania Seed Act of 1965, Act 187, as amended

- Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258 No. 86 (3P.S. 68.2) as amended

- Rules for Testing Seeds of the Association of Official Seed Analysts

- Federal and State pesticide acts and registration requirements

#### 1.3 SUBMITTALS

##### A. Certificates:

- 1. Unless directed otherwise, prior to use or placement of material, submit certifications to the CONTRACTING OFFICER of material composition of the following for approval:

- a. Topsoil
  - b. Seed mixtures

### PART 2 PRODUCTS

#### 2.1 TOPSOIL

- A. Fertile friable loam, sand loam, or clay loam which will hold a ball when squeezed with the hand, but which will crumble shortly after being released.

- B. Free of clods, grass, roots, or other debris harmful to plant growth.

- C. Free of pests, pest larvae, and matter toxic to plants.

- D. Topsoil should be acquired from a source area without infestations of state or federal noxious weeds or species of invasive weeds not yet known in the park.

## 2.2 SEED

- A. Deliver seed fully tagged and in separate packages according to species or seed mix. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.
- B. Fresh, clean, dated material from the last available crop and within the date period specified, with a date of test not more than 9 months prior to the date of sowing. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance. All seeds will be subject to analysis and testing.

## 2.3 SEED MIXTURES

- A. Use American Eagle seed mix from American Seed Company, Inc. Porters Sideling, PA or equal as approved by the Park.

## 2.4 MULCHING MATERIALS

- A. Mulching materials shall be wood fiber mulch.
- B. Mulch control netting will not be needed.

# PART 3 EXECUTION

## 3.1 TIME OF OPERATIONS

- A. Spring Seeding:
  - 1. Preliminary operations for seed bed preparation may commence as soon after February 15 as ground conditions permit.
- B. Fall Seeding:
  - 1. Preliminary operations for seed bed preparation may commence after July 15.

## 3.2 FINISH GRADING

- A. Preparation of Subgrade:
  - 1. "Hard pan" or heavy shale:
    - a. Plow to a minimum depth of 6".
    - b. Loosen and grade by harrowing, discing, or dragging.
    - c. Hand rake subgrade. Remove rocks over 2" in diameter and other debris.
  - 2. Loose loam, sandy loam, or light clay:
    - a. Loosen and grade by harrowing, discing, or dragging.
    - b. Hand rake subgrade. Remove rocks over 2" in diameter and other debris.

B. Placing Topsoil:

1. Place topsoil and spread over the prepared subgrade to obtain the required depth and grade elevation. Compact with a roller having not more than 65 pounds per roller foot width to a final compacted thickness of not less than 4".
2. Hand rake topsoil and remove all materials unsuitable or harmful to plant growth.
3. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry.
4. Do not handle topsoil when frozen or muddy.

C. Tillage:

1. After seed bed areas have been brought to proper compacted elevation, thoroughly loosen to a minimum depth of 4" by discing, harrowing, or other approved methods. Do not work topsoiled areas when frozen or excessively wet.

D. Finish Grading:

1. Remove unsuitable material larger than ½" in any dimension.
2. Uniformly grade surface to the required contours without the formation of water pockets.
3. Rework areas which puddle by the addition of topsoil and starter fertilizer and rake.

3.3 SEEDING

- A. Uniformly sow specified seed mix at a rate of 100 pounds per 1 acre for the sun and partial shade mix, as well as the shade mix. The erosion control mix shall be sown at a specified rate of 50 pounds per acre. Use an approved hydraulic seeder, power-drawn drill, power-operated seeder, or hand-operated seeder. Do not seed when winds are over 5 mph. All equipment to be used in seeding or mulching will be thoroughly cleaned to remove all seed, soil, vegetation and other debris before the equipment is brought into the park. Seeders will be inspected by the park before the start of operations. Hydroseeding should incorporate a wood cellulose or wood/paper mix mulch product and an organic based tackifier.
- B. Upon completion of sowing, cover seed to an average depth of 1/4" by hand raking or approved mechanical methods.
- C. Mulch immediately after seeding and compacting, by applying wood cellulose fiber hydraulically at a rate of 320 pounds per 1,000 square yards. Incorporate as an integral part of the slurry after seed and soil supplements have been thoroughly mixed.
- D. When mulch is applied to grass areas by blowing equipment, the use of cutters in the equipment will be permitted to the extent that a minimum of 95% the mulch is 6" or more in length. For cut mulches applied by the blowing method, achieve a loose depth in place of not less than 2".

