REHABILITATE KAWUNEECHE VISITOR CENTER

ROCKY MOUNTAIN NATIONAL PARK, CO

PMIS NO. 326235

PROJECT SPECIFICATIONS

NATIONAL PARK SERVICE

FINAL CONSTRUCTION DOCUMENTS

JANUARY 16, 2026

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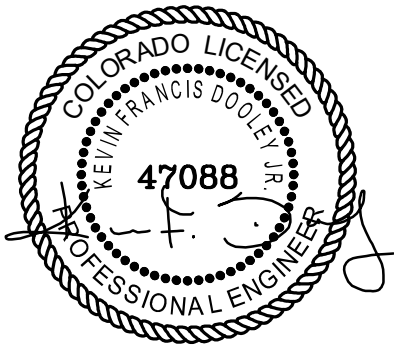
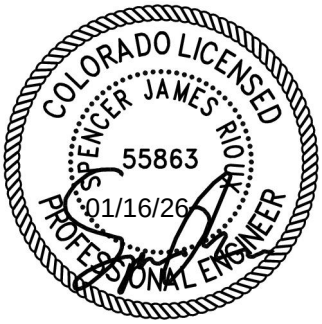
Civil Engineer Divisions 31-33 01 57 23 02 41 13 05 52 13 12 93 13 	**Structural** 03 30 00 05 12 00 06 10 00 06 16 00
Architect Divisions 4, 7-9, 10, 12 (except 10 81 19) 02 41 91 02 50 10 06 03 12 06 20 13 06 40 23 06 64 00 	**Mechanical and Plumbing Engineer** Divisions 22-23 
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SECTION 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. Work phases.
3. Work under other contracts.
4. Government Furnished Materials.
5. Contractor use of site.
6. Public use of site.
7. Government's Occupancy Requirements.
8. Work Restrictions.
9. Protection of Existing Vegetation, Structures, Equipment, Utilities and Improvements
10. Special Construction Requirements.
11. Additional Compliance Requirements.
12. References.
13. Additional Reports.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Location: Rocky Mountain National Park, Grand Lake, Colorado.

B. The Work consists of the following:

1. Base Contract: The approximately 5,000 SF slab on grade wood-framed historic Kawuneeche Visitor Center (KVC) shall be rehabilitated with new electrical, plumbing, telecommunications, ventilation and climate control systems, fire suppression, and fire alarm system. This building is eligible for listing on the National Register of Historic Places as an example of the Mission 66 historic architecture. The Secretary of the Interior Standards for the Treatment of Historic Properties has been integrated into the design and has been approved through compliance reviews. The building consists of three "nodes", connected by both internal and external walkways. Node 1 is the Administrative Wing (Admin. Wing) and houses offices and support spaces for park operations. Connected by an interior walkway is Node 2 - the Visitor Center - where exhibits, merchandising, and an auditorium are located. Node 3 – the Comfort Station - is connected via an exterior walkway and consists of a women's restroom, men's restroom, and utility/mechanical space.

   Node 1: Building envelope at the Administrative Wing shall be improved with added insulation in the exterior walls and installation of new aluminum thermally-broken double-paned sliding windows to match the profile of the historic steel windows (Refer to Section 01 27 00 – Definition of Contract Line Items for option to replace windows with custom steel in lieu of aluminum). Ceiling finishes shall be removed for running of new systems,

and new ceiling insulation shall be installed to meet code requirements. Office spaces shall be slightly altered with select new walls and doors. Existing staff restrooms shall be reconfigured and updated, and a new kitchenette shall be added in the break room to improve building accessibility. New interior finishes shall be installed throughout. Wood surfaces shall be repainted or refinished, and masonry surfaces cleaned and repointed.

Node 2: The historic, character-defining wood-slat ceiling finish shall be cataloged, removed and salvaged for running of new systems above, and new ceiling insulation shall be installed to meet code requirements. The historic wood ceiling shall be reinstalled and new interior finishes shall be installed throughout. Wood surfaces shall be refinished. UV film product shall be applied to the existing large storefront windows to reduce solar heat gain in the space. An interior partition with glazing, wood framing, and swinging door shall be installed to separate the Exhibit Hall and Wilderness Desk. New conduit is anticipated to run additional utilities across the space below the existing concrete floor. Custom exhibit installation by others is to be coordinated with this project.

Node 3 – Both restrooms of the Comfort Station will receive new plumbing fixtures and interior finishes and accessories to comply with ABAAS. The existing gable roof shall be removed and the historic flat roof restored with EPDM roofing and tapered insulation.

Exterior improvements include select regrading for ABAAS compliance, parking lot repaving to accommodate utility improvements and parking accommodations, and improvements to site gathering/seating areas/wayfinding. Restoration of exterior components of the building includes paint refinishing and masonry cleaning. Historic pole light fixtures shall be rehabilitated and altered to comply with Dark Sky requirements.

Full antifreeze fire suppression, fire alarm, electrical and data upgrades shall be provided throughout the building. New cooling equipment will be installed for dedicated server room only.

Base bid also includes provisions for the temporary relocation of building occupants, including trailer and furniture rental, two container rentals, installation of temporary utilities, and the actual packing and moving of furniture out of the building and then back into the building at the close of the project and unpacking. Select office furniture will be utilized in temporary facilities for NPS use during construction.

Temporary facilities shall be provided by the Contractor which include Visitor Contact trailer for merchandising, select exhibits, and reservation desk, and office trailers for NPS staff with restrooms. Visitor Contact trailer will be located in the Harbison Meadows Picnic Site parking lot where indicated on Drawings and will include one portable toilet and 10’x10’ storage shed. Office trailers will be located across Trail Ridge Road to the east where indicated on Drawings. Furnishing of temporary trailers shall be provided by Contractor as outlined in Section 02 50 10 – Employee Office Relocation.

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

1.3 WORK PHASES

A. The Work shall be conducted in one phase though sequencing of temporary facilities will be required.

1.4 WORK UNDER OTHER CONTRACTS

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

B. Concurrent Work: Government will award separate contract(s) for the following construction operations at Project site. Those operations shall be conducted simultaneously with work under this Contract.

1. Interpretive Media Fabrication and Installation: A separate contract will be awarded for fabrication and installation of the exhibit design as detailed in September 2023 design package. Close coordination of power, data, and attachments to historic building material between projects shall be required. Refer to Appendix for exhibit design drawings (not in contract).

1.5 GOVERNMENT-FURNISHED MATERIALS

A. Delivery and Storage

1. Government will arrange and pay for delivery of Government-furnished items according to Contractor's Construction Schedule.
2. After delivery, Government will inspect delivered items for damage. Contractor shall be present for and assist in Government's inspection.
3. If Government-furnished items are damaged, defective, or missing, Government will arrange for replacement.
4. Contractor is responsible for receiving, unloading, and handling Government-furnished items at Project site.
5. Contractor is responsible for protecting Government-furnished items from damage during storage and handling, including damage from exposure to the elements.
6. If Government-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
7. Contractor shall install and otherwise incorporate Government-furnished items into the Work.

B. Government-Furnished Products:

1. Server and server racks for installation by Contractor in coordination with Contracting Officer to ensure no lag time between switching of server locations from temporary to final.

2. Seed for revegetation and regrowth at the construction site as well as Harbison Meadows and temporary staff trailer locations.

3. Plant stock for revegetation and regrowth at the construction site as well as Harbison Meadows and temporary staff trailer locations.

4. Appliances and FFE to be installed by Government after Substantial Completion.

5. Log benches for installation by Contractor.

1.6 CONTRACTOR USE OF SITE

A. General: Contractor shall have limited use of the site for construction operations. Limit use of premises to areas within the limits indicated on drawings. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits of disturbance to be clearly marked visually by the contractor. Markings shall be painted, wooden survey stakes at least 2 ft visible above grade on an interval of 20 feet with stakes at each corner or as needed to clearly delineate the limits. Limit markings to be approved by the Contracting Officer prior to start of work. Requests for approvals by Contracting Officer is required 7 days prior to work. Contractor to remove stakes at substantial completion.
2. Limit site disturbance, including earthwork and clearing of vegetation, as shown on drawings. Notify Contracting Officer if conflicts or discrepancies exist.
3. To minimize impact to the park's natural and cultural environment, use lowest impact methodologies for trench excavation.
4. To the extent possible, equipment shall be kept on hardened surfaces.

B. Staging Areas and Storage of Materials:

1. Confine storage of materials to staging area indicated on drawings and approved by Contracting Officer.
2. Locate staging and stockpiling areas in previously disturbed areas to the extent possible and as approved by Contracting Officer. Return all staging and stockpiling areas to pre-construction conditions following construction.
3. When possible, place soils on asphalt, paved areas, planks or tarps to reduce ground and vegetation disturbance.

C. 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.

D. Construction Camp: Establishment of a camp within the park will not be permitted.

E. Construction Trailer: Establishment of a construction trailer will be permitted where indicated on drawings. Provide utilities as specified in Division 1 Section "Temporary Facilities and Controls". Keep trailer area neat and clean and return site to previous condition at completion of work.

F. Construction Equipment:

1. Construction Equipment shall not be stored along open roadways overnight, without prior approval of the Contracting Officer.
2. Construction equipment shall not be permitted to idle for long periods of time.

G. Hauling Restrictions: Comply with all NPS and DOT 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 Chief of Visitor and Resource Protection. 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.

1.7 PUBLIC USE OF SITE

A. The buildings will be closed to the public during construction.

B. Public access of an existing trail, as indicated on the drawings, shall be maintained throughout construction. When horse traffic is present on the trail, equipment shall be turned off until horses are out of sight.

C. Contractor shall at all times conduct his operations to ensure the least inconvenience to the public. Road closures will be permitted, when required, upon specific approval of Contracting Officer.

D. Harbison Ditch Riders (ditch maintenance crew): The Harbison Ditch runs through the project area. Contractor will assure that NPS and Harbison Ditch owner/operator has access to the ditch at all times.

1.8 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 6 a.m. to 6 p.m., Monday through Friday, except when otherwise indicated.

1. No work shall be performed beyond normal working hours, on weekends or federal holidays without prior approval of the Contracting Officer minimum 48 hours in advance.

B. Existing Utilities: Notify Contracting Officer and utility companies of proposed locations and times for excavation.

1. The utilities shown in the drawings are indicated in accordance with available records. All utilities may not be shown and those which are shown may not be shown accurately. The contractor shall be responsible for field locating all utilities including public utilities and NPS owned utilities to determine exact locations, elevations, and sizes. Contractor shall be responsible for locating and preventing damage to known or marked utilities.
2. Contractor shall be responsible for calling the Colorado 811, (800) 922-1987 a minimum three working days in advance of digging. Contractor may be required to use additional methods for utility locations, such as electromagnetic utility locating, acoustic pipe locating, ground penetrating radar or potholing.

a. Public Utilities include:

1) Primary Power – Mountain Park Electric
2) Gas Lines – Xcel Energy
3) Telephone – Comcast and Vonage
4) Cable/Internet – Comcast, Century Link, Exede, Direct TV, HughesNet.
5) Sewer outside the Park – Three Lakes Water and Sanitation District

b. NPS Utilities include:

1) Water within park boundary
2) Sewer within park boundary
3) Telephone within park boundary
4) Cable within park boundary
5) Fiber Optics within park boundary

3. Damage to Fiber Utilities:
   a. If damage occurs, notify utility owner and repair or coordinate repairs to utility at no additional expense to the Government.

   b. Any severing or damage of the fiber optics cabling shall be repaired by a reputable fiber optics company using the fusion splicing method at the expense of the Contractor. Line test results shall be provided for all damaged fibers once splicing is completed with each fiber having no loss greater than 0.1 Db

4. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

   a. Notify Contracting Officer not less than three days in advance of proposed utility interruptions.
   b. Do not proceed with utility interruptions without Contracting Officer's written permission.
   c. Hours for Utility Shutdowns: 8 hours maximum shutdown.
   d. Contractor shall be responsible for locating and preventing damage to known utilities. If damage occurs, repair utility at no additional expense to the government

C. Nonsmoking Building: Smoking is not permitted within buildings or within 20 feet of entrances, operable windows, or outdoor air intakes. Designated paved areas to be proposed by contractor for CO approval.

D. Fire Restrictions: The contractor shall be responsible for keeping informed and informing all on-site staff regarding current fire restrictions at the park. This may include an outdoor smoking prohibition if fire conditions warrant.

E. Hot Work Permits: Hot work permits are required for any equipment or work that is capable of producing a spark.
   1. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of the National Park Service Authority Having Jurisdiction.
   2. Hot work permits, approved through the Contracting Officer by the park's structural fire coordinator, are required for any hot work. Submittal of permit request is required no less than one week in advance of the work. Do not proceed until notified by the Contracting Officer that the permit has been approved.

1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS

A. As required by FAR Clause 52.236-9:

1. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, the Contracting Officer will provide guidance for repair or restoration.
2. The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site, and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

B. Provide temporary barriers to protect existing trees and plants and root zones.

C. Do not drive under tree crowns or on tree roots.

D. Provide temporary barriers to protect existing cultural features, as identified by the Contracting Officer or their representative. This includes the Harbison Ditch, which will still need to be accessed by the ditch rider.

E. 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.

F. Do not fasten ropes, cables, or guy wires to existing trees.

G. Carefully supervise excavating, grading, filling, and other construction operations near trees to prevent damage.

H. No storage, parking, or excavation shall be allowed within the drip line of protected trees without approval from the Contracting Officer.

1.10 SPECIAL CONSTRUCTION REQUIREMENTS

A. Weed Mitigation

1. All borrow, road base, aggregate, crusher fines, bedding, topsoil, hay bales and other fill materials brought into Rocky Mountain National Park and used in this project shall be certified weed free. Without certification, materials will come from commercial sources that have been approved by the Contracting Officer, prior to materials entering the Park.

2. Equipment Cleaning:

a. Clean vehicles and construction equipment prior to entry into the Park to minimize the potential for introduction and/or proliferation of invasive non-native weeds through project actions. The contractor is required to wash equipment, with

emphasis on undercarriages, with a high-pressure spray prior to transporting such equipment to Rocky Mountain National Park.

b. All vehicles and construction equipment entering Rocky Mountain National Park shall be inspected and approved by the Contracting Officer prior to entering the park.

c. Equipment not deemed clean by the Contracting Officer will not be allowed to enter the park. The contractor remains liable for additional transportation fees incurred when equipment fails inspection.

B. Avoid Soil Compaction

1. Avoid compaction from heavy equipment to surrounding area by keeping equipment inside the limits of disturbance.
2. Compacted soils must be ripped or decompacted post construction to enable vegetation.
3. All disturbances must be returned to grade and any tracks from equipment must be raked out.

C. Bird Protection Acts

1. In order to protect birds under the Migratory Bird Treaty Act (MBTA, 16 U.S.C. 703–712), all construction work performed between February 1 and August 31 requires a site survey, to be performed by a trained park employee. The survey must be completed within two weeks prior to the start of construction. Additional surveys will be required when all activities are not completed within the two-week timeframe from the date of the survey. The Contractor will be required to avoid cutting down trees with active nests, however, other work would be permitted to continue. Some species may also require a buffer around active nests where work cannot occur. Request site survey a minimum of one month prior to work.

2. In order to protect eagles under the Bald and Golden Eagle Protection Act (BGEPA, 16 U.S.C. 668-668c), all construction work requires a site survey, to be performed by a trained park employee. The survey must be completed within two weeks prior to the start of construction. If an active bald eagle or golden eagle nest is found, the Contractor may have to work in areas that are 100 meters or more away from the active nest. If avoiding work in the 100-meter area around the active nest is not possible, the Contractor may be required to postpone work in the area until a repeat survey indicates no impact to nesting eagles. If an active or inactive nest is found, the Contractor will be required to avoid cutting down trees with nests. Request site survey a minimum of one month prior to work.

D. Wildlife

1. Do not feed or disturb wildlife within the Park boundaries. Do not approach or remain within 25 yards of any wildlife.
2. All construction personnel working in the field must follow park food storage regulations, 36 CFR 2.10. All food, garbage, toiletry, or other bear attractants must not be left unattended for any length of time.
   a. These items shall be stored inside vehicle trunks.
   b. In vehicles with no trunk, place these items as low in the vehicle compartment as possible and covered from sight, with all windows and doors closed and locked.
3. On-site construction personnel are required to report all bear and moose sightings in the work area to the CO.

E. Archeological Monitoring

1. The Contractor is required to provide archeological monitoring for all excavation activities, as specified in Section 01 35 13 "Archeological Protection."

F. Work Within Rocky Mountain National Park and Coordination with Park Employees

1. Contractors will coordinate with park staff to reduce disruption to normal park activities.
2. Construction workers and job superintendent will be required to attend park resource orientation session lasting no more than two hours to learn about the special sensitivity of park values, regulations, and appropriate litter and trash control measures. The Contracting Officer or a representative will coordinate orientation session with the NPS Cultural Resource Specialist and NPS Natural Resource Specialist to develop resource awareness. Work schedule, equipment to be used on project and resource protection plan will be discussed. This training session shall occur prior to the start of work and will be repeated for changes of key personnel.
3. The National Park Service will ensure that all contractors and subcontractors are informed of the penalties for illegally collecting artifacts or intentionally damaging archeological and/or natural sites and/or historic properties. Contractors and subcontractors will also be instructed on procedures to follow, in case previously unknown archeological and/or natural resources are uncovered during construction.
4. Trail Ridge Road (US 34) is closed to through travel during the winter. Locations of closures will vary based on weather and road conditions. It is generally closed at the first significant snowfall (usually mid to late October) and reopened through plowing by late May. Check https://www.nps.gov/romo for up to date information.
5. If construction vehicles will be traveling to the project from the east side of the park via Trail Ridge Road, pilot cars are required for tractor trailers from the switchbacks of Trail Ridge Road on the west side to Hidden Valley on the east side. This must be planned in advance with the CO.

G. Blasting is not permitted in this project.

H. Snow management will be required in this project. Contractor shall assume responsibility for snow management within the limits of disturbance unless otherwise agreed upon by the Contracting Officer. Temporary facilities (both Visitor Contact and NPS Offices) will be maintained by NPS.

I. Harbison Ditch Riders

1. Harbison Ditch runs through the project area. Contractor will assure NPS and Harbison Ditch owner/operator has access to the ditch at all times. The ditch routinely overtops in the project area at the grate near the comfort station.

J. Existing FFE

1. Packing, moving, and storage of existing FFE within the building shall be completed by Contractor prior to start of work. Contractor shall coordinate with Contracting Officer regarding furniture to be removed and stored versus removed and disposed of.

K. Server

1. The existing server in Room 110 will remain during construction. Protection of server including dedicated ventilation and dust mitigation are required. Coordination with CO of

installation of new server racks is to be conducted so as to limit downtime when moving existing server to new location.

L. Weather Station
   1. The existing weather station is to be connected to the Visitor Center through new conduit provided by the Contractor. Contractor shall coordinate this work closely with CO and NOAA so as to limit downtime.

M. Exhibit Installation
   1. A separate contract will be awarded for fabrication and installation of the exhibit design as detailed in September 2023 design package. Close coordination of power, data, and attachments to historic building material between projects shall be required. Refer to Appendix for exhibit design drawings (not in contract).

1.11 ADDITIONAL COMPLIANCE REQUIREMENTS

A. The work of this project has been reviewed and approved by the State Historic Preservation Office for compliance with the requirements of Section 106 of the National Historic Preservation Act. To minimize impact to the cultural resources, work shall be performed as specified in Section 01 35 13 "Archeological Protection.", Section 01 35 91 "Historic Preservation Treatment Plan", and applicable specifications within Divisions 2-33.

1.12 REFERENCES

A. Industry Standards.

   1. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
   2. Publication Dates: Comply with standards in effect as of the date of the Contract Documents unless otherwise indicated.

1.13 ADDITIONAL REPORTS

A. Colorado Cultural Resource Survey, Architectural Inventory Form, Determination of Eligibility (See Appendix A)

B. Hazardous Material Survey Report, 2017 has been prepared by Landmark Environmental, Inc. (See Appendix B)

C. Original building as-constructed drawings, dated 1969 provided by the Government (See Appendix D) has been included for reference and contextual understanding only.
   1. The accuracy, completeness, or current applicability of these drawings has not been validated. Conditions depicted may be incomplete, outdated, or inconsistent with existing conditions due to undocumented alterations, deterioration, code-driven modifications, or changes over time.

2. Inclusion of these drawings in the Contract Documents does not constitute a representation or warranty, express or implied, of their accuracy or suitability for construction, pricing, coordination, or code compliance. The Contractor shall not rely exclusively on these drawings and shall verify all existing conditions through field investigation, measurements, and coordination with other Contract Documents prior to construction.
3. Any discrepancies between the historic as-constructed drawings and observed field conditions shall be promptly reported to the CO.

D. A copy of the reports is available to all plan holders within this package.

E. If conflicts occur between the report and drawings or specifications, the drawings and specifications govern.

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. This section consists of administrative and procedural requirements for contract modifications.

1.2 DEFINITIONS AND ALLOWANCES

A. Home Office Overhead: Costs incurred in support of all 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 preparation of modifications will not be allowed. 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 (PM), 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: 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 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: The hourly rate paid directly to the worker
    b. Labor Burden: Employer payments of all applicable burdens include insurance and taxes 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) Federal Unemployment Tax Act (FUTA) - Cap Rate and percentage to be proportionally allocated over one year.
        5) State Unemployment Tax Act (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 Contractor from claims resulting from bodily injury or property damage to a third party. Include as a separate line item within all modification proposals and provide a current insurance quote upon request.

G. Consent of Surety:

1. When any contract is modified, the Contractor shall provide the consent of surety if-

a. An additional bond is obtained from other than the original surety;
b. No additional bond is required and

1) The modification is for new work beyond the scope of the original contract; or
2) The modification does not change the contract scope but changes the contract price (upward or downward) by more than 25 percent or $50,000; or

c. Consent of surety is required for a novation agreement.

2. When a contract for which performance or payment is secured by any of the types of security listed in FAR 28.204 is modified as described in paragraph (a) of this subsection, no consent of surety is required.
3. Agencies shall use Standard Form 1414, Consent of Surety, for all types of contracts.

H. Builder's Risk Insurance: Covers the contractor's loss due to fire, high winds, or other natural forces. 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. Proposal be received in the format and within the time frame specified in the Request for Proposal (RFP) letter. Costs or delays resulting from failure of contractor to submit within the time frame specified will not be compensable.
2. The proposal shall 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 they are included in the hourly rate shown, or the 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 Government's form.
3. Requests for extensions of contract time as a result of change must be justified with a Time Impact Analysis (TIA). Refer to Section 01 32 16 "Construction Schedule", for time impact analysis requirements. TIA and associated costs shall 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 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 (CO) upon request.
5. Contractor shall review and approve all subcontractor/supplier pricing in detail for proper format, scope, production rates, and pricing prior to submission to 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 hours required for each craft directly engaged in modification work. Any work proposed requiring overtime work or premium pay shall be itemized separately. Rates shall be in accordance with the Davis-Bacon Act as incorporated herein. Labor Burden may include payroll taxes, Social Security, unemployment insurance, workers compensation insurance, Federal Insurance Contributions Act (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. Labor cost for foremen shall only be costs for related work required for the modification.

C. Materials:

1. Estimated cost for materials shall include quotes from multiple sources. Material prices shall include 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 NPS.

D. Equipment:

1. The equipment used for the project must be appropriately sized for 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 shall be broken out separately.
3. Regardless of ownership, rates to be used in determining equipment rental costs shall be the lowest cost from one of the following sources:

    a. United States (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. Estimated equipment rates shall include operating costs of all fuel, oil, lubrication, supplies, small tools, necessary attachments, ground engaging components, tires and tracks, routine repairs and maintenance (cost of major repair and overhaul is not allowed per Federal Acquisition Regulation (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 full rate for equipment only for duration that equipment will be utilized to accomplish work of the modification.
6. Standby unit rates used in accordance with paragraph 1.3, D, 2, above. If the U.S. Army Corp of Engineers is utilized, then their standby rates prevail. If Bluebook or local equipment pricing is accepted, then 1/2 of 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, established standby rate shall apply from the first day of the delay.
8. Equipment not used and on the job site for up to five consecutive days may be classified at standby rates, provided the equipment is or has been used solely to perform work on the modification and will be necessary to complete additional modification work. Equipment 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:

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 31which 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……12%
    Profit…… 6%

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, partnership may only receive home office overhead and profit in same amount as an individual Contractor (refer to paragraph 1.3,E,1 above). It is the responsibility of the partners to decide on division of revenue.
4. Combined Increases and Decreases: On proposals involving both increases and decreases in the Contract Price, overhead and profit mark-ups are required on 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 01 26 01

SECTION 01 27 00 – DEFINITION OF CONTRACT LINE ITEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section explains in general, what is and is not included in a contract line item, and limits or cut-off points where one item ends and another begins.

B. If no contract line item exists for a portion of work, include costs in a related item.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF CONTRACT LINE ITEMS

A. Contract Line Item Number 1, Rehab KVC Admin/Auditorium/Comfort Station

1. This item consists of all work associated with rehabilitation of the Admin/Auditorium/Comfort Station:
   a. Restoration of exterior components of the building includes paint refinishing and masonry cleaning. Existing gable roof at Comfort Station to be removed and replaced with a flat roof. Full antifreeze fire suppression, fire alarm, electrical and data upgrades, and new cooling equipment will be provided. Interior plumbing and light fixture replacements, new finishes throughout.
2. Measurement for payment will be by percentage of work completed in the previous month.
3. Payment will be made at the contract lump sum.

B. Contract Line Item Number 2, Site Work

1. This item consists of all work associated with rehabilitation of the Admin/Auditorium/Comfort Station:
   a. Exterior improvements include select regrading for ABAAS compliance, parking lot repaving to accommodate utility improvements and parking accommodations, and improvements to site gathering/seating areas/wayfinding.
2. Measurement for payment will be by percentage of work completed in the previous month.
3. Payment will be made at the contract lump sum.

C. Contract Line Item Number 3 – Temporary Modular Visitor Contact, Temporary Modular Office Trailers, and Furniture Move
1. This item consists of all costs related to the temporary modular facilities including:
   a. Mobilization and De-mobilization of the temporary modular structures including all transportation, equipment, labor, materials, and incidentals necessary to install and remove temporary trailers.

b. All rental fees for the modular structures including all appurtenances and incidentals required for the complete modular offices facilities as specified for the period starting with Phase 1 and ending with Phase 2.
c. Tie-downs engineered for site specific structural loading requirements. Note that trailer #1 must be designed as Risk Category 4.
d. Skirting
e. Metal ABAAS ramp
f. Metal stairs
g. Data hubs
h. Office furnishing and appliances rental fees
i. Kitchenette including insta-hot heater
j. Hitch cover or hitch removal
k. Canopy roof over main entrance door
l. Security camera system for front door
m. Maintenance including winterization and roof snow shoveling as required.

2. This item also consists of all work associated with removing and storing furniture identified by NPS and discarding furniture indicated to be disposed of as well as move-in of furniture from storage after project completion:
   a. Cost includes all temporary protection of building elements to remain during move out and move in.
   b. Include one Connex box for storage of furniture to be retained. NPS will not need access throughout duration of the project.
3. Measurement for payment, mobilization and initial setup costs will be paid per trailer as completed and by percentage of work completed in the previous month
4. Payment will be made at the contract lump sum.

D. Contract Line Item Number 4, Option 1 – Thermally Broken Steel Window Replacement
1. This item consists of all work associated with replacement of Admin Wing windows:
   a. Provide new custom steel windows for window type A1 and A2 in all locations indicated in lieu of aluminum base bid window replacement. Windows shall be thermally broken, double pane with low-e coating. Window operation shall match existing: equally split with slider, including exterior screen. Sash profiles to match existing and approved by C.O. through shop drawings and mock-up.
2. Measurement for payment will be by percentage of work completed in the previous month.
3. Payment will be made at the contract lump sum.

END OF SECTION 01 27 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Definitions
2. Construction Coordination
3. Submittals
4. Coordination Drawings
5. Requests for Information (RFIs)
6. NPS Project Management and Communication Software
7. Project Meetings
8. Environmental Coordination
9. Permits

B. Related Requirements:

1. Section 01 32 16 "Construction Schedule" for preparing and submitting Construction 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 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 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 Construction Contractors to ensure maximum accessibility for required maintenance, service, and repair.

3. Make 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 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 Construction Contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to:

1. Preparation of Construction Contractor 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. Submittals indicated as 'Action Submittals' shall be reviewed by the design team. Submittals indicated as 'Informational Submittals' shall be reviewed by Contracting Officer only.

B. 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 Contract Documents or standard printed data. Include following information, as applicable:

a. Indicate functional and spatial relationships of components of landscape, architectural, structural, civil, mechanical, plumbing, electrical, technology, and fire protection systems.
b. Indicate dimensions shown on 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 Contracting Officer (CO) for resolution of such conflicts.
c. Indicate space requirements for routine maintenance and 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 controls.

e. Indicate required installation sequences.

2. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
   a. Room 115 will require detailed coordination drawings including all trades that may not be explicitly noted in subsequent sections.
3. Follow **NPS DSC Electronic Drawing Standards.** See CAD/BIM (Computer Aided Design/Building Information Modeling) & Drafting Standards page > **DSC Requirements** section.

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural, structural, mechanical, plumbing, fire-protection, fire-alarm, electrical, and technology elements. 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 sub-framing 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:
   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.
7. Electrical Work:
   a. Runs of vertical and horizontal conduit 1-1/4 inches 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:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Contracting Officer will review coordination drawings to confirm Work is being coordinated; details of coordination are Construction Contractor's responsibility. If the Contracting Officer determines coordination drawings are not prepared in scope or detail,

or are otherwise deficient, the Contracting Officer will inform Construction Contractor, who shall make changes and resubmit.

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

D. Coordination Digital Data Files: Prepare coordination digital data files according to:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files using Portable Document Format (PDF) file format.
3. Contracting Officer will furnish Construction Contractor one set of digital data files (AutoCad.dwg) of Drawings for use in preparing coordination digital data files.

    a. Contracting Officer makes no representations as to accuracy or completeness of digital data files as they relate to Drawings.
    b. Digital Data Software Program: Drawings are available in AutoCad.dwg.

E. Division 1 submittals required prior to mobilization:

1. Letter designating Project Superintendent
2. Construction Baseline Schedule
3. A Comprehensive 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. Certificates of Insurance and Standard Form SF1413 for Contactor and all Subcontractors
8. Waste Management Plan
9. Quality Control Plan
10. Temporary Storm Water Pollution Prevention Plan (SWPP)
11. Indoor Air Quality (IAQ) Management Plan
12. Construction Contractor Commissioning Plan
13. Historic Preservation Treatment Plan (HPTP)
14. List of Required Construction Permits. Include the following information for each permit:
    a. Name of Permit
    b. Agency(ies) with Jurisdiction issuing the permit
    c. Information required from the Government to complete permit application

F. Provide items listed to Contracting Officer at least one week prior to Pre-Construction Conference, or as directed by Contracting Officer.

1. Failure to submit items may result in:
    a. Construction conference may be canceled, Notice to Proceed may not be issued, and Contracting Officer will consider other contractual remedies.
    b. Work shall not commence until written Notice to Proceed has been issued and Certificates of Insurance and SF1413 documents are received for Construction Contractor and all Subcontractors.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of Contract Documents, Construction Contractor shall prepare and submit an RFI utilizing form created on NPS project management and communication software.

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

B. Content of RFI: Include 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. Construction Contractor's suggested resolution: If suggested resolution impacts Contract Time or Contract Sum, Construction Contractor shall state impact in RFI.
8. Construction 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 and submit on NPS project management and communication software.

D. Contracting Officer’s Action: Contracting Officer will review each RFI, determine action required, and respond. The Contracting Officer will determine the critical nature of each RFI and issue 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 Construction Contractor's means and methods.
    d. Requests for coordination information already indicated in Contract Documents.
    e. Requests for adjustments in Contract Time or Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Contracting Officer's action may include a request for additional information; time for response will date from time of receipt of additional information.
3. Contracting Officer's action on RFIs may result in need for a change to Contract Time or Contract Sum. All contract changes will be processed according to the terms and conditions of the contract.

1.6 PROJECT MANAGEMENT AND COMMUNICATION SOFTWARE

A. Use to manage project communication and document sharing during contract period on:

1. Project directory
2. Project correspondence
3. Meeting agendas and minutes
4. Contract modifications forms and logs
5. RFI form and processing
6. Task and issue management
7. Photo documentation
8. Baseline schedule, schedule updates and calendar management
9. Submittal form and processing
10. Payment coordination documentation
11. Reminder and tracking functions
12. Archiving functions
13. Notification of submittal and RFI statuses and current responsible party
14. Permits and addendums

B. Some documents are not suitable to be shared using NPS project management and communication software. Documents containing Personal Identifying Information (PII) (i.e. certified payrolls) shall not be shared and shall be coordinated with the project team as appropriate.

1.7 PROJECT MEETINGS

A. Preconstruction Conference: Before the start of construction, the Contracting Officer will arrange an on-site meeting with Construction Contractor. Meeting agenda, developed by the Contracting Officer, will include the following as a minimum:

1. Roles & Responsibilities / Lines of Authority
2. Park rules and regulations
3. Compliance requirements
4. Historic Preservation requirements
5. Temporary facilities requirements (three sites)
6. Public Use of Site – horse traffic on trail
7. Snow removal responsibilities
8. Wildlife Encounters
9. Jobsite Safety
10. Resolution of comments on required Division 1 documents
11. Coordination of Subcontractors
12. Labor law application
13. Modifications
14. Payments to Construction Contractor
15. Payroll reports
16. Contract time
17. Liquidated damages
18. Construction Contractor Performance Evaluation
19. Display of Hotline posters
20. Notice to proceed
21. Correspondence procedures

22. NPS project management and communication software (Project Teams)
23. Acceptance/rejection of work
24. Progress meetings
25. Submittal procedures
26. NPS Final Accessibility Inspection
27. Environmental requirements
28. Permit requirements
29. As-constructed drawings/operation and maintenance (O&M) manuals.
30. Saturday, Sunday, holiday and night work.
31. Reference materials
32. Value engineering
33. Schedule of Values

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

1. Attendees: In addition to Government Representatives, each Construction Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented. Participants at meetings 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. Meeting agenda will include:

    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, Accessibility, etc.)
    h. Construction Schedule update (provide updated Critical Path Method (CPM)).
    i. Status of Project Record Drawings and O&M manuals.
    j. Other business relating to work.
    k. Permit requirements

C. Preinstallation Conferences: Conduct 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 installation and its coordination or integration with other materials and installations that have preceded or will follow shall attend meetings. Advise the Contracting Officer of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for particular activity under consideration, including requirements for:

    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 meetings 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 the performance of Work and reconvene the conference at the earliest feasible date.

1.8 ENVIRONMENTAL COORDINATION

A. Construction Contractor’s Environmental Manager: Designate on-site party responsible for overseeing Construction Contractor’s conformance to environmental goals for project and implementing procedures for environmental protection.

1. Qualifications: Minimum 3 years Construction experience on projects of similar size and scope; with environmental procedures similar to this project; familiar with environmental regulations applicable to construction operations.
2. Responsibilities: Responsibilities shall include:

a. Compliance with applicable Federal, State, and local environmental regulations, including maintaining required documentation.
b. Implementation of Waste Management Plan (WMP).
c. Implementation of Indoor Air Quality (IAQ) Management Plan.
d. Implementation of Storm Water Pollution Prevention Plan (SWPPP).
e. Present overview of environmental issues and summarize site specific procedures relating to management plans at Preconstruction conference.

f. Training for Construction Contractor personnel in accordance with position requirements.
g. Monitoring and documentation of environmental procedures.

B. Perform project quality control in accordance with requirements specified in Related Sections, including:

1. Quality Requirements
2. Regulatory Requirements
3. Indoor Air Quality (IAQ) Management
4. Noise and Acoustics Management
5. Temporary Storm Water Pollution Prevention Environmental Management
6. Construction Waste Management

C. Construction Contractor's Environmental Training Program: Construction Contractor shall provide environmental training for workers performing work on project site. Training shall include:

1. Overview of environmental issues related to building industry.
2. Overview of environmental issues related to Project.
3. Review of site-specific procedures and management plans:

a. Construction Waste Management
b. Indoor Air Quality (IAQ) Management
c. Noise and Acoustics Management
d. Temporary Storm Water Pollution Prevention

4. Pollution Prevention (P2) practices: Submit evidence of familiarity with P2 practices.
5. Compliance with environmental regulations: As specified in Regulatory Requirements. Submit Construction Contractor 40 CFR (Code of Federal Regulations) employee training records upon request of the Contracting Officer.

D. Provide documentation for environmental procedures as specified herein and in accordance with the approved Waste Management Plan, IAQ Management Plan, and Storm Water Pollution Prevention Plan.

1.9 PERMITS

A. General:

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

B. Government Furnished Permits: During development of the project's design, permits listed below were negotiated and agreed to by the Government. Terms and provisions of these permits shall be adhered to for the duration specified in each permit.

1. None

C. Potential Permits: 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 Construction Contractor in determining which permits will be required for contract's chosen means and methods. The list shall not be considered complete; it is the Construction Contractors' responsibility to determine means and methods and obtain required permits. Construction Contractor shall obtain all permits required to legally conduct work.

1. Colorado Discharge Permit System (CDPS) General Permit COR400000 Stormwater Discharges Associated with Construction Activity – Colorado Department of Public Health & Environment
2. CDPS General Permit COG080000 for Discharges from Short-Term Construction Dewatering Activities – Colorado Department of Public Health & Environment
3. Permit for Archeological Investigations – National Park Service (if archeological monitor is non-NPS employee)

D. 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 work: Coordinate meetings, reporting requirements, inspections, and other requirements.

E. 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.
2. Supply needed information to Agency(ies) with Jurisdiction issuing permits, pay fees required and provide material needed to comply with permit's conditions and provisions.
3. Upload permits to NPS project management and communication software when permits are obtained.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 33 – PHOTO DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for:

1. Existing condition images
2. Periodic construction images

B. See Section 01 35 13 “Archeological Protection”

C. See Section 01 35 91 “Historic Preservation Treatment Procedures”

D. See Section 01 77 00 "Closeout Procedures" for a complete listing of closeout documents.

E. See Section 01 79 00 "Demonstration and Training" for submitting videos of demonstration of equipment and training of National Park Service (NPS) personnel.

1.2 SUBMITTALS

A. Construction Images: Submit images electronically within seven days of taking the image. Include:

1. 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 digital camera, without alteration, or modifications using image-editing software.

B. Closeout: Submit complete set of digital image electronic files as a Project Record Document**.** Submit on Digital Video Disc (DVD).

1. Provide index as separate file on Disc. List each image as a file name with number, date, and time. Include description and or vantage point image was taken.
2. Submit images that have the same aspect ratio as the sensor, un-cropped.

PART 2 - PRODUCTS

2.1 FORMAT REQUIREMENTS

A. Images: Provide sRGB (standard Red Green Blue) color images in JPEG (Joint Photographic Experts Group) format. Minimum sensor size of 8 megapixels, and at image resolution of not less than 1600 by 1200, and 300 dpi (dots per inch).