3.4 MAINTENANCE

- A. Maintenance includes watering, weeding, cleanup, edging and repair of depressions, washouts or gullies.

- B. Those areas which do not show a prompt catch of grass within 14 days of seeding shall be reseeded until grass has achieved 70% cover.

END SECTION

## SECTION 33 12 13 - WATER SERVICE CONNECTIONS

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. The work of this section includes, but is not limited to:
1. Tapping water mains by installation of corporation stops or other suitable fittings or couplings, up to and including 2" diameter.
  2. Connection of service pipe and fittings up to curb stops and meter boxes.
  3. Installation of meter setting equipment.
- B. Related work specified elsewhere:
1. Trenching, backfilling and compacting: Section 31 23 33
  2. Water mains: Section 33 11 13
  3. Testing & Disinfecting Water Mains Section 33 13 00

C. Definitions: NONE

#### 1.02 QUALITY ASSURANCE

- A. Reference Standards:
1. American Society for Testing and Materials (ASTM):
    - B62 Specification for Composition Bronze or Ounce Metal Castings
    - B88 Specification for Seamless Copper Water Tube
    - C62 Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
  2. American Water Works Association (AWWA):
    - C700 Cold Water Meters - Displacement Type, Bronze Main Case
    - C800 Underground Service Line Valves and Fittings

#### 1.03 SUBMITTALS

- A. Certificates:
1. Submit two copies each of certificate for pipe and pipe fittings from each manufacturer attesting that each of these meets or exceeds specification requirements.
- B. Manufacturers' Literature:
2. Submit two copies each of manufacturers' catalog for each size and type of corporation stop, curb stop, curb box, meter setting and pipe, fitting or coupling.



#### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

##### A. Product Delivery:

1. During loading, transporting and unloading of all materials and products, exercise care to prevent any damage.

##### B. Storage:

1. Store all products and materials off the ground and under protective coverings and custody, and in a manner to keep products clean and in good condition until used.

### PART 2 - PRODUCTS

#### 1.01 PIPE OR TUBING AND FITTINGS

##### A. Copper Water Tubing:

1. ASTM B88, Type K, Seamless
2. Matching bronze fittings of flared or compression type

#### 1.02 CORPORATION STOP ASSEMBLY

##### A. Corporation Stops:

1. Brass or Red Brass alloy body conforming to ASTM B62.
2. Inlet end threaded for tapping according to AWWA C800.
3. Outlet end suitable for service pipe specified.

##### B. Service Clamps:

1. Galvanized iron or bronze body.
2. Neoprene, O-ring gasket.
3. Single or double straps with matching hardware.

#### 1.03 CURB STOP ASSEMBLY

##### A. Curb Stops:

1. Brass or Red Brass alloy body conforming to ASTM B62.
2. Plug type valve.
3. Positive pressure sealing.

##### B. Curb Boxes and Covers:

1. Cast iron body, extension type or Buffalo type.
2. Minneapolis or arch pattern base.
3. Lid with inscription 'Water', with pentagon plug, or as approved by Contracting Officer.

#### 1.04 METER SETTING EQUIPMENT

##### A. Meter Setting:

1. Meter yokes, copper or iron.
2. Inlet and outlet horizontal/vertical setting with matching couplings, fittings and stops.

#### 1.05 METERS

##### A. Displacement Type: AWWA C700

#### 1.06 BRICK

##### A. ASTM C62, Grade SW

#### 1.07 UNDERGROUND PIPE MARKERS

- A. Utility Marking Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- B. Tracer Wire: Electronic detection materials for non-conductive piping products.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Establish location of curb stops and boxes or meter pits for each service connection.
- B. Perform trench excavation and associated work as specified in Section 31 23 33.