B. Upload images to project management software.

PART 3 - EXECUTION

3.1 CONSTRUCTION IMAGES

A. General: Take digital images using the maximum range of depth of field, in-focus, to clearly show the Work. No blurry or out-of-focus areas accepted.

1. Maintain index with each set of Construction images and identify the number, date, time, and description for each.
2. Maintain one set of images accessible in field office at Project site available for reference.

B. Existing Condition Images: Before mobilization and commencement of work take color digital images of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.

1. The Contractor will follow the NRHP Submittal Standards (see link). A photo log will be completed and include the view, location, direction, and description of each image. Photography will follow the standards set out in the National Register of Historic Places and National Historic Landmarks Consolidated and Updated Photograph Policy 2024 (NRHP/NHL Consolidated Photograph Policy 2024): https://www.nps.gov/subjects/nationalregister/upload/NR-NHL-photo-policy-2024-01-02.pdf

2. Flag limits of disturbance before recording construction images.
3. Take eight separate images to show existing conditions adjacent to property before starting Work.
4. Take eight separate images of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
5. Take video to show existing conditions adjacent to property before starting Work as well as 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 monthly, coinciding with 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.

1. Three days advance, where feasible.
2. In emergency situations, take additional images within 24 hours of request.
3. Additional images include, but are not limited to:

   a. Immediate follow-up when on-site events result in construction damage or losses.
   b. Fabrication locations away from Project site.
   c. Substantial Completion of a major phase or component of 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. 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 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 and in some cases as requested in drawings. Types of submittals are indicated in individual specific sections.

1. Contracting Officer (CO) reserves 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 for legibility, accuracy, completeness, and compliance with Contract Documents.

1. Coordinate 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 Work so processing will not be delayed because of need for concurrent review coordination.

a. Contracting Officer reserves right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittal List: Submittal list is attached to the end of this Specification Section. The intent is to provide an overall summary of submittal requirements. The requirements of individual Specification Sections and terms and conditions of the Contract still apply regardless of what is shown on submittal list.

D. Processing Time: Allow enough time for submittal review and re-submittals. Contract time extensions will not be authorized if submittals are not transmitted with enough time to permit processing, including re-submittals.

1. Action Submittals

a. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.
b. Re-submittal Review: Allow 10 days for review of each re-submittal.

2. Informational submittals

a. Review: Allow 10 days for review of each submittal.

E. Approved Equal Submittal Requirements:

1. For each item proposed, submit supporting data, including:

a. Drawings and samples as appropriate.
b. Comparison of the salient 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 Construction 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 installation of an approved item and make changes required in other elements of the work because of the substitution.
e. Waives claims for additional expenses that may be incurred as a result of the substitution.

F. Submittals: Identify and incorporate information in each submittal file as follows:

1. Physical samples: Complete Transmittal Form and deliver physical sample to the Contracting Officer (or designee) on site for processing. All comments and actions will be documented on the Transmittal Form.

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 alphabetic suffix after another decimal point (e.g. .001.A).

H. Re-submittals: Make re-submittals using same process used with initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in the title block on the Transmittal Form (CM-16) and clearly indicate extent of revision.
3. Re-submit submittals until they are marked "No Exceptions Taken" or "Reviewed 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 “No Exceptions Taken" or "Reviewed with notations". Ensure notations have been incorporated and, at a minimum, keep one copy of final approved submittal on site for use during construction.

1.4 CONSTRUCTION CONTRACTOR’S USE OF CAD/BIM FILES

A. General: At Construction Contractor’s written request, copies of CAD/BIM (Computer Aided Design/Building Information Modeling) files will be provided to Construction Contractor for use in connection with Project, subject to:

1. Files provided as is; no format or other changes to files or changes to 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. As applicable, include:

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 (portable document format) 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, unless submittal of CAD/BIM Drawings is otherwise permitted.

1. Preparation: Fully illustrate requirements in Contract Documents. As applicable, include:

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 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 Transmittal Form (CM-16) on the NPS project management and communication software website for processing and documentation of action on submitted samples.
3. Identification: Attach label on unexposed side of Samples that includes:

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 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 full range of colors, textures, and patterns available.

a. Number of Samples: Submit three full 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 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: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit four sets of Samples. Contracting Officer will retain three Sample sets; remainder will be returned. Retain Sample set as a Project Record Sample.

D. Historic Preservation Treatment Plan: Comply with requirements specified in Section 01 35 91 "Historic Preservation Treatment Procedures".

E. Construction Materials: Construction Contractor is encouraged to submit products made out of recycled or environmentally responsible material. Every effort will be made by NPS to approve these materials.

F. Coordination Drawings: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

G. Quality Control Plan: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

H. Qualification Data: Prepare written information demonstrating 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.

I. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. As applicable, include:

   1. Statement on condition of substrates and their acceptability for installation of product.
   2. Summary of installation procedures being followed, compliance with 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.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by individual Specification Sections. Note that this is a general statement and some informational submittals indicated below may be Action Submittals where indicated in subsequent specification sections and should therefore be treated as Action in lieu of Informational.

1. Post informational submittals as PDF electronic files directly to the NPS project management and communication software.
2. Certificates and Certifications: Provide a notarized statement with signature of entity responsible for preparing certification. Certificates and certifications shall be signed by officer or other individual authorized to sign documents on behalf of that entity.
3. Informational submittals that do not comply with requirements specified in Contract Documents will be rejected and one copy will be returned.

B. Construction Contractors Construction Schedule: Comply with requirements specified in Section 01 32 16 "Construction Schedule."

C. Accident Prevention Plan: Comply with requirements specified in Section 01 35 23 "Safety Requirements."

D. Schedule of Values: Comply with requirements specified in Section 01 32 16 "Construction Schedule."

E. Waste Recycling Plan: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

F. Storm Water Pollution Prevention Plan: Comply with requirements specified in Section 01 57 23 "Temporary Storm Water Pollution Prevention" and storm water permit requirements identified in Section 01 31 00 "Project Management and Coordination."

G. Indoor Air Quality Management Plan: Comply with requirements specified in Section 01 57 19.11 "Indoor Air Quality Management."

H. Welding Certificates: Prepare written certification that welding procedures and personnel comply with Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on American Welding Society (AWS) forms. Include names of firms and personnel certified.

I. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying Installer complies with Contract Documents and, where required, is authorized by manufacturer for this specific Project.

J. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying manufacturer complies with Contract Documents. Include evidence of manufacturing experience where required.

K. Product Certificates: Prepare written statements on manufacturer's letterhead certifying product complies with Contract Documents.

L. Material Certificates: Prepare written statements on manufacturer's letterhead certifying material complies with Contract Documents.

M. 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 requirements in Contract Documents.

N. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agenc y, or on comprehensive tests performed by a qualified testing agency.

O. 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.

P. 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 Contract Documents.

Q. 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.

R. 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 requirements in Contract Documents.

S. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

T. Design Data: Prepare written and graphic information, including: 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.

U. Manufacturer's Instructions: Prepare written or published information documenting 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.

V. 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 CONSTRUCTION CONTRACTOR'S REVIEW

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

B. Errors due to incomplete or inaccurate submittals will be responsibility of the Contractor providing the data.

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 back of submittal; an incorrect format of submittals is provided; transmittal form is incorrectly filled out; submittals are not coordinated; or submittals do not show evidence of Construction Contractor's approval.

1. Any work done or orders for materials or services placed before approval shall be at Construction Contractor's own risk.

B. Action Submittals: Contracting Officer will review each submittal, generate comments on corrections or modifications required, and indicate appropriate action on the Transmittal Form (CM-16). Submittal will be marked as defined below:

1. NO EXCEPTIONS TAKEN: Submittal appears to conform to design requirements, but contractor is still responsible for all aspects of construction.
2. REVIEWED WITH NOTATIONS: Minor corrections or clarifications required. Comments are clear and no further review is required. Construction Contractor shall address 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. Contracting Officer will identify reasons for disapproval. Construction 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

Submittal List with Review Estimate Template

National Park Service (NPS) - Denver Service Center (DSC) | 1-27-21

SUBMITTAL LIST

Park Acronym/Project Management Information System (PMIS) Number: **ROMO 326235**

Project Title: **Rehabilitate Kawuneeche Visitor Center and Improve Accessibility for Visitor Enjoyment**

SUBMITTAL			REQUIREMENTS (Indicate with **X**)							
			INFORMATIONAL				ACTION			
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER
01 31 00		**Project Management and Coordination**								
	1.4.A	Coordination Drawings								X
	1.4.B	Coordination Drawing Organization								X
	1.4.C	Coordination Digital Data Files				X				
	1.4.D	Division 1 documents								X
01 33 23		**Submittal Procedures**								
	2.1.A	Submittal Schedule								X
	2.1.B	Product Data							X	
	2.1.C	Shop Drawings						X		
	2.1.D	Samples					X			
	2.1.E	Construction Materials								X
	2.1.F	Coordination Drawings								X
	2.1.G	Quality Control Plan								X
	2.1.H	Qualification Data								X

SUBMITTAL LIST

Park Acronym/Project Management Information System (PMIS) Number: **ROMO 326235**

Project Title: **Rehabilitate Kawuneeche Visitor Center and Improve Accessibility for Visitor Enjoyment**

SUBMITTAL			REQUIREMENTS (Indicate with **X**)							
			INFORMATIONAL				ACTION			
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER
	2.2.B	Construction Contractors Construction Schedule		X						
	2.2.C	Accident Prevention Plan		X						
	2.2.D	Schedule of Values		X						
	2.2.E	Waste Recycling Plan		X						
	2.2.F	Storm Water Pollution Prevention Plan		X						
	2.2.G	Indoor Air Quality Management Plan		X						
	2.2.H	Welding Certificates	X							
	2.2.I	Installer Certificates	X							
	2.2.J	Manufacturer Certificates	X							
	2.2.K	Product Certificates	X							
	2.2.L	Material Certificates	X							
	2.2.M	Material Test Reports		X						
	2.2.N	Product Test Reports		X						
	2.2.O	Research/Evaluation Reports		X						
	2.2.P	Preconstruction Test Reports		X						
	2.2.Q	Compatibility Test Reports		X						
	2.2.R	Field Test Reports		X						

SUBMITTAL LIST

Park Acronym/Project Management Information System (PMIS) Number: **ROMO 326235**

Project Title: **Rehabilitate Kawuneeche Visitor Center and Improve Accessibility for Visitor Enjoyment**

SUBMITTAL			REQUIREMENTS (Indicate with **X**)							
			INFORMATIONAL				ACTION			
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER
	2.2.S	Maintenance Data			X					
	2.2.T	Design Data			X					
	2.2.U	Manufacturer's Instructions			X					
	2.2.V	Manufacturer's Field Reports		X						
	2.2.W	Permit Compliance Products				X				
01 32 16		**Construction Schedule**								
	1.3.A	Electronic Copies				X				
	1.3.B	Schedule of Values:				X				
	1.3.C	Construction Baseline Schedule				X				
	1.3.D	Critical Path Method (CPM) Reports				X				
	1.3.E	Construction Schedule Updates				X				
	1.3.F	Construction Schedule Revisions and Time Impact Analysis				X				
01 32 33		**Photographic Documentation**								
	1.2.A	Construction Images				X				
	1.2.B	Closeout				X				
01 35 91		**Historic Preservation Treatment Procedures**								
	1.3.A	Historic Preservation Treatment Plan								X
	1.3.B	Alternative Methods and Materials								X

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	1.3.C	Photographs or Videotape								X
01 40 00		**Quality Requirements**								
	1.4.A	Quality Control Plan								X
	1.4.B	Qualification Data								X
	1.4.C	Contractor Quality Control (CQC) Daily Reports		X						
	1.4.D	Test Reports		X						
	1.4.E	Accessibility Inspection Report		X						
	1.4.F	Off-Site Inspection Reports: Submit prior to shipment		X						
	1.4.H	Permits, Licenses, and Certificates	X							
01 57 19.11		**Indoor Air Quality Management**								
	1.4.A	Indoor Air Quality (IAQ) Management Plan		X						
	1.4.B	Product Data			X					
	1.4.C	Inspection and Test Reports		X						
01 57 23		**Temporary Storm Water Pollution Prevention**								
	1.3.A	SWPP		x						
	1.3.B	Inspection Schedule				x				
	1.3.C	Product Data			x					
01 67 00		**Product Requirements**								
	1.3	Record Submittals-Sustainable Design Close-out Documentation			X					
01 73 29		**Cutting and Patching**								
	1.2.A	Cutting and Patching Plan								X

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01 73 40		**Execution**								
	1.2.A	Certificates	X							
	1.2.B	Landfill Receipts				X				
	1.2.C	Certified Surveys	X							
	1.2.D	Quantity Surveys		X						
01 74 19		**Construction Waste Management and Disposal**								
	1.4.A	Waste Management Plan		X						
	1.4.B	Progress Documentation		X						
	1.4.C	Waste Reduction Calculations		X						
	1.4.D	Records of Donations				X				
	1.4.E	Records of Sales				X				
	1.4.F	Recycling and Processing Facility Records				X				
	1.4.G	Landfill and Incinerator Disposal Records				X				
	1.4.H	Qualification Data			X					
	1.4.I	Statement of Refrigerant Recovery				X				
	1.4.J	Progress payment requirements		X						
	1.4.K	Closeout Submittals				X				
01 81 13		**Sustainability Design Requirements for Non-LEED Projects**								
	1.3.B.1	Recycled Content of Materials			X					
	1.3.B.2	Certified Wood	X							

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	1.3.B.3	Construction Indoor Air Quality (IAQ) Management Plan – During Construction		X						
	1.3.B.4	Construction IAQ Management Plan – Before Occupancy		X						
	1.3.B.5	Low Emitting Materials - Adhesives and Sealants			X					
	1.3.B.6	Low Emitting Materials - Paints and Coatings			X					
	1.3.B.7	Low Emitting Materials - Flooring			X					
	1.3.B.8	Biopreferred Products		X						
01 91 14		**Total Building Commissioning**								
	1.6.A	Two-week look-ahead schedules				X				
	1.6.B	Certificates of readiness				X				
	1.6.C	Contractor's Commissioning Representative Qualifications				X				
	1.6.D	Commissioning Plan				X				
	1.6.E	Pre functional checklists.				X				
	1.6.F	Functional performance test forms				X				
	1.6.G	List of test instrumentation, equipment, and monitoring devices				X				
	1.6.H	Deficiency Report and Resolution Record				X				
02 41 91		**Selective Historic Demolition**								
	1.3.A	Historic Preservation Treatment Plan								X
	1.2.B	Schedule								X
	1.2.C	Shop Drawings						X		
02 50 10		**Employee Office Relocation**								

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	1.5.A	Moving Schedule								X
	1.5.B	Temporary furniture product data							X	
	1.5.C	Qualifications and Certification of moving contractor								X
	1.6.A	Maintenance and moving recommendations				X				
	1.6.B	Existing Conditions documentation				X				
	1.6.C	Quality control program		X						
02 81 01		**Offsite Transportation and Disposal**								
	1.3.A	Planned means/methods of disposal (Refer to 01 74 19)				X				
	1.3.B	Permit				X				
	1.3.C	Copies of Bills of Lading and Manifests				X				
02 84 16		**Handling of Lamps Containing Mercury**								
	1.7.B	Proof of permits				X				
	1.7.C	Employee certification	X							
	1.7.D	HEPA Certification	X							
	1.7.E	Construction schedule				X				
	1.7.F	Description of waste handling procedures				X				
	1.7.G	COC forms				X				
03 30 00		**Cast-in-Place Concrete**								
	1.4.A	Product data for each type of product							X	
	1.4.B	Design Mixtures					X			
	1.4.C	Shop drawings						X		

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	1.5.A	Qualification data				X				
	1.5.B	Welding certificates	X							
	1.5.C	Material certificates	X							
	1.5.D	Material Test Reports		X						
	1.5.E	Research Reports		X						
04 03 10		**Historic Masonry Cleaning**								
	1.5.A	Product data for each type of product							X	
	1.5.B	Qualifications Data								X
	1.5.C	Quality-control program								X
	1.5.D	Preconstruction Test Reports								X
	1.5.E	Cleaning program								X
04 03 42		**Historic Stone Masonry Repair**								
	1.5.A	Product Data							X	
	1.5.B	Shop Drawings						X		
	1.5.C	Samples for Initial Selection					X			
	1.5.D	Manufacturer's Literature and Product Data							X	
	1.5.E	Construction Procedures								X
	1.5.F	Qualification Data								X
	1.5.G	Preconstruction Test Reports								X
	1.5.H	Quality-control program								X
	1.5.I	Stone historic treatment program								X

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	1.6.A	Mock-ups								X
05 12 00		**Structural Steel Framing**								
	1.5.A	Product Data							X	
	1.5 B	Shop Drawings						X		
	1.6 A	Qualification Data	X							
	1.6 B	Welding Certificates	X							
	1.6 C	Mill Test Reports		X						
	1.6 D	Product Test Reports		X						
05 52 13		**Pipe and Tube Railings**								
	1.3.A	Product data							X	
	1.3.B	Sustainable Design Submittals								X
	1.3.C	Shop Drawings						X		
	1.3.D	Delegated Design Submittal								X
	1.3.E	Sample					X			
	1.4.A	Qualification Data				X				
	1.4.B	Welding Certificates	X							
	1.4.C	Mill Certificates	X							
	1.4.D	Product Test Reports		X						
	1.4.E	Evaluation Reports		X						
06 03 12		**Historic Wood Repair**								
	1.4.A	Product data for each type of product							X	

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	1.4.B	Shop Drawings						X		
	1.4.C	Samples for Verification					X			
	1.4.D	Qualification Statements								X
	1.4.E	Wood Historic Treatment Program								X
	1.4.F	Samples for Verification					X			
	1.5.A	FSC Certification	X							
06 10 00		**Rough Carpentry**								
	1.4A	Product data for each type of product							X	
	1.5A	Reports		X						
	1.5B	FSC Certification	X							
06 16 00		**Sheathing**								
	1.3A	Product data for each type of product							X	
06 20 13		**Exterior Finish Carpentry**								
	1.3.A	Product data for each type of product							X	
	1.3.B	Wood-Preservative Treatment							X	
	1.3.C	Samples					X			
	1.3.D	Samples for Initial Selection					X			
	1.3.E	Samples for Verification					X			
	1.4.A	Compliance Certificates	X							
	1.4.B	Evaluation Reports		X						
	1.4.C	Sample Warranties				X				

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06 40 23		**Interior Architectural Woodwork**								
	1.4.A	Product Data							X	
	1.4.B	Shop Drawings						X		
	1.4.C	Samples					X			
	1.4.D	Samples for Initial Selection					X			
	1.4.E	Samples for Verification					X			
	1.5.A	Qualification Data				X				
	1.5.B	Product Certificates	X							
	1.5.C	Field quality-control reports		X						
06 64 00		**Plastic Paneling**								
	1.2.A	Product Data							X	
	1.2.B	Samples					X			
07 21 00		**Thermal Insulation**								
	1.2.A	Product Data							X	
	1.2.B	Insulation installation schedule								X
	1.2.C	Installer qualifications								X
	1.2.D	Post installation inspection report								X
	1.2.E	Installer's certification								X
	1.3.A	Product Test Reports		X						
	1.3.B	Research Reports		X						
07 25 00		**Weather Barriers**								