#### 3.02 TAPPING WATER MAINS

- A. Each connection for different kinds of water mains shall be tapped using suitable materials, equipment and methods in accordance with manufacturer's instructions.
- B. Provide service clamps for asbestos cement and PVC water mains.
- C. Fill ductile iron main 24 hours in advance of tapping (no dry tap). Pretesting of main is recommended before tapping.
- D. Screw corporation stops directly into a tapped and threaded iron main at 10 or 2 o'clock positions on the main's circumference. Locate corporation stops at least 12" apart longitudinally and staggered. Tap into main shall be a minimum of 2' from the center of bell.
- E. In case of plastic pipe water mains, provide full support for the service clamp all around the circumference of the pipe, with minimum 2" width of bearing area. Exercise care against crushing or other damage to water mains at the time of tapping or installing the service clamp or corporation stop.
- F. Use proper seals or other devices to ensure that no leaks are left in the water mains at the points of tapping. Do not backfill and cover the service connection until observed by the Contracting Officer.

G. Top taps shall be removed and replaced with taped brass plug.

### 3.03 SERVICE LINE AND FITTINGS

- A. Use bends to connect the service pipe or tubing to the tapping fitting or corporation stops to provide flexibility to counteract the effects of settlement or expansion/contraction in the line.
- B. Lay each section of the service line in a manner to form a tight joint with the adjoining section. Avoid offsets, kinks or awkward bends to ensure a smooth flow line. Provide bedding as detailed on the Contract Drawings. Limestone based masonry sand is not permitted.
- C. Clean and inspect each pipe and part of the fitting before installing and assemble to provide a flexible joint.
- D. Install service fittings and appurtenances on suitable brick or concrete supports, as shown on the Contract Drawings. Do not use earth, rocks, wood or other organic materials as supports.
- E. Operate each corporation and curb stop before and after installation.
- F. When the work is not in progress, and at the end of each work day, securely plug the ends of pipe and fittings to prevent any dirt or foreign substances from entering the lines.
- G. Backfill in accordance with Section 31 23 33.

### 3.04 SURFACE RESTORATION

- A. Restore unpaved areas in accordance with Section 31 23 33.
- B. Restore other areas in accordance with the Contract Drawings.

END OF SECTION

## SECTION 33 41 00 - STORM DRAIN PIPE

### PART 1 GENERAL

#### 1.01 DESCRIPTION

- A. This work includes storm sewer pipelines.

#### 1.02 QUALITY ASSURANCE

##### A. Reference Standards:

1. Pennsylvania Department of Transportation (PennDOT), latest revision:

Publication 408, Specifications

Publication 72M, Standards for Roadway Construction

2. American Society for Testing and Materials (ASTM):

D2241 Specification for Poly (Vinyl Chloride)(PVC) Pressure Rated Pipe (SDR series)

D2321 Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.

F405 Specification for Corrugated Polyethylene (PE) Tubing and Fittings

F667 Specification for Large Diameter Corrugated Polyethylene Tubing and Fittings

3. American Association of State Highway Transportation Officials (AASHTO):

M252 Corrugated Polyethylene Drainage Tubing

M278 Class PS50 Polyvinyl Chloride (PVC) Pipe

M294 (and MP6-95) Corrugated Polyethylene Pipe, 12" to 36" Diameter

#### 1.03 SUBMITTALS

##### A. Certificates:

1. Submit to the CONTRACTING OFFICER two copies of manufacturer's certification attesting that the pipe, fittings, and joints meet or exceed specification requirements.

##### B. Manufacturer's Literature:

1. Submit to the CONTRACTING OFFICER two copies of the manufacturer's recommendations on installation, handling, and storage of materials.

#### 1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. During loading, transporting, and unloading, exercise care to prevent damage to materials.
- B. Do not drop pipe or fittings. Avoid shock or damage at all times.
- C. Do not place materials on private property without written permission from the property owner.

## PART 2 PRODUCTS

### 2.01 CORRUGATED POLYETHYLENE PIPE

- A. Tubing and Fittings - 3" to 6"
  - 1. AASHTO M252
  - 2. ASTM F405
- B. Pipe and Fittings - 12" to 48"
  - 1. Integrally formed smooth interior.
  - 2. AASHTO M294 and MP6-95
  - 3. ASTM F667
- C. Pavement Base Drains - 4", 6"
  - 1. AASHTO M304

### 2.02 POLY (VINYL CHLORIDE) PIPE 3" TO 6"

- A. Pipe and Fittings
  - 1. AASHTO M278
  - 2. ASTM D3034

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Perform trench excavation and associated work as specified in Section 31 23 33.
- B. Provide pipe bedding as specified on the Drawings.