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	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X		
	1.2.C	Post inspection data and photographs								X
07 53 23		**Ethylene-Propylene-Diene-Monomer (EPDM) Roofing**								
	1.4.A	Product Data							X	
	1.4.B	Shop Drawings						X		
	1.4C	Samples for Verification					X			
	1.4.D	Wind-Uplift-Resistance Submittal								X
	1.4.E	Qualification Data								X
	1.5.A	Manufacturer Certificates	X							
	1.5.B	Product Test Reports		X						
	1.5.C	Research Reports		X						
	1.5.D	Field quality-control reports		X						
	1.5.E	Qualification Data				X				
	1.5.F	Sample Warranties				X				
07 62 00		**Sheet Metal Flashing and Trim**								
	1.3.A	Product Data							X	
	1.3.B	Shop Drawings						X		
	1.3.C	Samples					X			
	1.3.D	Samples for Initial Selection					X			
	1.3.E	Samples for Verification					X			

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	1.3.F	Anodized Aluminum Samples					X			
	1.3.G	Qualification Statements								X
	1.4.A	Certificates	X							
	1.4.B	Product Test Reports		X						
	1.4.C	Research Reports		X						
	1.4.D	Sample warranties				X				
07 92 00		**Joint Sealants**								
	1.3.A	Product Data							X	
	1.3.B	Samples for Initial Selection					X			
	1.3.C	Samples for Verification					X			
	1.3.D	Joint-Sealant Schedule								X
	1.4.A	Preconstruction Laboratory Test Schedule				X				
	1.4.B	Preconstruction Laboratory Test Reports		X						
	1.4.C	Preconstruction Field-Adhesion-Test Reports		X						
	1.4.D	Field Quality-Control Reports		X						
	1.4.E	Sample warranties				X				
	1.7	Mock-ups								X
08 03 14		**Historic Treatment of Wood Doors**								
	1.5.A	Product Data							X	
	1.5.B	Door Schedule								X
	1.5.C	Shop Drawings						X		

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	1.5.D	Samples for Initial Selection					X			
	1.5.E	Historic Treatment Specialist Qualifications								X
	1.5.F	Wood Door Historic Treatment Program								X
08 11 13		**Hollow Metal Doors and Frames**								
	1.5.A	Product Data							X	
	1.5.B	Product Data Submittals							X	
	1.5.C	Shop Drawings						X		
	1.5.D	Product Schedule								X
	1.6.A	Product Test Reports		X						
	1.6.B	Field quality-control reports		X						
08 14 16		**Flush Wood Doors**								
	1.4.A	Product Data							X	
	1.4.B	Product Data Submittals							X	
	1.4.C	Sustainable Design Submittals							X	
	1.4.D	Shop Drawings						X		
	1.4.E	Samples for Initial Selection					X			
	1.4.F	Samples for Verification					X			
	1.5.A	Qualification Data			X					
	1.5.B	Field Quality Control Reports		X						
	1.5.C	Sample Warranty				X				
08 31 13		**Access Doors and Frames**								

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	1.2.A	Product Data							X	
	1.2.B	Samples					X			
	1.2.C	Product Schedule								X
	1.2.D	Shop Drawing						X		
08 51 13		**Aluminum Windows**								
	1.3.A	Product Data							X	
	1.3.B	Shop Drawings					X			
	1.3.C	Samples for Initial Selection					X			
	1.3.D	Samples for Verification					X			
	1.3.E	Product Schedule								X
	1.3.F	Mock ups								X
	1.4.A	Test and Evaluation Reports		X						
	1.4.B	Field quality-control reports		X						
	1.4.C	Qualification Statements				X				
	1.4.D	Sample warranties				X				
08 51 23.13		**Hot-Rolled Steel Windows**								
	1.3.A	Product Data							X	
	1.3.B	Shop Drawings						X		
	1.3.C	Samples for Initial Selection					X			
	1.3.D	Samples for Verification					X			
	1.3.E	Product Schedule								X

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	1.3.F	Mock ups								X
	1.4.A	Test and Evaluation Reports		X						
	1.4.B	Field quality-control reports		X						
	1.4.C	Qualification Statements				X				
	1.4.D	Sample Warranties				X				
08 71 00		**Door Hardware**								
	1.3.B1	Product Data							X	
	1.3.B2	Riser and Wiring Diagrams						X		
	1.3.B3	Samples for Verification					X			
	1.3.B4	Door Hardware Schedule								X
	1.3.B5	Key Schedule								X
	1.3.B6	Qualification Data			X					
08 71 13		**Power Door Operators**								
	1.4.A	Product Data							X	
	1.4.B	Shop Drawings						X		
	1.5.A	Qualification Data				X				
	1.5.B	Sample Warranties: For special warranties.				X				
08 80 00		**Glazing**								
	1.5.A	Product Data							X	
	1.5.B	Glass Samples					X			
	1.5.C	Glazing Accessory Samples					X			

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	1.5.D	Glazing Schedule								X
	1.5.E	Window Film Samples					X			
	1.6.A	Qualification Data				X				
	1.6.B	Product Certificates	X							
	1.6.C	Product Test Reports		X						
	1.6.D	Preconstruction adhesion and compatibility test report.		X						
	1.6.E	Sample Warranties: For special warranties.				X				
09 03 91		**Historic Treatment of Plain Painting**								
	1.5.A	Product Data							X	
	1.5.B	Samples					X			
	1.5.C	Product List								X
	1.5.D	Qualification Data								X
	1.5.E	Plain Painting Historic Treatment Program								X
	1.5.F	Color Matching Certificate								X
	1.6.A	Preconstruction Test Reports		X						
	1.8.D	Mockups								X
09 29 00		**Gypsum Board**								
	1.3.A	Product Data							X	
	1.3.B	Shop Drawings						X		
	1.3.C	Samples					X			
09 30 13		**Ceramic Tiling**								

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	1.4.A	Product Data							X	
	1.4.B	Shop Drawings						X		
	1.4.C	Samples for Initial Selection					X			
09 51 23		**Acoustical Tile Ceilings**								
	1.3.A	Product Data							X	
	1.3.B	Samples					X			
	1.3.C	Samples for Initial Selection					X			
	1.3.D	Samples for Verification					X			
	1.3.E	Coordination Drawings						X		
	1.4.A	Qualification Data				X				
	1.4.B	Product Test Reports		X						
	1.4.C	Evaluation Reports		X						
	1.4.D	Field quality-control reports		X						
	1.7.A	Mock ups								X
09 65 13		**Resilient Base and Accessories**								
	1.2.A	Product Data							X	
	1.2.B	Samples					X			
	1.2.C	Samples for Initial Selection					X			
	1.2.D	Samples for Verification					X			
	1.2.E	Product Schedule								X
09 65 43		**Linoleum Flooring**								

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	1.3.A	Product Data							X	
	1.3.B	Shop Drawings						X		
	1.3.C	Samples					X			
	1.3.D	Samples for Verification					X			
	1.3.E	Heat-Welded Seam Samples					X			
	1.3.F	Product Schedule								X
	1.4.A	Qualification Data				X				
09 68 13		**Tile Carpeting**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X		
	1.2.C	Samples for Initial Selection					X			
	1.2.D	Samples for Verification					X			
	1.3.A	Product Test Reports		X						
	1.3.B	Qualification Statements				X				
	1.3.C	Sample Warranties				X				
09 84 33		**Sound-Absorbing Wall Units**								
	1.3.A	Product Data							X	
	1.3.B	Shop Drawings						X		
	1.3.C	Samples for Initial Selection					X			
	1.3.D	Samples for Verification					X			
	1.4.A	Product Certificates	X							

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	1.4.B	Sample Warranty				X				
09 91 13		**Exterior Painting**								
	1.3.A	Product Data							X	
	1.3.B	Samples					X			
	1.3.C	Samples for Initial Selection					X			
	1.3.D	Samples for Verification					X			
	1.5.A	Mockups								X
09 91 24		**Interior Painting**								
	1.3.A	Product Data							X	
	1.3.B	Samples for Verification					X			
	1.3.C	Product List								X
	1.5.A	Mockups								X
09 93 01		**Staining and Transparent Finishing**								
	1.2.A	Product Data							X	
	1.2.B	Samples for Initial Selection					X			
	1.2.C	Samples for Verification					X			
	1.2.D	Product List								X
	1.4.A	Mockups								X
10 14 23.16		**Room-Identification Panel Signage**								
	1.4.A	Product Data							X	
	1.4.B	Shop Drawings						X		

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	1.4.C	Samples for Initial Selection					X			
	1.4.D	Samples for Verification					X			
	1.4.E	Product Schedule								X
	1.5.A	Qualification Data				X				
	1.5.B	Sample Warranty				X				
10 21 00		**HDPE Toilet Compartments**								
	1.4.A	Product Data							X	
	1.4.B	Shop Drawings						X		
	1.4.C	Samples for Initial Selection					X			
10 26 00		**Wall and Door Protection**								
	1.2.A	Product Data							X	
	1.2.B	Samples for Initial Selection					X			
	1.2.C	Samples for Verification					X			
10 28 00		**Toilet Accessories**								
	1.3.A	Product Data							X	
	1.3.B	Samples					X			
	1.3.C	Product Schedule								X
	1.3.D	Delegated Design Submittals								X
10 44 13		**Fire Protection Cabinets**								
	1.3.A	Product Data							X	
	1.3.B	Shop Drawings						X		

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	1.3.C	Samples					X			
	1.3.D	Samples for Initial Selection					X			
	1.3.E	Samples for Verification					X			
	1.3.F	Product Schedule								X
10 44 16		**Fire Extinguishers**								
	1.3.A	Product Data							X	
	1.3.B	Product Schedule							X	
	1.4.A	Warranty				X				
12 20 00		**Window Treatments**								
	1.2.A	Product Data							X	
	1.2.B	Samples for Initial Selection					X			
	1.2.C	Samples for Verification					X			
	1.2.D	Product Schedule								X
	1.3.A	Product Certificates	X							
	1.3.B	Product Test Reports		X						
	1.3.C	Qualification Statements				X				
12 32 13		**Manufactured Wood-Veneer-Faced Casework**								
	1.5.A	Product Data							X	
	1.5.B	Shop Drawings						X		
	1.5.C	Samples					X			
	1.5.D	Samples for Initial Selection					X			

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	1.5.E	Samples for Verification					X			
	1.6.A	Qualification Data				X				
	1.6.B	Sample Warranty				X				
	1.6.C	Field quality-control reports		X						
12 36 61		**Simulated Stone Countertops**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X		
	1.2.C	Samples for Initial Selection					X			
	1.2.D	Samples for Verification					X			
	1.3.A	Qualification Statements				X				
12 48 13		**Entrance Floor Mats and Frames**								
	1.3.A	Product Data							X	
	1.3.B	Shop Drawings						X		
	1.3.C	Samples					X			
12 93 13		**Picnic Tables**								
	1.4.A	Product Data							X	
	1.4.B	Shop Drawings						X		
	1.4.C	Samples					X			
21 00 00		**Fire Suppression Basic Requirements**								
	1.4 A-P	Submit shop drawings, calculations and product data sheets as one complete stand-alone package.						X	X	X

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	1.4 Q	Operation and Maintenance Manuals							X	X
	1.4 R	Record Drawings						X		
	1.4 S	Calculations								X
21 13 00		**Fire Suppression Sprinkler Systems**								
	1.4 B	System installer and designer qualifications.				X				
	1.4 B	Hydraulic calculations.								X
22 05 00		**Common Work Results for Plumbing**								
	1.5.A	Product Data							X	
	1.5.B	Maintenance Manuals			X					
	1.5.C	Welder Certificates	X							
22 05 17		**Sleeve and Sleeve Seals for Plumbing Piping**								
	1.2.A	Product Data							X	
	1.3.A	Field quality-control reports		X						
22 05 18		**Escutcheons for Plumbing Piping**								
	1.2.A	Product Data							X	
22 05 23.12		**Ball Valves for Plumbing Piping**								
	1.2.A	Product Data							X	
22 05 23.14		**Check Valves for Plumbing Piping**								
	1.2.A	Product Data							X	
22 05 29		**Hangers and Supports for Plumbing Piping and Equipment**								
	1.2.A	Product Data							X	

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	1.2.B	Shop Drawings						X	X	
	1.2.C	Delegated Design Submittals		X				X	X	
	1.3.A	Welder Certificates	X							
22 07 19		**Plumbing Piping Insulation**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
	1.2.C	Samples					X			
	1.3.A	Qualification Data	X							
	1.3.B	Material Test Reports	X	X						
	1.3.C	Field quality-control reports		X						
22 11 16		**Domestic Water Piping**								
	1.2.A	Product Data							X	
	1.3.A	System purging and disinfecting activities report		X						
	1.3.B	Field quality-control reports		X						
22 11 19		**Domestic Water Piping Specialties**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
	1.3.A	Test and Inspection reports		X						
	1.3.B	Field quality-control reports		X						
22 11 23.21		**Inline, Domestic-Water Pumps**								
	1.2.A	Product Data							X	

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	1.3.A	Coordination Drawings		X						
	1.3.B	Field quality-control reports		X						
22 13 16		**Sanitary Waste and Vent Piping**								
	1.2.A	Product Data							X	
	1.3.A	Coordination Drawings		X						
	1.3.B	Field quality-control reports		X						
22 13 19		**Sanitary Waste Piping Specialties**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
	1.3.A	Field quality-control reports		X						
22 33 00		**Electric, Domestic-Water Heaters**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
22 34 00		**Fuel-Fired, Domestic-Water Heaters**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
23 01 30.52		**Existing HVAC Air Distribution System Cleaning**								
	1.3.A	Product Data							X	
	1.4.A	Field quality-control reports		X						
23 05 00		**Common Work Results for HVAC**								
	1.5.A	Product Data							X	

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	1.5.B	Maintenance Manuals			X					
	1.5.C	Welder Certificates	X							
23 05 93		**Testing, Adjusting, and Balancing for HVAC**								
	1.3.A	Qualification Data	X							
	1.3.B	Contract Documents Examination Report		X						
	1.3.C	Strategies and Procedures Plan		X						
	1.3.D	System Readiness Checklist		X						
	1.3.E	Examination Report		X						
	1.3.F	Certified TAB Report		X						
	1.3.G	Sample Report Forms		X						
	1.3.H	Instrument Calibration Reports		X						
23 07 13		**Duct Insulation**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
	1.3.A	Field quality-control reports		X						
23 07 19		**HVAC Piping Insulation**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
	1.2.C	Samples					X			
	1.3.A	Qualification Data	X							
	1.3.B	Material Test Reports	X	X						

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	1.3.C	Field quality-control reports		X						
23 23 00		**Refrigerant Piping**								
	1.2.A	Product Data							X	
	1.2.B	Product Data							X	
	1.2.C	Delegated Design Submittals		X				X	X	
	1.2.D	Shop Drawings						X	X	
	1.3.A	Welder Certificates	X							
	1.3.B	Field quality-control reports		X						
23 31 13		**Metal Ducts**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
	1.2.C	Delegated Design Submittals		X				X	X	
	1.3.A	Coordination Drawings		X						
	1.3.B	Welder Certificates	X							
	1.3.C	Field quality-control reports		X						
23 33 00		**Air Duct Accessories**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
	1.3.A	Coordination Drawings		X						
	1.3.B	Source quality-control reports		X						
23 34 16		**Centrifugal HVAC Fans**								

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	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
	1.3.A	Coordination Drawings		X						
	1.3.B	Field quality-control reports		X						
23 37 13.23		**Registers and Grilles**								
	1.2.A	Product Data							X	
23 54 16.13		**Gas-Fired Furnaces**								
	1.3.A	Product Data							X	
	1.3.B	Shop Drawings						X	X	
	1.4.A	Sample Warranty		X						
23 81 26		**Split-System Air-Conditioners**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
	1.3.A	Sample Warranty		X						
23 82 39.19		**Plumbing Piping Insulation**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X	X	
	1.2.C	Samples					X			
26 05 19		**Low-Voltage Electrical Power Conductors and Cables**								
	1.3	Product data for each type of product indicated							X	
	1.3	Field quality-control test reports.		X						

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26 05 26		**Grounding and Bonding for Electrical Systems**								
	1.2	Product data for each type of product indicated							X	
	1.2	As-Built grounding plans		X						
	1.2	Field quality-control test reports.		X						
26 05 29		**Hangers And Supports for Electrical Systems**								
	1.5	Product data for each type of product indicated							X	
	1.5	Shop Drawings						X	X	
	1.5	Welding Certificates	X							
26 05 33		**Raceway and Boxes for Electrical Systems**								
	1.4	Product data for each type of product indicated							X	
26 05 44		**Sleeves and Sleeve Seals for Electrical Raceway and Cabling**								
	1.3	Product data for each type of product indicated							X	
26 05 53		**Identification for Electrical Systems**								
	1.3	Product data for each type of product indicated							X	
	1.3	Identification Schedule		X						
26 08 00		**Commissioning of Electrical Systems**								
	1.4	Construction Checklists		X						
	1.5	O&M Data			X					
26 09 23		**Lighting Control Devices**								
	1.4	Product data for each type of product indicated							X	
	1.4	Shop Drawings						X		

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	1.4	Field quality-control test reports.		X						
	1.4	O&M Data			X					
26 09 43		**Network Lighting Controls**								
	1.4	Product data for each type of product indicated							X	
	1.4	Shop Drawings						X		
	1.4	Coordination Drawings		X						
	1.4	Field quality-control test reports.		X						
	1.4	Software and Firmware Operational Documentation			X					
	1.4	O&M Data			X					
	1.4	Warranty			X					
26 24 16		**Panelboards**								
	1.3	Product data for each type of product indicated							X	
	1.3	Shop Drawings						X		
	1.3	Panelboard Schedules				X				
	1.3	Field quality-control test reports.		X						
	1.4	O&M Data			X					
26 27 13		**Electricity Metering**								
	1.3	Product data for each type of product indicated							X	
	1.3	Field quality-control test reports.		X						
	1.3	O&M Data		X						
26 27 26		**Wiring Devices**								

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	1.4	Product data for each type of product indicated							X	
	1.4	O&M Data			X					
26 28 16		**Enclosed Switches and Circuit Breakers**								
	1.4	Product data for each type of product indicated							X	
	1.4	Shop Drawings						X		
	1.4	Field quality-control test reports.		X						
	1.4	O&M Data			X					
26 41 13		**Lightning Protection for Structures**								
	1.3	Product data for each type of product indicated							X	
	1.3	Shop Drawings						X		
	1.4	Coordination Drawings		X						
	1.4	Qualification Data	X							
	1.4	Product Certificates	X							
	1.4	Field quality-control test reports.		X						
	1.5	O&M Data			X					
	1.5	Completion Certificate	X							
26 43 13		**Transient-Voltage Suppression for Low-Voltage Electrical**								
	1.4	Product data for each type of product indicated							X	
	1.5	Field quality-control test reports.		X						
	1.5	Sample Warranty			X					
	1.6	O&M Data			X					

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26 51 00		**Lighting Fixtures**								
	1.4	Product data for each type of product indicated							X	
	1.4	Shop Drawings						X		
	1.4	Qualification Data	X							
	1.4	O&M Data			X					
	1.4	Warranties			X					
27 05 26		**Grounding and Bonding for Communications Systems**								
	1.2	Product data for each type of product indicated							X	
	1.2	As-Built grounding plans		X						
	1.2	Field quality-control test reports.		X						
27 05 28		**Pathways for Communications Systems**								
	1.4	Product data for each type of product indicated							X	
27 05 36		**Cable Tray for Communications Systems**								
	1.4	Product data for each type of product indicated							X	
27 05 44		**Sleeves and Sleeve Seals for Communications Systems**								
	1.4	Product data for each type of product indicated							X	
27 05 53		**Identification for Communications Systems**								
	1.3	Product data for each type of product indicated							X	
	1.3	Identification Schedule		X						
27 11 16		**Communications Racks, Frames and Enclosures**								
	1.4	Product data for each type of product indicated							X	