### 3.02 LAYING PIPE IN TRENCHES

- A. Give ample notice to the CONTRACTING OFFICER in advance of pipe laying operations, minimum twenty-four hours.
- B. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.
- C. Lay pipe proceeding upgrade with the bell or groove pointing upstream.
- D. Lay pipe to a true uniform grade with the barrel of the pipe resting solidly in bedding material throughout its length. Excavate recesses in bedding material to accommodate joints, fittings and appurtenances. Do not subject pipe to a blow or shock to achieve solid bearing or grade.

- E. Lay each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.
- F. Clean and inspect each pipe and fitting before joining. Align pipe with previously laid sections. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement. Assemble joints in accordance with the pipe manufacturer's instructions.
- G. Check each pipe installed as to line and grade in place. Correct deviation from line and grade immediately. A deviation from the designed line or grade as shown on the Contract Drawings will be cause for rejection.
- H. Place and compact sufficient backfill to hold each section of pipe firmly in place as the pipe is laid.

### 3.03 BACKFILLING TRENCHES

- A. Backfill pipeline trenches only after examination of pipe by the CONTRACTING OFFICER.
- B. Backfill and compact trenches as specified in Section 31 23 33, Paragraph 3.07.

### 3.04 SURFACE RESTORATION

- A. Restore unpaved areas in accordance with Section 31 23 33, Paragraph 3.10.
- B. Restore other areas in accordance with the Contract Drawings.

END OF SECTION

## SECTION 33 44 00 - STORM INLETS, CATCH BASINS, ENDWALLS

### PART 1 GENERAL

#### 1.01 DESCRIPTION

- A. This section includes storm drainage inlets, storm drainage catch basins, and endwalls..

#### 1.02 RELATED WORK

- A. All work under this section shall be done in accordance with the Pennsylvania Department of Transportation Specifications, Publication 408, latest edition. Where reference is made to a specific part of the PennDOT Specifications, such applicable part shall be considered as part of this section of the Specifications. In case of a conflict in the requirements of the PennDOT Specifications and the requirements stated herein, the more stringent requirement shall prevail. Only PennDOT Standards and Specifications relating to construction and materials will be used. All Publication 408 references relating to measurement and payment are hereby excluded from this Specification.

#### 1.03 SUBMITTALS

##### A. Certificates:

- 1. Submit certification from material suppliers attesting that materials provided meet or exceed specification requirements.

##### B. Shop Drawings:

- 1. Submit detailed Shop Drawings, including reinforcing steel details.

- C. Submit concrete mix designs, certified results of compressive strength tests, certified field tests and copies of batch slips for all cast-in-place inlets, catch basins or endwalls.

#### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

##### A. Precast Concrete Units:

- 1. After fabrication and curing, transport the units to the job site. Protect until required for installation.
- 2. Handle to avoid damage to surfaces, edges and corners and to avoid creation of stresses within the units.

##### B. Inspections

- 1. Inspection by the CONTRACTING OFFICER will, at a minimum, be made of materials upon delivery to the job site; of the subgrade, prior to construction or placement; and of the completed structure, prior to backfill.

2. Precast cement concrete products shall be subject to rejection for failure to conform with these specifications or if any one of the following conditions is noted:
  - a. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
  - b. Defects that indicate incorrect proportioning, mixing, and molding.
  - c. Surface defects larger than ½" diameter indicating honey-combed or open texture.
  - d. Damaged or cracked ends, where such damage would prevent making a satisfactory joint.

## PART 2 PRODUCTS

### 2.01 MATERIALS

#### A. Crushed Stone Subbase:

1. AASHTO No. 57, Type C, Crushed Stone or Gravel aggregate, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.

#### B. Brick: ASTM C32 Grade SS, solid.

#### C. Masonry Mortar: ASTM C270, Type S.

#### D. Malleable Iron Castings: ASTM A47, Grade 35018, Domestic.

#### E. Ductile Iron Castings: ASTM A536, Grade 60-40-18, Domestic.

#### F. Structural Grade Carbon Steel: ASTM A36.

#### G. Cast-in-Place Cement Concrete: Section 03050.

#### H. Cast Gray Iron Castings: ASTM A48.

### 2.02 FABRICATIONS

#### A. Precast Cement Concrete Units:

1. Comply with the requirements of Section 714, Publication 408 Specifications. Concrete shall be Class AA, unless otherwise specified.
2. All reinforcing shall comply with the requirements of Publication 72M.
3. 6' inlets shall be similar in all respects to standard inlets except that the longitudinal dimension shall be increased by 24".
4. Modified boxes (PennDOT Type 1, 2 or 3, Modified Type I or Modified Type II) shall have reinforced cover adjustment slabs in accordance with Details in Publication 72M.



B. Pipe Culvert End Sections:

1. Concrete or Metal - Comply with the requirements of, Publication 72M, RC-33.
2. Polyethylene end sections shall have smooth interior and be anchored at the flared end.

C. Inlet Grates:

1. Comply with the requirements of Publication 72M, RC-34 PennDOT approved diagonal or bicycle safe grates.
2. 6' inlet grates shall be similar in all respects to standard inlet grates except that the longitudinal dimension shall be increased by 24".
3. Inlet grates in traffic areas shall be capable of handling HS-25 loading.
4. Welded structural steel grates and frames shall be coated with bituminous paint. All iron castings shall be furnished unpainted.

D. Precast Cement Concrete Grade Adjustment Risers: Risers shall be cast from 4,000 psi concrete (28-day compressive strength), shall be a maximum of 2" thick, and shall be reinforced in accordance with ASTM A478.

E. Outlet Structures

1. Precast concrete or cast-in-place concrete in accordance with Paragraph A.
2. Construct outlet structures to dimensions shown on Contract Drawings.

PART 3 EXECUTION

3.01 EXCAVATION

- A. Excavate as specified in Section 31 23 33, Paragraph 3.01.
- B. Excavate at location marked in the field.
- C. Excavate to the required depth and grade for the bottom of the unit plus that excavation necessary for placement of base material.

3.02 CONSTRUCTION

- A. Construct inlets and catch basins of either precast cement concrete sections or of cast-in-place cement concrete, and of the type indicated on the Contract Drawings.
  1. Place precast units on a minimum 12" compacted crushed stone base.
  2. Construct cast-in-place units on undisturbed earth.
  3. Shape bottom of inlet boxes to channel flow of water to the outlet pipe and to prevent water from standing in box.

4. Unless units are cast-in-place, use precast cement concrete grade adjustment risers or brick to adjust to grade. Mortar in place.
  5. Place bicycle safe grates in all paved (present or future) areas.
- B. Construct endwalls to the dimensions and design indicated on Standard Drawing RC-31, Publication 72M, and of the type shown on the Contract Drawings. Construct endwalls of monolithically cast reinforced concrete.
  - C. Do not permit pipes to project more than 2" into inlets. Do not expose end of pipe through faces of endwalls.
  - D. Where indicated on the Contract Drawings, provide pipe culvert end sections of the design and dimensions of Standard Drawing RC-33, Publication 72M.
  - E. Install polyethylene end sections in accordance with manufacturer's instructions, bedded and anchored as required.
  - F. Construct basin outlet structures with inverts, grates and openings at the required elevations shown on the Contract Drawings. Connect to new or existing outlet pipes, relaying or adding pipe as needed to meet the structure.

### 3.03 BACKFILLING

- A. Backfill structures only after inspection by the Contracting Officer.
- B. Perform backfilling and compaction as specified in Section 31 23 33, Paragraph 3.07.

### 3.04 DISPOSAL OF EXCAVATED MATERIAL

- A. Excavated material remaining after completion of backfilling shall remain the property of the CONTRACTOR, removed from the construction area, and legally disposed of.

### 3.05 RESTORATION OF SURFACE AREAS

- A. Restore paved areas in accordance with the Contract Drawings
- B. Restore unpaved surfaces as specified in Section 31 23 33, Paragraph 3.10.

END OF SECTION