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27 13 23		**Communications for Optical Fiber Backbone Cabling**								
	1.4	Product data for each type of product indicated							X	
	1.4	O&M Data			X					
27 15 13		**Communications for Copper Horizontal Cabling**								
	1.4	Product data for each type of product indicated							X	
	1.4	O&M Data			X					
27 41 00		**Audio Video Systems**								
	1.4	Product data for each type of product indicated							X	
	1.4	O&M Data			X					
28 13 00		**Access Control Software and Database Management**								
	1.4	Product data for each type of product indicated							X	
	1.5	Coordination Drawings		X						
	1.5	Installer Qualification Data	X							
	1.5	Field Quality Control Reports		X						
	1.5	System testing plans		X						
	1.6	Operation and Maintenance Manuals			X					
	1.6	Warranties			X					
	1.6	Software and Firmware Operational Documentation			X					
	1.6	Field Test and Inspection Reports		X						
28 14 00		**Access Control System Hardware**								
	1.4	Product data for each type of product indicated							X	

SUBMITTAL LIST

Park Acronym/Project Management Information System (PMIS) Number: **ROMO 326235**

Project Title: **Rehabilitate Kawuneeche Visitor Center and Improve Accessibility for Visitor Enjoyment**

SUBMITTAL			REQUIREMENTS (Indicate with **X**)							
			INFORMATIONAL				ACTION			
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER
	1.4	Shop Drawings						X		
	1.5	Coordination Drawings		X						
	1.5	Installer Qualification Data	X							
	1.5	Field Quality Control Reports		X						
	1.6	Record Drawings		X						
	1.6	Operation and Maintenance Manuals			X					
	1.6	Warranties			X					
	1.6	Extra Material				X				
	1.6	Field Test and Inspection Reports		X						
28 16 00		**Intrusion Detection**								
	1.4	Product data for each type of product indicated							X	
	1.4	Shop Drawings						X		
	1.5	Coordination Drawings		X						
	1.5	Qualification Data	X							
	1.5	Field Quality Control Reports		X						
	1.5	System Testing Plans		X						
	1.6	Record Documents		X						
	1.6	O&M Data			X					
	1.6	Warranties			X					
	1.6	Software and Firmware Operational Documentation		X						
	1.6	Extra Material				X				

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	1.6	Field Test and Inspection Reports		X						
28 20 00		**Video Surveillance**								
	1.4	Product data for each type of product indicated							X	
	1.4	Shop Drawings						X		
	1.5	Coordination Drawings		X						
	1.5	Qualification Data	X							
	1.5	Field Quality Control Reports		X						
	1.5	System Testing Plans		X						
	1.6	Record Drawings		X						
	1.6	O&M Data			X					
	1.6	Warranties			X					
	1.6	Software and Firmware Operational Documentation			X					
	1.6	Field Test and Inspection Reports		X						
28 00 01		**Fire Alarm Basic Requirements**								
	1.4 A-O	Submit shop drawings, calculations and product data sheets as one complete stand-alone package.						X	X	X
	1.4 P	Operation and Maintenance Manuals							X	X
	1.4 Q	Record Drawings						X		
	1.4 B	System installer and designer qualifications.				X				
	1.4 B	Shop Drawings						X		
	1.4 C	Operation and Maintenance Manuals						X	X	X

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31 10 00		**Site Clearing**								
	1.5.A.1	Permits for transport of debris		X						
	1.5.B.1	Demolition procedures			X					
31 20 00		**Earth Moving**								
	1.5.A	Delivery Tickets	X							
	1.5.B	Product Data							X	
	1.5.C	Material Test Reports		X						
	1.5.D	Compaction Test Results	X							
	1.5.E	Preexcavation Photography or Videotape		X						
31 25 00		**Erosion and Sediment Control**								
	1.3.A	Product Data							X	
32 12 16		**Asphalt Paving**								
	1.3.A	Product Data							X	
	1.3.B	Test Results	X							
32 13 20		**Site Concrete**								
	1.4.A	Product Data							X	
	1.4.B	Design Mixtures		X						
	1.4.C	Steel Reinforcement Shop Drawings						X		
	1.4.D	Qualification Data	X							
	1.4.E	Material Certificates	X							
	1.4.F	Materials test Report		X						

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	1.4.G	Field quality control reports		X						
32 15 43		**Permeable Aggregate Surfacing**								
	1.3.A	Product Data							X	
	1.3.B	Color Samples					X			
	1.3.C	Installer Qualifications								X
32 17 00		**Paving Specialties**								
	1.2.A	Material Certificates	X							
	1.2.B	Shop Drawings						X		
	1.2.C	Product Data							X	
32 31 13		**Guardrail Fencing**								
	1.3.A	Product Data							X	
	1.3.A	Samples for initial selection					X			
	1.3.A	Samples for verification					X			
	1.3.B	Shop Drawings						X		
	1.3.C	Design Calculations		X						
	1.3.D	Mill Test Reports		X						
32 32 00		**Boulder Placement**								
	1.3.A.1	Photographs								X
	1.3.A.2	Dimensions								X
	A.3.A.3	Source Location								X
	A.3.A.4	Mock-up								X

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32 31 14		**Post and Rail Fence**								
	1.2.A	Product Data							X	
	1.2.B	Shop Drawings						X		
	1.2.C	Samples for initial selection					X			
	1.2.D	Samples for verification					X			
	1.2.E	Product Certificates	X							
	1.2.F	Field quality control reports		X						
	1.2.G	Operation and Maintenance Data			X					
	1.2.H	Warranty		X						
32 33 00		**Site Furnishings**								
	1.3.A	Product Data							X	
	1.3.B	Shop Drawings						X		
32 40 00		**Tree and Vegetation Retention and Protection**								
	1.5.B	Tree and Vegetation Protection Work Plan		X						
	1.5.D-F	Proposed Methods, Materials, and Tools				X				
	1.5.G	Watering Plan and Schedule		X						
	1.5.H	Soil Moisture and Watering Log		X						
33 10 00		**Water Utilities**								
	1.3.A	Product Data							X	
	1.3.B	Manufacturer's Certification	X							
	1.3.C	Pipe Testing Reports		X						

SUBMITTAL LIST

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SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER
33 30 00		**Sanitary Sewerage**								
	1.3.A	Product Data							X	
	1.3.B	Manufacturer's Certification	X							
	1.3.C	Record Drawing As-Builts		X						
	1.3.D	Pipe Testing Reports		X						
33 40 00		**Storm Drainage**								
	1.3.A	Product Data							X	
	1.3.B	Manufacturer's Certification	X							

SECTION 01 35 13 – ARCHEOLOGICAL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this section consists of protecting archeological and historical resources, and within and/or around the limits of disturbance limits.

B. The area of work has the potential to contain precontact and historically significant buried features and artifacts. The Contractor shall strictly limit and control the depth and extent of excavations and disturbance, minimizing them to the greatest extent possible in order to avoid impacts within the project work area.

C. The limits of disturbance for the work shown on the drawings has been submitted to and accepted by authorities with responsibility for ensuring that the scope of work is in compliance with cultural resource requirements. Any changes to the location of work, must be approved by the Contracting Officer and may require temporarily relocating work until the revised location is approved by required officials, as specified below.

D. The contractor shall provide professional archeological services that includes archeological monitoring to observe and document all excavation and ground disturbing activities. Archeological monitor requirements are specified in this Section.

E. The Contractor shall provide maximum protection of government-provided data and information about precontact, historic resources, and other sensitive areas within the park. The Contractor may be required to sign the park's Sensitive Archeological and Ethnographic Data Confidentiality Agreement, Upon the completion of the project, such data and information will either be (1) returned to the government or (2) destroyed in an appropriate manner approved by the Contracting Officer.

F. The contractor may not publish articles based on the research covered under this contract, without prior written consent of the park. The NPS will have unlimited rights to all records, images, maps, and notes produced in relation to this project. The completed documentation may be used and reproduced in any fashion that the NPS chooses, with appropriate credit given to the contractor.

G. Any consultations and/or coordination with the office of the State Historic Preservation Officer or American Indian tribes traditionally associated with ROMO lands will be the responsibility of the NPS and is not required of the contractor.

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 precontact 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 (SHPO) and, if necessary, associated American Indian tribes.

C. Archeologist: a person that meets the Secretary of Interior's Professional Qualification Standards for Archeology which can be found at Professional Qualifications Standards (U.S. National Park Service) (nps.gov) and meets the Archaeological Resource Protection Act (ARPA) standards for undertaking archeological investigations (43 CFR 7.8).

D. Archeological Monitor: A person employed by the Contractor that meets the Secretary of Interior's Professional Qualification Standards for Archeology which can be found at Professional Qualifications Standards (U.S. National Park Service) (nps.gov) (https://www.nps.gov/articles/sec-standards-prof-quals.htm)and meets the Archaeological Resource Protection Act (ARPA) standards for undertaking archeological investigations (43 CFR 7.8).

E. Cultural Resource Specialist: A person employed by the park that meets the Secretary of the Interior's Professional Qualification Standards.

F. Archaeological 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.

G. Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (P.L. 101-601; 25 U.S.C. 3001-3013): defines the rights of Native American lineal descendants, Indian tribes, and Native Hawaiian organizations with respect to the treatment, repatriation, and disposition of Native American human remains and associated cultural items.

H. Section 106 of the National Historic Preservation Act (54 U.S.C. 306108): requires federal agencies to take into account the effects of their undertakings on historic properties either listed in or eligible to be listed in the National Register of Historic Places and provide consulting parties a reasonable opportunity to comment before making decisions.

I. Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation. Archeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines (nps.gov) (https://www.nps.gov/subjects/historicpreservation/upload/standards-guidelines-archeology-historic-preservation.pdf)

J. Secretary of the Interior's Standards for the Treatment of Historic Properties: common sense historic preservation principles in non-technical language. They promote historic preservation best practices and can be found at https://www.nps.gov/tps/standards.htm

K. NPS Management Policies (http://www.nps.gov/subjects/policy/management-policies.htm)

L. NPS Director's Order No. 28 and 28A (Archeology) (see http://www.nps.gov/subjects/policy/directors-orders.htm)

1.3 SUBMITTALS

A. Archaeological Resources Protection Act (ARPA) permit application for work performed by a contracted archeological monitor. ARPA permit application shall be submitted at least 75 days before Contractor mobilization unless approved by Contracting Officer.

B. Resume and qualifications of proposed Archeological Monitor(s) for the project.

C. Preliminary Report
   1. Draft report - Due 30 days after completion of the field component.
      a. Draft report
      b. Draft site records
      c. Geodatabase
      d. Photographs and photo log
   2. Revised Draft report – Due 21 days after receipt of NPS comments on draft report
      a. Revised draft report
      b. Revised draft site records
      c. Geodatabase
      d. Photographs and photo log

D. Final Report/Final Project Deliverables - Due 15 days after receiving Revised Report comments.
   1. Final Report
   2. Final Site Records
   3. Geodatabase
   4. Photographs (all project photographs) and photo log
   5. All field records, including field notes
   6. Any archeological resources collected during the project (if applicable)

1.4 QUALITY ASSURANCE

A. As specified in Section 01 11 00 “Summary of Work," orientation session for construction workers and job superintendent will be coordinated by the Contracting Officer and shall be attended by construction workers and job superintendent prior to the start of work. Orientation session will be repeated for changes of key personnel.

B. Weekly progress meetings, as specified in Section 01 31 00 “Project Management and Coordination” shall include Archeological, and Historical Resource Protection as an agenda item to address:

   1. Identification of significant features within the work area and a protection plan for features that will be:

      a. Protected and avoided.
      b. Protected with minimal impacts (features that will have minimal destruction, damage, or alteration and features that will be temporarily removed, stored, and reinstalled).

c. Removed and replaced with materials in-kind following the Secretary of the Interior's Standards for the Treatment of Historic Properties.

C. The contractor is responsible for quality control, which includes ensuring the technical accuracy and completeness of the deliverables prior to submission to the park. The contractor's quality control efforts shall ensure that all draft and final deliverables have been reviewed for consistency, professional and copy quality, technical adequacy, and readability. Quality control review shall ensure appropriate analysis with sufficient support and rationale for National Register of Historic Places (NRHP) eligibility recommendations.

D. Archaeological Resources Protection Act (ARPA) Permit as specified in the Section.

E. Report data, GPS information, photographs and final report shall meet the electronic format requirements specified in this Section.

1.5 ARCHEOLOGICAL INVESTIGATION BY NON-NPS PERSONNEL

A. An Archaeological Resources Protection Act (ARPA) permit is required for any archeological work that is performed by a subcontractor.

B. Permits are issued by the NPS under the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa-mm) and its regulations (43 CFR 7).

C. Permit form and guidance can be found at https://home.nps.gov/orgs/1187/issue-arpa-permits.htm and https://www.nps.gov/articles/series.htm

1. Applicants should submit Permit Application (DI Form 1926). Submit permit application in Word (.docx) format to the Contracting Officer.
2. The ARPA permit process typically takes 75 days.

PART 2 - PRODUCTS

2.1 DAILY WORK SCHEDULE

A. A Daily Work Schedule is required for all work requiring an archeological monitor. Including;

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.

2.2 ARCHEOLOGICAL SERVICES

A. Documentation and evaluation of archeological and historic resources shall be conducted by historic preservation professionals meeting the Secretary of the Interior's Standards.

B. Data Transfer: All sensitive archeological site location information will be submitted to the park electronically via the MS Teams project link to the park's cultural resource specialist. If submittals cannot be made via the MS Teams, submittals shall be made to the park via the Contractor's FTP transfer or encrypted USB Drives.

C. Documentation Forms: The Cultural Resource Program at the park follows a hybrid method of cultural resources documentation that fulfills the requirement of both the Colorado Office of Archaeology and Historic Preservation (OAHP) and National Park Service (NPS) for fulfilling compliance with Section 106 and Section 110 of the National Historic Preservation Act. The contractor will follow the RMNP Cultural Resource Documentation Form Guide (See 01 35 13 - Appendix A).

D. Geospatial data prepared for GIS Cultural Resource Geodatabase: ROMO will provide the contractor with a blank project geodatabase. The contractor shall follow ROMO Cultural Resource Survey GIS Data Management and Deliverables (see 01 35 13 - Appendix B) and the NPS Cultural Resource Spatial Data Transfer Standards (2014). Sites will be plotted on the appropriate USGS topographic maps. Collected data shall be < 1 meter in accuracy.

E. Photographs: The Contractor will follow the NRHP Submittal Standards (see link). A photo log will be completed and include the view, location, direction, and description of each image. Photography will follow the standards set out in the National Register of Historic Places and National Historic Landmarks Consolidated and Updated Photograph Policy 2024 (NRHP/NHL Consolidated Photograph Policy 2024): https://www.nps.gov/subjects/nationalregister/upload/NR-NHL-photo-policy-2024-01-02.pdf

F. Artifact Collection Guidelines. It is not anticipated that any artifacts or other archeological materials will be collected during the monitoring. If unusual or particularly significant diagnostic artifacts are discovered, the Park Archeologist shall be consulted, and their approval secured prior to collection.

2.3 ARCHEOLOGICAL MONITORING

A. The Contractor Shall perform archeological monitoring to identify and document any archeological deposits or features that may be revealed during ground disturbing construction activities.

B. The methodology shall consist of visual observation and monitoring of project activities with the potential to cause disturbance to surface/subsurface soils. The on-site monitor must be always present when ground disturbing project activities are being conducted.

C. On-site monitoring shall be documented using park specific/OAHP field forms and a daily field log, supplemented by photography and scaled drawings as required. GPS data collection shall include the location of identified archeological deposits, artifacts, and features.

D. As ground disturbance occurs, the archeological monitor shall examine excavated materials, using construction layout centerline and perimeter staking as a reference point to record locations of findings in addition to GPS data.

E. If the archeological monitor discovers potentially significant archeological resources or human remains, the monitor shall stop work in the area of the discovery and make a reasonable effort to protect the area from further disturbance and then immediately notify the CO, COR, and park archeologist.

F. The archeological monitor shall be empowered to stop and/or redirect ground disturbing activities in the event that a discovery of potentially significant archeological resources or human remains is made. If human remains are identified, the archeological monitor shall confirm the discovery in writing to the CO and the Cultural Resources Program Manager/Archeologist and the NPS will then develop and implement an appropriate course of action.

G. As directed by Cultural Resources Program Manager/Archeologist, the archeological monitor shall record, document, and assess the discovery using the appropriate ROMO Cultural Resource Documentation Form or CO OAHP Form (see 01 35 13 - Appendix A):
   1. ROMO Cultural Resource Documentation Forms - use for newly recorded resources and previously recorded resources if prior documentation was on CO OAHP form. Use this form for linear resources.
   2. OAHP Revisitation Form (1405) - use for previously recorded resources when a ROMO Cultural Resource Documentation Form or CO OAHP IF Form was completed within 5 years and there have been no significant changes to the resource.

H. The archeological monitor shall fully photo-document such discoveries and record: measurements, including dimensions of discoveries and depth at which they were identified; geospatial locations of discoveries using GPS with sub-meter accuracy; sediment types and Munsell colors observed for all identified strata; and excavation profiles through drawing and digital photography.

I. Artifacts shall undergo in-field analysis and be counted, measured, and photographed before being left at the site

J. Daily field notes shall be kept to document time on site, NPS and other contacts, and any other information relevant to describing project activities and supporting invoices.

K. Photographs shall be taken of each day's activities, and any potentially significant archeological deposits or features discovered. A photo log will be completed with information on each photo, including view, location, direction, and description of each image. Select photographs shall be included in the monitoring report. All photographs taken in the course of the project will be submitted to the NPS with the final deliverables. Photographic documentation of features or artifacts encountered shall include but not be limited to an appropriate scale, north arrow, and signboard describing the date, location, trinomial site number if associated with a recorded site and soil horizon if known. Specifications for taking (TIFF or RAW format) the photographs and labeling the files and disks shall meet the NRHP/NHL Consolidated Photograph Policy (2024), https://www.nps.gov/subjects/nationalregister/upload/NR-NHL-photo-policy-2024-01-02.pdf.

L. Artifact collection is not anticipated. If unusual or particularly significant diagnostic artifacts are discovered, the park archeologist shall be consulted, and their approval secured prior to

collection. If artifact collection is authorized, project documentation shall require preparation of artifacts for curation in consultation with the park archeologist/curator.

M. All final digital files pertaining to the project, including the final report in MS Word and PDF, and all graphics, maps plans, photographs, and supporting materials will be provided electronically.

2.4 REPORTING

A. Preliminary Report

1. The monitoring report shall include a summary of the undertaking and description of the project area. It shall include detailed documentation of archeological monitoring, investigations, and discoveries of archeological resources within the areas within the project area. This shall include high-resolution digital photography, and a narrative description of the field methods, and results. The report shall include the steps to taken to protect the resources and documentation of resource impacts.

2. The report should be organized by Description of Project/Undertaking, Environmental Setting, Cultural Historical Context, Class I File Search, Monitoring Methods, Results, Discussion and Conclusion.

3. Daily field notes and ROMO Cultural Resource Documentation Forms/OAHP Forms shall be included as appendices.

4. The report shall be prepared in accordance with the ROMO Class III Archeological Inventory Report and Documentation Form Standards (included with this section).

5. The contractor shall submit the geodatabase (zipped), compatible with ArcGIS Pro version 3.x

6. Existing cartographic standards for the NPS shall be incorporated into all GIS mapping deliverables. The following elements shall be incorporated into all GIS generated maps:
   a. All layers represented in the geographic extent must be identified and clearly labeled in the legend.
   b. Symbology in legend should match that in the geographic extent.
   c. Where applicable, include a set of reference maps (e.g., overview maps with plot locations, cities, roads).
   d. Include reference citations for all data layers reproduced in the map.
   e. Map will contain relative path name location of the document within the Project folder.

7. The draft report and documentation forms shall be complete, and reviewed by archeological contractor's subject matter expert, technical editor, and copy editor before submission to NPS. If the park begins review and finds any of the following the report and/or documentation forms will not be accepted:
   a. Three or more instances where NRHP eligibility recommendations are not consistent between the report and corresponding documentation form.
   b. Report sections are incomplete or missing.
   c. Report and/or documentation forms shall be free of typos, grammatical errors, or technical errors.

d. Documentation forms are not properly formatted and/or missing photos/map.
e. Two or more documentation forms are missing values for two or more data fields.

8. Draft report: (one copy (1) in MS Word and one (1) copy in Adobe Acrobat PDF with lines numbered on numbered pages. Draft site records: one (1) copy in MS Word and one (1) copy in Adobe Acrobat PDF of all site forms. Geodatabase: one (1) geodatabase (zipped), compatible with ArcGIS Pro version 3.x. Photographs: one (1) copy of all photographs following guidance in NRHP/NHL Consolidated Photograph Policy 2024 and one (1) copy of project photo log.
   a. The NPS will have thirty (30) calendar days to review the first draft report submittal and provide consolidated comments to the Contractor.
9. Revised draft report: (one copy (1) in MS Word and one (1) copy in Adobe Acrobat PDF with lines numbered on numbered pages of both copies. Revised draft site records: one (1) copy in MS Word and one (1) copy in Adobe Acrobat PDF of all site forms. Geodatabase: one (1) geodatabase (zipped), compatible with ArcGIS Pro version 3.x. Photographs: one (1) copy of all photographs following guidance in NRHP/NHL Consolidated Photograph Policy 2024 and one (1) copy of project photo log.
   a. Within twenty-one (21) calendar days of receipt of the NPS comments on the draft report, the Contractor shall revise the draft report and submit the revised draft report to the NPS for review. The NPS will have thirty (30) calendar days to review the revised draft report submittal and provide consolidated comments to the Contractor.

B. Final Report/Project Deliverables
1. Within fifteen (15) calendar days of receipt of the NPS comments on the revised draft report, the Contractor shall submit the final report and all associated documentation.
2. Deliverables:
   a. Final report: one copy (1) in MS Word and one (1) copy in Adobe Acrobat PDF. Five hard copies, spiral bound.
   b. Final site records: one (1) copy in MS Word and one (1) copy in Adobe Acrobat PDF of all site forms.
   c. Geodatabase: one (1) geodatabase (zipped), compatible with ArcMap or ArcPro.
   d. Photographs: one (1) copy of all project photographs in following guidance in NRHP/NHL Consolidated Photograph Policy 2024 and one (1) copy of project photo log.
   e. All field records - originals or copies of material associated with the project - including field notes.
   f. If applicable, archeological resources collected during the project shall be returned to Cultural Resources Program Manager/Archeologist for NPS cataloging, accessioning, and curation in ROMO's museum research facility.

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION ACTIVITIES

A. Kick-off meeting within 15 days of contract award with Park Cultural Resources Program Manager/Archeologist to discuss scope of project and the expectation for archeological services. Discuss ARPA permit process and required information.

B. Archeological Services Kick-off meeting: with Park Cultural Resources Program Manager/Archeologist and Subcontracted Principal Investigator (PI) and archeologists listed on

ARPA permit should be in attendance to discuss the following: scope of project and the expectations for archeological services. Identify additional information/research that is needed, provide information on previous cultural resource survey, previously recorded archeological resources, methods for flagging and avoiding known resources, methods for documenting newly identified resources or when boundaries of previously identified resources are expanded, and inadvertent discovery protocol.

C. The park will provide the contractor with the most recent survey information (GIS data, site forms/guidelines, survey reports) for the project vicinity.

D. Meeting within 15 days of approved ARPA permit with Park Cultural Resources Program Manager/Archeologist to review expectations of ARPA permit, identify any additional information that needs to be provided to park or to contractor.

E. Class I Files and Records Search: The Contractor will conduct an archeological file and literature review through the Office of Archaeology and Historic Preservation (OAHP). Additional records would be consulted, including general land office (GLO) records, historical maps, and other archival sources. Records are also available from Rocky Mountain National Park Cultural Resources Site Files, the park's Museum Storage Facility/Archives, and the Geographic Information System (GIS) data at the park. Other sources would include the documents and drawings available at the Technical Information Center (TIC) at the National Park Service offices in Lakewood, Colorado (also available through e-TIC). The Contractor should assume that research at the Estes Park Museum and Grand Lake area archives (County Courthouse, Grand Lake Historical Society, etc.) may be needed. A full range of document types will be sought in the research process to include site specific and regional archival data that reflects on the various periods of development and changes of the area. In particular, previous studies/reports on the area, historic photographs, site development plans, maps, and other planning documents should be part of this research effort. Aerial photographs and other sources will be identified in consultation with the NPS.

3.2 BARRICADES

A. Comply with requirements specified in Section 01 50 00 "Temporary Facilities and Controls."

3.3 DISCOVERY OF RESOURCES

A. Archeological Findings

1. Artifacts, burial grounds or remains, structural features, ceremonial, domestic, and archeological objects of any nature, historic or precontact, found within the construction area, are the property of and will be removed only by the Government. Should Contractor's operations uncover or his employees find any archeological remains, Contractor shall suspend operations at the site of discovery; notify Contracting Officer or their representative immediately of the findings; and continue operations in other areas. Included with the notification shall be a brief statement of the location and details of the findings. Should the temporary suspension of work at the site result in delays, or the discovery site require archeological studies resulting in delays or additional work for

Contractor, the Contractor will be compensated by an equitable adjustment under the General Provisions of the Contract.

2. The Archeological Monitor will identify and document the discovered resource and an appropriate mitigation strategy will be developed if necessary. If necessary, the NPS Cultural Resource Specialist will consult with the State Historic Preservation Officer (SHPO) in accordance with 36 CFR Part 800.13, Post-review Discoveries.

B. Human Remains

1. If human remains are discovered, the contractor will cease all work, secure the area, and immediately notify the COR, CO, and Cultural Resource Specialist of the discovery. The NPS Cultural Resource Specialist will follow procedures outlined in the Native American Graves Protection and Repatriation Act (NAGPRA) to protect the site.

C. Confidentiality:

1. All archeological discoveries are confidential and information about those discoveries will remain confidential to the extent that they meet the definitions set forth at Section 304 of the National Historic Preservation Act, Section 9 of the Archeological Resources Protection Act, Native American Graves Protection and Repatriation Act, and similar legislation.

D. Additional Findings

1. In addition to archeological findings uncovered by Contractor's operations, if an Archeological Monitor, NPS Cultural Resource Specialist, Contracting Officer Representative, or Inspector discovers archeological resources in the area of work, suspend operations at the site of discovery as specified above. Delays; mitigation, if necessary; and further compliance consultation will be handled as specified above.

END OF SECTION 01 35 13

01 35 13 - Appendix A

ROMO Class III Archeological Inventory Report and Documentation Form Standards

Report Organization:

Cover Page
Inside Cover
Abstract
Table of Contents
Figures
Tables
OAHP 1421 Form or Equivalent
Project Area Map (Maps)
Introduction
    Description of Undertaking and Disturbance (if applicable – Section 106)
    Description of Purpose of Survey (Section 110)
    Project Location(s)
    Size of Project
    Description of Fieldwork
Environment
    Present Environment
    Geology/Hydrology
    Flora/Fauna
    Land Use Patterns
    Resource Use Potential
Cultural History and Previous Work
    Cultural Context
    File Search
    Historic Research
    Previous Survey/Research
    Known Cultural Resources
    Expected Results
Statement of Objectives
Field and Laboratory Methods
    Site and Isolate Definitions (park specific, definition below)
    Field Methods
    Artifact Analysis Methods
Extent of Survey Coverage and Field Conditions
    Photographs and Maps
Collection (if applicable)
    Laboratory Methods (if applicable)
    Curation (if applicable)
Results and Evaluations (organize by geographic area/project area)
    Previously Recorded Sites
    Newly Recorded Sites
Isolated Finds
Project Summary and Recommendations
References
Appendices

Report shall include the following:

Throughout Report

- Follow the Society for American Archaeology (SAA) Style Guide.
- Report should be written in an active voice and concise.

- Spelling of archeology/archaeology. Federal spelling is without the a, make sure archeology, archeologist, archeologists, and archeological are spelled without the second 'a' unless referencing law/policy (Archaeological Resources Protection Act) or company or organizational name (Centennial Archaeology, NAU Archaeology Program).
- If report includes multiple project locations, assign project area names to each location, and organize Results and Evaluations by project area.
- NPS recognizes buildings, structures, and sites. When referring to a building used for human shelter (office, house, church, etc.) use the word building; when referring to a structure (bus stop, road, trail, etc.) use the word structure; when referring to an archeological site (lithic scatter, depression, homestead, etc.) use the word site. It's fine to use "resource" as well. Do not use "sites" to reference extant buildings, structures (trails, roads, irrigation ditches, etc..). For example, a historic trail segment should not be referred to as a site.
- References to buildings should include the full building name, followed by the trinomial, CRIS #, and Building or Structure Number.
    - Example: Beaver Meadows Visitor Center (5LR9947, 052765, B-447)

Abstract/Introduction

- Refer to the park in the Abstract/Introduction as Rocky Mountain National Park (Park). Use Park throughout the document. Do not use ROMO or ROMO.

Table of Contents

- Text should not exceed one line for each item listed in the Table of Contents, List of Tables, or List of Figures.

Project Area Maps (Maps)

- Include an overview map of the park showing the APE/project location(s).

Field and Laboratory Methods

- Site Definition - For the purposes of cultural resource identification at the park, a cultural resource is defined as a geographic location containing the remains of past human activities or events shown by artifacts, ecofacts, features, or structures that are at least 50 years old. Cultural sites may vary in density from 10 or more artifacts in a 10-meter diameter area, to a single feature with or without artifacts, to a large complex group of features, structures, and artifacts. An exception is when all items originate from a single object such as a pot or bottle break, which are classified as isolated finds (IF). An area with fewer than 10 artifacts of a single artifact type will be recorded as an IF.

Results and Evaluations

- Include CRIS Numbers in Resource Descriptions. The Park will provide CRIS Numbers to the contractor.
- Resource Descriptions in order by Smithsonian Number:
    - Include current description of the resource
    - Literature review/previous documentation
    - NRHP Eligibility Recommendation (this should include previous NRHP recommendation and date)
    - Management Recommendations
        - Avoid and Protect: (precontact, protohistoric, and historic resources that are eligible, listed, need data)
            - ROMO Site Form: Treatment Proposed: should be Protection
        - No Further Work: site is not eligible
            - ROMO Site Form: Treatment Proposed: No Action
        - Preserve Historical Integrity: (historic trails, roads, buildings, etc.)
            - ROMO Site Form: Treatment Proposed: should be Protection
    - Include site map for each resource
- Maps showing resources that are eligible/listed/need data within the project area(s).
- Overview maps and site maps must be clearly legible and may require 11 x 17 foldout

Documentation Forms Shall Include the Following:

- Follow ROMO Class III Cultural Resources Inventory Report and Documentation Form Standards (this document).
- Follow ROMO Cultural Resource Documentation Form Guide.
- ROMO Cultural Resource Documentation Forms: Preserve page formatting: Page 2 starts with CULTURAL SUMMARY; Page 3 starts with ENVIRONMENTAL DATA; Page 4 starts with CONDITION; Page 5 starts with NATIONAL REGISTER EVALUATION; Page 6 starts with ADMINISTRATIVE AND MANAGEMENT DATA; Page 7 starts with SITE NARRATIVE. Use continuation pages if needed (location information can be included on continuation page).
- OAHP Isolated Find Forms shall include at least one overview photograph of the resource.
- Follow the Society for American Archaeology (SAA) Style Guide for ROMO Site Documentation Form.
- Text should be concise and written in an active voice.
- Refer to the park intext as Rocky Mountain National Park (Park). Use Park throughout the document. Do not use ROMO or ROMO.
- Spelling of archeology/archaeology. Federal spelling is without the a, make sure archeology, archeologist, archeologists, and archeological are spelled without the a unless referencing law/policy (Archaeological Resources Protection Act) or company or organizational name (Centennial Archaeology, NAU Archaeology Program).
- NPS recognizes buildings, structures, and sites. When referring to a building used for human shelter (office, house, church, etc.) use the word building; when referring to a structure (bus stop, road, trail, etc.) use the word structure; when referring to an archeological site (lithic scatter, depression, homestead, etc.) use the word site. It's fine to use "resource" as well. Do not use "sites" to reference extant buildings, structures (trails, roads, irrigation ditches, etc..). For example, a historic trail segment should not be referred to as a site.
- References to buildings should include the full building name, followed by the trinomial, CRIS #, and Building or Structure Number.
    - Example: Beaver Meadows Visitor Center (5LR9947, 052765, B-447)
- Each electronic documentation form file will be named using the following naming convention:
    - 5GA00###_SiteForm_2020.pdf, 5BL0####_SiteForm_2020.pdf, or 5LR0####_SiteForm_2020.pdf. Replace SiteForm with IFForm, ArchitecturalForm, or LinearForm as applicable.

01 35 13 - Appendix B

ROMO Cultural Resource Survey GIS Data Management and Deliverables (2020)

Contractor shall collect data in NAD 83 2011 UTM Zone 13N and use a data collection device capable of sub meter accuracy. The contractor must submit within a file geodatabase and the contractor is responsible for populating every field in the attribute table (except GUIDs) unless specifically discussed during the project kickoff meeting. The contractor shall ensure GIS data is secure and not uploaded to AGOL or other web-based data collection service.

Rocky Mountain National Park requires the contractor to deliver GIS data to the park in two ways:

1. Original "raw" GIS data collected in the field
2. Processed GIS data that matches the park's cultural geodatabase schema.

Original "raw" GIS data refers to any files originally collected using a Trimble, mobile device, or other high-accuracy GNSS device. The most common formats of raw data formats may include GPX, SSF, XLS, MDB, ACCDB, SHP, and GDB. These data need to simply be downloaded off devices, compiled in a single folder, compressed, and sent to the park.

Processed GIS data that matches the park's geodatabase schema refers to data that have been properly loaded or copied into a File Geodatabase. This will ensure that the data are efficiently integrated into the park's master GIS database.

The park will provide the contractor with an XML workspace document and an empty geodatabase that matches the park's master database schema. The blank geodatabase provided to the contractor will include required feature classes, metadata, and all established fields and domains. Separate guidance documents will be provided to the contractor that will explain the database structure and list the data requirements.

The contractor can use the append tool, copy and paste function, and other geoprocessing tools in GIS to properly migrate data from the contractor's format to the park format. However, the contractor shall review the park's database schema before beginning field work. The contractor should consider creating data dictionaries or a database schema that closely matches the park's before conducting field work.

If the contractor collects data in a new field that cannot be integrated into the park's existing schema but believes the additional field is important for contributing important information, the contractor has one of two options.

1. The contractor may include additional fields in the final deliverable; however, the contractor may not delete fields included in the park's schema.
2. The contractor can include the additional data in the generic comments field (in the park's database).

Before adding data to the comments field or adding a new field to a table, the contractor should first seriously consider if the data could be added to an existing field.

If documentation or potions of the database schema are unclear, the park's GIS Specialist can provide technical guidance; however, it is the ultimate responsibility of the contractor to completely populate the database for delivery to the park.

The Cultural Resource Table Domain Guidance and Symbology Standards to be used will be provided for each feature layer upon contract award.

SECTION 01 35 23 - SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes establishing an effective accident prevention program and providing a safe working environment for personnel and visitors.

1.2 CONDITIONS PRESENT FOR PROJECT

A. Winter weather conditions include low temperatures and high snowfall; wildlife include but are not limited to moose, elk, deer, and bird. Confined spaces, water, electrocution, trenching, scaffolding, crane and lifting equipment procedures, wildlife, weather, hazardous materials, flooding, fatigue, heat, cold, among many other requirements are present.
   1. Wildfire issues may result in local fire restrictions.
   2. Wildlife interactions shall be minimized for everyone's safety.
      a. No feeding the wildlife.
      b. Food storage regulations shall be followed.
      c. Bear, mountain lion, and any unusual sightings shall be reported to the Contracting Officer.
   3. The contractor is recommended to include these subjects in the weekly safety meeting on an ongoing basis.

1.3 SUBMITTALS

A. Accident Prevention Plan (APP): Submit APP after contract award and before Pre-Construction conference. Contracting Officer (CO) will review proposed APP. If APP requires any revisions or corrections, Contractor shall resubmit Plan within 10 days. No progress payments will be made until the APP is accepted.

1.4 QUALITY ASSURANCE

A. Comply with contract clauses "Accident Prevention" and "Permits and Responsibilities." In case of conflicts between Federal, State, and local safety and health requirements, the most stringent shall apply. Onsite equipment shall meet 29 CFR 1926 (Code of Federal Regulations) (Occupational Safety and Health Administration (OSHA)) requirements. Failure to comply with requirements of this section and related sections may result in suspension of work.

B. Site Safety Supervisor:

   1. Designate authorized onsite representative for preparation and maintenance of the APP.
      a. Site Safety Supervisor is permitted to have other roles and responsibilities.

   2. Shall be responsible for:

a. Implementation and enforcement of the APP
b. Daily safety inspections
c. Conducting and documenting weekly and monthly safety meetings
d. Review of safety requirements at progress meetings
e. Compilation and maintenance of Safety Data Sheets (SDS) and safety reference materials
f. Tracking and resolution of safety violations
g. Site personnel and visitor compliance with site safety and health requirements and APP
h. Investigation and reporting of accidents and injuries

C. Qualifications of Employees:

1. Physically able to perform their assigned duties in a safe manner.
2. Do not allow employees whose ability or alertness is impaired because of prescription or illegal drug use, fatigue, illness, intoxication, or other conditions that may expose themselves or others to injury to perform work.
3. Provide operating instructions for equipment. Operators of vehicles, hoisting equipment, and hazardous plant equipment shall be able to understand signs, signals, operating instructions, and be fully capable of operating such equipment. Retain copies of operator licenses and certifications onsite.

1.5 ACCIDENT REPORTING

A. Reportable Accidents: Defined as: death, occupational disease, and/or traumatic injury to employees or the public; fires; and/or property damage by accident in excess of $100.

1. Notify Contracting Officer immediately in the event of a reportable accident.
2. Fill out and forward an Accident/Property Damage Report Form (CM-22) to Contracting Officer within 7 days of a reportable accident. Obtain form from Contracting Officer.

B. All Other Accidents: The Contractor shall report all other accidents to the Contracting Officer as soon as possible and assist the Contracting Officer and other officials as required in the investigation of the accident.

PART 2 - PRODUCTS

2.1 ACCIDENT PREVENTION PLAN (APP)

A. APP shall be written to comply with OSHA and project requirements (generic plan is not acceptable) including but not limited to:

1. Name and qualifications of supervisor responsible to carry out program.
2. Weekly and monthly safety meetings shall be documented with topics and attendees.
3. First aid and rescue procedures.
4. Job Hazard Analysis (JHA) for each major phase. List of hazards associated and methods proposed to provide for property protection and safety of the public, National Park Service personnel, and Contractor's employees. Include initial and continuing training.

5. Planning for possible emergency situations, as detailed in Article 1.2. Such planning shall take nature of construction, site conditions, and degree of exposure of persons and property into consideration.
6. Fire protection plan (including hot work).
7. Fall protection plan.
8. Hazardous communications plan.
9. Infectious Disease Preparedness:

    a. Contractors are responsible for their employees' safety and the safety of job site visitors during the performance of this contract. We encourage Contractors to follow guidance from the Department of Labor (DOL), Occupational Safety and Health Administration (OSHA), the Centers for Disease Control and Prevention (CDC), and all other applicable local, city, and state mandates. We encourage Contractors to develop policies for infection prevention and an Infectious Disease Preparedness and Response Plan.
    b. To the extent appropriate, Contractors should include the protective health and safety measures they intend to implement in any accident prevention or safety submittals required under this contract. These plans should contain preventive measures the Contractor intends to follow while performing work on government property as well as responsive and corrective actions to be taken if an employee exhibits symptoms or tests positive for contagion.

2.2 FIRST AID FACILITIES

A. Provide adequate facilities for number of employees and appropriate to construction hazards.

2.3 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

A. Selection shall conform to OSHA Subpart E.

PART 3 - EXECUTION

3.1 DAILY SAFETY INSPECTIONS

A. Conduct daily safety inspections and maintain daily safety reports which include:
    1. Area/operation inspected
    2. Date of inspection
    3. Identified hazards
    4. Corrective actions taken

3.2 EMERGENCY INSTRUCTIONS

A. Post telephone numbers and reporting instructions for ambulance, physician, hospital, fire department, and police in conspicuous locations at work site.

3.3 FIRE AND LIFE SAFETY

A. Comply with requirements of 2024 International Fire Code.

3.4 HAZARDOUS MATERIALS

A. Hazardous materials: Explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful substances that could cause death or injury.

B. Store hazardous materials in accordance with manufacturer's and OSHA Subpart D requirements. Maintain Safety Data Sheets (SDS) for each chemical readily available on site.

1. Immediately report spills of hazardous materials to the Park.
2. Maintain a spill emergency response kit.
3. Train employees how to respond to a spill and use emergency response kit.

3.5 PROTECTIVE EQUIPMENT

A. Inspect personal protective equipment daily and maintain in a serviceable condition. Clean, sanitize, and repair personal items as appropriate before issuing to another individual.

3.6 SAFETY MEETINGS

A. As a minimum, conduct one weekly 15-minute "toolbox" safety meeting conducted by a foreman or supervisor and attended by construction personnel at worksite. Topics shall coincide with work scheduled for following week. Document and submit meeting minutes to Contracting Officer within one day after meeting.

B. Conduct monthly safety meetings for personnel, contractors, and subcontractors performing work on the site. Notify Contracting Officer of meeting dates and times. Meetings shall be used to: review effectiveness of Contractor's safety effort; resolve current health and safety problems; provide a forum for planning safe construction activities, and for updating Accident Prevention Plan. Contracting Officers Representative will attend meetings and enter results of meetings into the daily log.

3.7 HARD HATS AND PROTECTIVE EQUIPMENT AREAS

A. A hard hat use area shall be designated by Contractor. Hard hat area shall be posted by Contractor in a manner satisfactory to Contracting Officer.

B. It is Contractor's responsibility to require persons working on or visiting site to wear hard hats and PPE in good repair at all times. As a minimum, maintain two hard hats and other APP required equipment.

3.8 TRAINING

A. First Aid: Provide training to personnel to ensure prompt and efficient first aid.

B. Hazardous Material: Train and instruct each employee exposed to hazardous material in safe and approved methods of handling and storage.

END OF SECTION 01 35 23

SECTION 01 35 91 - HISTORIC PRESERVATION TREATMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special procedures for historic treatment on Project including, but not limited to:

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. Historic preservation treatment procedures
8. Protection, General
9. Temporary protection of historic materials during construction.
10. Protection during application of chemicals
11. Protection during use of heat-generating equipment

B. Kawuneeche Visitor Center (KVC) is a one-story Park Service Modern style building constructed in 1968–1969 with additions constructed in 1989 and 1999. This building is eligible for listing on the National Register of Historic Places as an example of historic Mission 66 architecture. It is noted as significant under Criterion A in the area of Community Planning and Development as well as Criterion C in the area of Architecture. The Secretary of the Interior Standards for the Treatment of Historic Properties has been integrated into the design and has been approved through compliance reviews. Refer to Appendix A for additional information.

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 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 they are-not original fabric.

E. "Stabilize": To apply measures designed to reestablish a weather-resistant enclosure and structural reinforcement of an item or portion of the building while maintaining 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 New Materials: Includes replacement with new material of like kind (custom fabricated of manufactured) that is currently in production. It means duplication of appearance using like material.
   2. 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 ready for reuse.

K. "Remove and Reinstall": To detach items from existing construction, store in protected place, 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 contract award and before Pre-Construction conference, submit for approval a written Historic Preservation Treatment Plan (HPTP). Submit a written plan for each phase or process including protection of surrounding materials during operations. Describe in detail materials, methods, and equipment to be used for each phase of work.

2. If the plan requires revisions or corrections, Contractor shall resubmit plan within 10 days.
3. No change in approved plan may be made without written concurrence by Contracting Officer.

B. Coordination Drawing of Exhibit Room 101 and 102 ceiling indicating existing and new penetrations sizes and locations with emphasize on alignment of new installations as indicated on the Drawings. Drawing shall include anticipated finishes of all new and existing fixtures.

C. 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.

D. Photographs or Video: In accordance with Section 01 32 33 "Photo Documentation," 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.
1. The Contractor will follow the NRHP Submittal Standards (see link). A photo log will be completed and include the view, location, direction, and description of each image. Photography will follow the standards set out in the National Register of Historic Places and National Historic Landmarks Consolidated and Updated Photograph Policy 2024 (NRHP/NHL Consolidated Photograph Policy 2024): https://www.nps.gov/subjects/nationalregister/upload/NR-NHL-photo-policy-2024-01-02.pdf

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.

B. Supervisory Personnel: Must have at least 10 years' experience in the field of historic preservation treatment.

1.5 REFERENCES FOR BUILDING TREATMENT

A. Colorado Cultural Resource Survey, Architectural Inventory Form, Determination of Eligibility (See Appendix A)

B. Character Defining Features – Requiring Additional Care
1. Vertical steel and wood clad columns at the corners of the Administrative Wing, Visitor Center, and covered walk
2. Inverted corners of the Visitor Center clad in native stone
3. Glass curtain walls of the Visitor Center
4. Broad, windowless stone wall at west end of the Administrative Wing
5. Wood post and beam light poles with globe lights in the parking lot
6. Low benches that are integrated in the covered walk and are freestanding along the east side of the parking lot and sidewalk

7. Wood plank ceiling of the Visitor Center

1.6 STORAGE AND PROTECTION OF HISTORIC MATERIALS

A. Removed and Salvaged Historic Materials:

1. Clean salvaged historic items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in secure area until delivery to Contracting Officer.
4. Transport items to storage area designated by Contracting Officer.
5. Protect items from damage during transport and storage.
6. 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. 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 as designed.
5. Wood plank ceiling, which must be replaced in exactly the same location, number panels on the back as they are removed and create a visual (annotated photo or drawing) representation of the original locations to aid reinstallation. Thorough coordination of systems installations in this ceiling is critical.

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 suitable, protected storage location during historic treatment and cleaned and reinstalled in their original locations after historic treatment operations are complete.

D. Storage and Protection: When removed from existing location, store historic materials within weather-tight enclosure 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 original location.
2. Develop key plan when many similar items are scheduled for removal and reinstallation.
3. Ensure that the containers used for storage are pest free, including rodent and insects.

1.7 PROJECT-SITE CONDITIONS

A. Exterior Cleaning and Repairing:

1. Proceed with 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 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 air temperature is below 40 degrees Fahrenheit (5 degrees Celsius).
c. Do not begin cleaning, patching, or repairing given likelihood of frost or freezing.
d. Do not begin cleaning when either air or surface temperature is below 45 degrees Fahrenheit (7 degrees Celsius) unless approved means are provided for maintaining 45 degrees Fahrenheit (7 degrees Celsius) temperature of air and materials during, and for 48 hours subsequent to, cleaning.

2. Perform cleaning and rinsing of the exterior only during daylight hours.

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, coordination, 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).

B. The Historic Preservation Treatment Plan shall cover the following topics, at a minimum:
1. Worker training regarding the site's history, cultural sensitivity and Secretary of the Interior's guidance with the regard to the treatment of historic properties.
2. Protection of existing historical elements to remain during the removal of adjacent material systems, elements, etc.
3. Removal and salvage of existing wood plank ceiling for reinstallation. Including careful coordination of new installations to minimize penetrations in existing wood planks.
4. Rehabilitation of wood post and beam light poles with globe lights in the parking lot.
5. Replacement of historic steel windows in the Admin Wing with special attention to the removal of non-historic interior trim and historic exterior trim.

C. Review Preservation Plan and historic preservation priorities in detail with park at a pre-construction meeting prior to the start of any demolition. May be combined with pre-construction meeting detailed in Section 01 31 00 “Project Management” with the approval of the Contracting Officer.
   1. Review extent of asbestos abatement removal
   2. Review removed devices (re: mechanical and electrical)
   3. Review coordination of Visitor Center wood plank ceiling removal and reinstallation including coordination with all trades and penetrations.

3.2 HISTORIC PRESERVATION TREATMENT PROCEDURES

A. Refer to material specific rehabilitation specifications for material specific procedures and evaluation criteria.

B. 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".

C. Materials requiring cutting/patching:
   1. Gypsum board: Provide infill patch with gypsum wallboard at removed devices, doors, windows, etc.; texture to match existing; paint entire wall.
   2. Wood panel at removed devices: Provide new metal face plate, brushed brass finish (final finish to be confirm through submittal process), overlap surrounding wood by 1/4" minimum.
   3. Wood panel at drilled/cored abandoned penetration: Clean rough edges by enlarging hole minimum of 1/4" or until the edges are smoothed; provide wood plug to match grain pattern and species; stain to match existing.
   4. Interior and exterior wood trim: Provide wood patch to match grain pattern and species; stain to match existing.

D. Smoking is prohibited in and around the building. It shall be permitted in the fenced staging area only, provided that it is greater than 25 feet from the building.

E. Notify Contracting Officer of visible changes in integrity of material or components 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 work in question until directed by Contracting Officer.

F. 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. In some cases, materials are to be salvaged and returned to the park for archiving. Refer to Section 02 41 91 “Selective Historic Demolition” for more specific information.

G. Identify new or replacement materials and features with inconspicuous, permanent marks (including the date of installation, if possible) on areas not observable by the public to distinguish them from original materials. Record the legend of identification marks and the locations of these marks on Record Drawings.

H. 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.

3.3 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 supervisory personnel are present when work begins and during 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.
3. Items requiring protection during demolition and construction (not all are historic):
   a. Historic wood ceiling in Exhibit space.
   b. Historic light fixtures.
   c. IT equipment in Room 110.
   d. Wood paneling in Rooms: Hall 108, Wilderness Desk 107, Exhibit 101, Exhibit 102, Vestibule 100.
   e. Wood base and trim throughout the building.
   f. Exterior wood-clad steel columns.
   g. Exposed wood ceiling at exterior walkway.
   h. Historic benches at exterior where indicated on plan.
4. See also Section 02 41 91 “Selective Historic Demolition” for procedures and submittals.

D. Protect landscape work adjacent to or within work areas as follows:

1. Provide barriers to protect tree trunks.
2. Bind spreading shrubs.
3. Coverings shall allow plants to breathe. Remove coverings at end of day. Do not cover plant material with waterproof membrane more than 8 hours at a time.
4. Set scaffolding and ladder legs away from plants.

E. Existing Drains: Prior to start of work or cleaning operations, test drains and other water removal systems to ensure drains and systems function properly. Notify Contracting Officer immediately

of stopped or blocked drains or systems. Do not begin Work of this Section until drains are in working order.

1. Provide method to prevent solids including stone or mortar residue from entering drains or drain lines. Clean out drains and drain lines blocked or filled 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.

3.4 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 Section 01 50 00 "Temporary Facilities and Controls."

C. Cover adjacent surfaces with materials proven to resist chemical cleaners selected for Project unless chemicals being used will not damage adjacent surfaces. Use covering materials containing only waterproof, UV (ultraviolet)-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. Promptly remove masking to prevent adhesive staining on completion.

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 preventing soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

G. Document daily clean-up, proper storage, and disposition of any flammable/combustible materials with daily reports.

3.5 PROTECTION DURING USE OF HEAT-GENERATING EQUIPMENT

A. Comply with 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 appropriate hot work permit from the park as required.

2. As far as practical, use heat-generating equipment in shop areas or outside building.

3. Before work with heat-generating equipment commences, furnish 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 combustible gas indicator test to ensure area is safe.
5. Remove and keep 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 spraying of sparks or hot slag into surrounding combustible material.
7. Prevent 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 day's work not sooner than 30 minutes after completion of operations to detect hidden or smoldering fires; ensure proper housekeeping is maintained.

END OF SECTION 01 35 91

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements. Quality of work shall be 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 Contract Document requirements.

C. See Divisions 2 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 actual products incorporated into the work and completed construction comply with requirements.

C. Mockups: Full-size physical assemblies constructed on-site. Mockups are constructed from selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Approved mockups establish the standard by which the Work will be judged, unless otherwise indicated.

D. Preconstruction Testing: Tests and inspections performed specifically for project before products and materials are incorporated into work to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections 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.

F. Source Quality Control Testing: Tests and inspections performed at the source, i.e., plant, mill, factory, or shop.

G. Field Quality Control Testing: Tests and inspections performed on-site for installation of work and for completed work.

H. Testing Agency or Laboratory: Entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. 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 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 corresponding generic name.

1.3 CONFLICTING REQUIREMENTS

A. Reference Standards: If compliance with two or more standards is specified and standards establish different or conflicting requirements for minimum quality levels, comply with most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Contracting Officer before proceeding.

B. Minimum Quality Levels: Quality level shown or specified shall be minimum provided or performed. Actual installation may comply exactly with minimum quality specified, or it may exceed minimum within reasonable limits. To comply with requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Contracting Officer before proceeding.

1.4 SUBMITTALS

A. Quality Control Plan:

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

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

C. Contractor Quality Control (CQC) Daily Reports: Submit showing inspections and tests on first workday following date covered by report. Quality Control Supervisor shall utilize DSC Forms.

1. Review Construction Management Representative (CMR) Daily report if applicable and reconcile any differences prior to posting.

D. Test Reports

1. Test reports shall be completed by person performing 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 test was performed.

E. Accessibility Inspection Report:

1. Fill out applicable sections of the Accessibility Inspection Report and attach to Contractor Quality Control Daily Report.
2. Utilize attached Accessibility Inspection form to document compliance with Architectural Barriers Act Accessibility Standards (ABAAS).
3. Inspect at various stages of construction as needed to ensure finished product meets standards.
   i. Utilize 2' smart level to measure slopes for ABAAS compliance.
4. Submit report no later than one calendar day after inspection was performed.

F. Off-Site Inspection Reports: Submit prior to shipment.

G. If Contractor Quality Control plan and Quality Control Daily Reports are not submitted as specified, Contracting Officer may retain payments until such time plan(s) is/are accepted and implemented, or may retain payments for work completed on days with no Quality Control Daily Reports.

H. Permits, Licenses, and Certificates: For National Park Service (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 work.

1.5 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Contractors Quality Control Staff:

1. Contractor's Quality Control Supervisor shall be assigned no other duties.
2. Contractor's designated Quality Control Supervisor shall be on the project site whenever contract work is in progress.

C. Installer Qualifications: Firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent indicated for Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: Firm experienced in manufacturing products or systems similar to those indicated for Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Fabricator Qualifications: Firm experienced in producing products similar to those indicated for Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

F. Professional Engineer Qualifications: Professional engineer legally qualified to practice in jurisdiction where Project is located and is experienced in providing engineering services of kind indicated (including Structural Tests and Special Inspections (STSI)). Engineering services are defined as those performed for installations of system, assembly, or products similar to those indicated for Project in material, design, and extent.

G. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing Work.

2. Substituted workers, if required, shall meet all required qualification requirements indicated.

H. Testing Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or an independent agency with experience and capability to conduct testing and inspecting indicated, according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by Contract, is acceptable to Contracting Officer.

1. Nationally Recognized Testing Laboratory (NRTL): Nationally recognized testing laboratory according to 29 CFR 1910.7 (Code of Federal Regulations).
2. National Voluntary Laboratory Accreditation Program (NVLAP): Testing agency accredited according to National Institute of Standards and Technology's (NIST) National Voluntary Laboratory Accreditation Program.
3. Measuring devices, laboratory equipment, and instruments shall be calibrated at established intervals against certified standards in accordance with NIST requirements. Measuring and testing devices shall be made available for use by Government for verification tests.

I. Factory-Authorized Service Representative Qualifications: Authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products similar in material, design, and extent to those indicated for Project.

J. Mockups: Refer to Appendix E – Mock-Up List for summary of anticipated mockups. List may not be all-inclusive and Contractor shall refer to each specification section for confirmation on requirements. Before installing portions of work requiring mockups, build mockups for each form of construction and finish required to comply with following requirements, using materials indicated for completed work:

1. Build mockups in location and of size indicated; if not indicated, as directed by Contracting Officer.
2. Notify Contracting Officer seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate proposed range of aesthetic effects and workmanship.

4. Obtain Contracting Officer's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups in an undisturbed condition as a standard for judging the completed work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.6 QUALITY CONTROL

A. Contractor is responsible for testing and inspections, including Structural Tests and Special Inspections (STSI), as identified in attached STSI. Inspect and test work as needed to ensure 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 qualified testing agency to perform quality-control services.
2. Submit appropriate report for each quality-control service.
3. Testing and inspecting requested by Contractor and not required by Contract Documents are Contractor's responsibility.
4. Contracting Officer may designate test locations.

B. Government will engage a third-party inspector to perform routine inspections as identified in the attached Inspection Checklist. Contractor shall coordinate with, cooperate with, and remedy any issues posed by this inspector and confirmed by the Contracting Officer.

C. Manufacturer's Field Services: Where indicated, engage factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

D. 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 of replaced work that failed to comply with Contract Documents.

E. 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 work during performance of services.
2. Determine location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, State in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit 3 copies of certified written report of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase Contract Document requirements or approve or accept any portion of Work.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide:

1. Access to 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 material mixes that require control by testing agency.
7. Security and protection for samples and testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with minimum delay and to avoid 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. Quality Control Plan shall include:

1. List of personnel responsible for quality control and assigned duties. Include each person's qualifications. Include alternate(s) and qualifications.
2. Copy of letter of direction to Contractor's Quality Control Supervisor(s) outlining assigned duties and authorities designated by principal or owner.
3. Names, qualifications / accreditations, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms from laboratories.
4. Methods of performing, documenting, and enforcing quality control of work including Contractor report forms and acknowledgment of NPS forms.
5. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.
6. Specific discussion regarding mockups, off-site visits, receiving inspections, manufacturers representation, startup requirements, and other aspects of performance specific to Project.
7. Provisions for substantial completion(s) and final inspection(s) per Contract.

PART 3 - EXECUTION

3.1 OFF-SITE CONTROL

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

3.2 ON-SITE CONTROL

A. Notification:

1. Notify Contracting Officer at least 48 hours in advance of preparatory phase meeting.
2. Notify Contracting Officer at least 24 hours in advance of 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, Contractor's Quality Control Supervisor and foreman responsible for feature of work shall be in attendance.
2. Review applicable specifications sections and drawings related to feature of work.
3. Ensure copies of referenced standards related to sampling, testing, and execution for feature of work are available on site.
4. Ensure provisions have been made for field control testing.
5. Examine work area to ensure preliminary work has been completed.
6. Verify field dimensions and advise Contracting Officer of discrepancies with contract documents.
7. Ensure necessary equipment and materials are at project site and they comply with approved shop drawings and submittals.
8. Document preparatory phase activities and discussions on Contractor's Quality Control Daily Report.

C. Initial Phase:

1. As soon as work begins, inspect and test representative portion of particular feature of work for quality of workmanship.
2. Review control testing procedures to ensure compliance with contract requirements.
3. Document initial phase activities and discussions on 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 same feature of work for following reasons:

1. Quality of on-going work is unacceptable.
2. Changes in quality control staff, on-site production supervision, or work crew.
3. Work on particular feature of work is resumed after substantial period of inactivity.

3.3 DOCUMENTATION

A. Maintain Quality Control Daily Reports, Daily Test Report Information Sheets, and Accessibility Inspection Reports of quality control activities and tests. (Download from DSC Workflows website > Forms/Templates/Samples/Guidelines page > Construction Forms section.)

B. Quality Control Daily Reports shall not be substituted for other written reports required under clauses of contract, such as Disputes, Differing Site Conditions, or Changes.

C. Quality Control Daily Reports shall accurately portray all work and materials. The materials shall match the materials as approved from the Construction Documents (CD) requirements. Combustible/flammable materials shall be documented as well.

3.4 ENFORCEMENT

A. Contractor shall stop work on any item or feature pending satisfactory correction of deficiency noted by quality control staff or 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. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams as invisible as possible.
2. Comply with Contract Document requirements for Section 01 73 29 "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

Construction Management Representative (CMR) & Contractor Quality Control (CQC) Daily Report

National Park Service (NPS) - Denver Service Center (DSC) | 2-6-18

REPORT NUMBER		PROJECT MANAGEMENT INFORMATION SYSTEM NUMBER (PMIS No.):	

PROJECT	CONTRACT NUMBER	DATE
PARK	CONTRACTOR	CMR REPORTING

WEATHER (Rain, Snow, Cloudy, Windy)	MOISTURE AMOUNT (INCHES)	TEMPERATURE		WEATHER DELAY	DESCRIBE WEATHER DELAYED WORK	GROUND CONDITIONS (Dry, Damp, Wet, Frozen)
		MAXIMUM	MINIMUM	Yes ☐ No ☐		

PRIME CONTRACTOR:

EMPLOYEES BY JOB CATEGORIES	NUMBER	HOURS	EQUIPMENT ON JOB (Include model, manufacture, size, year.)	NUMBER OF UNITS	EQUIPMENT HOURS WORKING		
					YES	STANDBY	MOBILIZED/ DEMOBILIZED DATE
Project Manager (PM)							
Superintendent							
Quality Control Officer							
Safety Officer							
Laborers							

MATERIALS DELIVERED	QUANTITY	OFFICIAL VISITORS

WORK PERFORMED BY PRIME: **(Include detail description per each activity including location, quantities, and production.)**

SPECIFIC INSPECTIONS: **(Inspections performed, results, and corrective actions, and Primes and Subprimes.)**

TESTING:

Was any testing performed today YES / NO. (Complete and attach Test Report Information Sheets.)

☐ ☐

Type and Location of Testing:

SUBCONTRACTOR(S):	PMIS Number:		Date:	

SUBCONTRACTOR NAME

EMPLOYEES BY JOB CATEGORIES	NUMBER	HOURS	EQUIPMENT ON JOB (Include model, manufacturer, size, and year.)	NUMBER OF UNITS	EQUIPMENT HOURS WORKING			
					YES	STANDBY	MOBILIZED/ DEMOBILIZED DATE	

MATERIALS DELIVERED	QUANTITY	EQUIPMENT MOBILIZIED/DEMOBILIZED

WORK PERFORMED BY SUBCONTRACTOR: Include detail description per each activity. Include location, quantity, and production.

SUBCONTRACTOR NAME

EMPLOYEES BY JOB CATEGORIES	NUMBER	HOURS	EQUIPMENT ON JOB (Include model, manufacturer, size, and year.)	NUMBER OF UNITS	EQUIPMENT HOURS WORKING			
					YES	STANDBY	MOBILIZED/ DEMOBILIZED DATE	

MATERIALS DELIVERED	QUANTITY	EQUIPMENT MOBILIZIED/DEMOBILIZED

WORK PERFORMED BY SUBCONTRACTOR: Include detail description per each activity. Include location, quantity, and production.

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					YES	STANDBY	MOBILIZED/ DEMOBILIZED DATE	

MATERIALS DELIVERED	QUANTITY	EQUIPMENT MOBILIZIED/DEMOBILIZED

WORK PERFORMED BY SUBCONTRACTOR: Include detail description per each activity. Include location, quantity, and production.

SUBCONTRACTOR(S):	PMIS Number:		Date:	

SUBCONTRACTOR NAME

EMPLOYEES BY JOB CATEGORIES	NUMBER	HOURS	EQUIPMENT ON JOB (Include model, manufacturer, size, and year.)	NUMBER OF UNITS	EQUIPMENT HOURS WORKING			
					YES	STANDBY	MOBILIZED/ DEMOBILIZED DATE	

MATERIALS DELIVERED	QUANTITY	EQUIPMENT MOBILIZIED/DEMOBILIZED

WORK PERFORMED BY SUBCONTRACTOR: Include detail description per each activity. Include location, quantity, and production.

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					YES	STANDBY	MOBILIZED/ DEMOBILIZED DATE	

MATERIALS DELIVERED	QUANTITY	EQUIPMENT MOBILIZIED/DEMOBILIZED

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					YES	STANDBY	MOBILIZED/ DEMOBILIZED DATE	

MATERIALS DELIVERED	QUANTITY	EQUIPMENT MOBILIZIED/DEMOBILIZED

WORK PERFORMED BY SUBCONTRACTOR: Include detail description per each activity. Include location, quantity, and production.

PMIS Number:		Date:	

CRITICAL POINT/MILESTONE OBSERVATIONS *(Describe item inspected, observations, problems, and action items.)*

DESCRIPTION OF WORK BEING MONITORED ON A TIME AND MATERIAL BASIS AND WHY

BREAKDOWN OF TIME AND MATERIAL WORK PERFORMED

Location:

Labor:

Equipment:

Material:

Production Rates:

STATUS OF GOVERNMENT FURNISHED SERVICES AND/OR SUPPLIES

SAFETY COMMENTS

Accidents / Lost Time:

Incidents:

First Aid Administered:

Other:

DIFFICULTIES WITH CONSTRUCTION CONTRACTOR

UNFORESEEN DEVELOPMENTS *(Describe conditions, action taken, person contacted, and recommended actions.)*

CONSTRUCTION DEFICIENCIES OR RE-TESTING REQUIRED

OTHER COMMENTS

CERTIFICATION

For Construction Management Representative (CMR): I certify the above report is complete and correct and that I, or my authorized representative, have inspected all work performed this day by the Prime Contractor and each Subcontractor and determined all materials, equipment, and workmanship are in strict compliance with plans and specifications except as may be noted above.

I certify that I or my authorized representative have reviewed and reconciled all differences between this daily report and the Construction Contractors. In the event a discrepancy is found, the Construction Contractor was notified and an acceptable revision was completed and resubmitted by either or both parties within this document. If unable to agree with the Construction Contractor, explain nature of disagreement in "Other Comments" above as needed.

For Contractor's Representative: I certify that the above report is complete and correct and that I, or my authorized representative, have inspected all work performed this day by the Prime Contractor and each Subcontractor and determined that all materials, equipment, and workmanship are in strict compliance with the plans and specifications except as may be noted above. I have reconciled all differences found when comparing this CQC daily diary with the CMR's daily diary. All unresolved issues are described under "Other Comments" above.

SIGNATURE	TITLE:

PMIS Number:		Date:	

ADDITIONAL COMMENTS OR INFORMATION (***Describe item inspected, observations, problems, and action items.)***

PMIS Number:		Date:	

IMAGES IN SUPPORT OF REPORT INFORMATION

INSPECTION CHECKLIST

National Park Service
Parks Planning Facilities and Lands, Building Code Official
Building_code@nps.gov

Review	Required	Signature of Inspector	Date Approved
Footing & Foundation			
Concrete Slab, Foundation Wall & Under Floor	X		
Lowest Floor Elevation (in flood areas)			
Underground			
Roof Framing	X		
Wall Framing	X		
Wall Close-In	X		
Ceiling Close-In	X		
Life Safety	X		
Fire & Smoke Resistant Penetrations			
Fire Protection	X		
Fire Alarm	X		
Lath & Gypsum Board	X		
Accessibility	X		
Underground Plumbing	X		
Rough Plumbing	X		
Underground Electrical	X		
Rough Electrical	X		
Mechanical	X		
Energy Efficiency	X		
Elevator			
Waterproofing	X		
Other:			
Other:			
Other:			
Other:			
Other:			
Other:			
Final Inspection:			
Fire/Life Safety	X		
Electrical	X		
Mechanical	X		
Plumbing	X		
Accessibility	X		

INSPECTION CHECKLIST

National Park Service
Parks Planning Facilities and Lands, Building Code Official
Building_code@nps.gov

INSTRUCTIONS:

DESIGN

- Architect/Engineer (A/E) shall indicate if a listed inspection is required.
- If additional inspections are required, the A/E shall indicate under "Other" on the form.
- All required inspections are based on the 2024 International Code Council (ICC) codes and 2023 National Fire Protection Association (NFPA) 70.

CONSTRUCTION SOLICITATION

- Completed checklist shall be included with the construction solicitation and construction contract as part of the Construction Documents.

CONSTRUCTION

- Checklist shall be the official record for construction inspection approval or disapproval.
- Inspectors will sign-off on this form when inspections are complete and approved.
- Final inspection approval is required prior to issuance of Certificate of Occupancy. Original completed form shall be submitted with the request. Copies will be sent to the contractor, Contracting Officer, Contracting Officer's Representative and Construction Management Representative.

Questions regarding this form shall be directed to the Building Code Official at building_code@nps.gov

Universal Design & Accessibility Scoping for Buildings & Sites

(Architectural Barriers Act (ABA) Accessibility Standards)

National Park Service (NPS) - Denver Service Center (DSC) | 10-25-24

Use for facilities, buildings (new and existing), parking and drop-off areas, and sites (walks, ramps, plazas, lawns, etc.). Complete where applicable. For checkboxes, N/A=not applicable.

Park: Rocky Mountain National Park

Project Title: Rehabilitate Kawuneeche Visitor Center

PMIS Number: 326235
(Project Management Information System)

Prepared By: Click or tap here to enter text.

Date: Click or tap to enter a date.

Programs and Activities at this Building/Site (existing and proposed)

Site Programs	Amenities	Building Programs	Interpretive Programs
☐ Car Parking	☐ Benches/Seating	☐ Visitor Use Building	☐ Information Desk
☐ Bus Parking	☐ Restrooms	☐ Historic Building	☐ Brochures/Handouts
☐ Recreational Vehicle (RV) Parking	☐ Family Restrooms	☐ Maintenance Building	☐ Audiovisual Programs
☐ Employee Parking	☐ Employee Restrooms	☐ Museum	☐ Exhibits
☐ Building Entrance	☐ Public Telephones	☐ Theater	☐ Interactive Exhibits
☐ Drop-off Area	☐ Drinking Fountains	☐ First Aid/Wellness Room	☐ Large Scale Map
☐ Alternate Transportation	☐ Vending Machines	☐ Information Desk	☐ Tactile Map
☐ Bus/Shuttle Stop	☐ Concessions-Food	☐ Visitor Lodging	☐ Guided Tours
☐ Service Area	☐ Concessions-Ticketing	☐ Employee Housing	☐ Educational Programs
☐ Walks	☐ Gift Shop	☐ Conference Rooms	☐ Museum Objects
☐ Shelters	☐ Bookstore	☐ Office Space	☐ Waysides
☐ Seating/Gathering Space	☐ Trash/Recycling	☐ Kitchen/Break Room	☐ Special Events
☐ Cultural Landscape	☐ Bicycle Racks/Rental	☐ Elevator	☐ Self-Guided Walks
☐ Other:	☐ Other:	☐ Other:	☐ Other:
☐ Other:	☐ Other:	☐ Other:	☐ Other:
☐ Other:	☐ Other:	☐ Other:	☐ Other:
☐ Other:	☐ Other:	☐ Other:	☐ Other:
☐ Other:	☐ Other:	☐ Other:	☐ Other:
☐ Other:	☐ Other:	☒ Other:	☐ Other:

Universal Design

The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. A human-centered design with all users in mind.

1. **The Principles of Universal Design** (North Carolina State University (NCSU) > Center for Universal Design) - Utilize throughout the design process to provide a facility usable by all.

   1. ☐Yes ☐No ☐N/A **Principle 1: Equitable Use**
      The design is useful and marketable to people with diverse abilities. Is the same means of use provided for all users, identical whenever possible, equivalent when not?
   2. ☐Yes ☐No ☐N/A **Principle 2: Flexibility in Use**
      Does the design accommodate a wide range of individual preferences and abilities? Is a choice of method provided?
   3. ☐Yes ☐No ☐N/A **Principle 3: Simple and Intuitive Use**
      Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
   4. ☐Yes ☐No ☐N/A **Principle 4: Perceptible Information**
      Does the design communicate necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities?
   5. ☐Yes ☐No ☐N/A **Principle 5: Tolerance for Error**
      Is there a tolerance for error? Does the design minimize hazards and adverse consequences of accidental or unintended actions?
   6. ☐Yes ☐No ☐N/A **Principle 6: Low Physical Effort**
      Does the design require low physical effort? Can the design be used efficiently and comfortably and with a minimum of fatigue?
   7. ☐Yes ☐No ☐N/A **Principle 7: Size and Space for Approach and Use**
      Is there appropriate size and space provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility? Is there adequate space provided for using assistive devices or personal assistance?

2. DSC Universal Design Best Practice Requirements

*If requirement cannot be met, describe reason for departure and accommodations provided.

a. ☐Yes ☐No* ☐N/A **Integrated Pedestrian Routes**
   Project is designed for all users to follow the same routes through the facility and site. Describe any departure:
   Click or tap here to enter text.

b. ☐Yes ☐No* ☐N/A **Level Entrance**
   Project is designed with no steps at primary entrances (visitor and employee). Staired secondary routes can be included on sloped sites. Describe any departure:
   Click or tap here to enter text.

c. ☐Yes ☐No* ☐N/A **Covered Entry**
   Project provides a covered entry and roof drains away from entry walk and entrance. Describe any departure:
   Click or tap here to enter text.

d. ☐Yes ☐No* ☐N/A **Closed-in Parking and Drop-off**
Distance from drop-off and closest accessible parking space (car and RV/Bus) to accessible entrance of facility is 200 feet or less. Describe any departure:
Click or tap here to enter text.

e. ☐Yes ☐No* ☐N/A **Power Assist Entrance Doors**
Visitor use buildings provide power assist door openers on main accessible entrances. Describe any departure:
Click or tap here to enter text.

f. ☐Yes ☐No* ☐N/A **Accessibility Plans**
Provide accessibility plans to identify project universal design and accessibility goals. Include site plan with accessible parking and accessible routes with slope requirements; floorplans with accessible features, accessible routes, turning space, maneuvering space and reach ranges shown.
Click or tap here to enter text.

ABA Accessibility Standards - Chapter 2 Scoping Requirements

3. F202 Existing Buildings and Facilities

Renovations and additions including historic facilities.

a. ☐Yes ☐No ☐N/A F202.2.1 Accessible Route
b. ☐Yes ☐No ☐N/A F202.2.3 Toilet and Bathing Facilities
c. ☐Yes ☐No ☐N/A F202.3.1 Prohibited Reduction in Access
d. ☐Yes ☐No ☐N/A **Entrances to Existing Facilities**
If project is a historic building, is the accessible route the same as the general public route? If not, does the accessible route rejoin the general route quickly and intuitively?
e. ☐Yes ☐No ☐N/A **Exception**
The only exceptions used for qualified historic buildings and facilities are 1 accessible route to 1 accessible entrance (instead of standard 60% of entrances), at least 1 accessible floor in a multi-story building, and no less than 1 toilet room for each sex complying with 603 or 1 unisex toilet room.
f. ☐Yes ☐No ☐N/A **State Historic Preservation Officer (SHPO) Concurrence**
If any of these exceptions are taken, is there a concurrence memo from the SHPO? F202.5 - These exceptions apply only when the State Historic Preservation Officer agrees that compliance with requirements for the specific element would threaten or destroy the historic significance of the building or facility.

4. F203 General Exceptions

Facility spaces not required to comply with ABA Accessibility Standards requirements. A project element meets 1 of the following exceptions.

a. ☐Yes ☐No ☐N/A F203.4 Raised Areas
b. ☐Yes ☐No ☐N/A F203.5 Limited Access Spaces
c. ☐Yes ☐No ☐N/A F203.6 Machinery Spaces
d. ☐Yes ☐No ☐N/A F203.7 Single Occupant Structures

5. F205 Operable Parts

a. ☐Yes ☐No ☐N/A **Hardware**
Door, window, restroom and furnishing hardware, levers, knobs, openers, etc., can be operated with 1 hand and do not require tight grasping, pinching, or twisting of the wrist; are designed between 15 inches minimum and 48 inches maximum above the finished floor. The force required to operate hardware is 5 pounds maximum.

b. ☐Yes ☐No ☐N/A **Operable Parts**
Light switches, electrical outlets, appliance controls, window blind controls, etc., are designed between 15 inches minimum and 48 inches maximum above the finished floor. The force required to activate operable parts is 5 pounds maximum.

6. F206 Accessible Routes

a. ☐Yes ☐No ☐N/A F206.2.2 Within a Site
b. ☐Yes ☐No ☐N/A F206.2.3 Multi-Story Buildings and Facilities
c. ☐Yes ☐No ☐N/A F206.2.3 > Exception 1
d. ☐Yes ☐No ☐N/A F206.2.3 > Exception 6
e. ☐Yes ☐No ☐N/A F206.3 Location
f. ☐Yes ☐No ☐N/A F206.4 Entrances

7. F206.5 Doors, Doorways and Gates

a. ☐Yes ☐No ☐N/A **Clear Floor Space on Both Sides of Accessible Doors**
Accessible doors are designed to have adequate clear floor space meeting **Figure 404.2.4.1** in section 404.2.4.1 Swinging Doors and Gates.

b. ☐Yes ☐No ☐N/A F206.5.1 Entrances
c. ☐Yes ☐No ☐N/A F206.5.2 Rooms and Spaces

8. F207 Accessible Means of Egress

a. ☐Yes ☐No ☐N/A F207.1 General
The accessible egress route is shown on code plan.

b. ☐Yes ☐No ☐N/A **Areas of Refuge**
This project includes areas of refuge complying with International Building Code (IBC) that serve as a part of the accessible means of egress. The accessible egress route is shown on code plan.

c. ☐Yes ☐No ☐N/A F207.2 Platform Lifts

9. F208 Parking Spaces

Newly constructed parking facilities shall provide accessible parking spaces in accordance with Table F208.2. Where a parking facility provides separate types of parking spaces (car, recreational vehicle, bus, drop- off/unloading, etc.), Table F208.2 shall apply to each separate type of parking space provided.

Parking Spaces: Refer to **Table F208.2** under F208.2 Minimum Number.

Total number of parking spaces provided: Click or tap here to enter text.
Number of accessible parking spaces provided (including van spaces): Click or tap here to enter text.
Number of van accessible parking spaces provided: Click or tap here to enter text.
Number of RV/bus accessible parking spaces provided: Click or tap here to enter text.

a. ☐Yes ☐No ☐N/A F208.2 Minimum Number
b. ☐Yes ☐No ☐N/A F208.2.4 Van Parking Spaces
c. ☐Yes ☐No ☐N/A F208.3 Location
d. ☐Yes ☐No ☐N/A **Oversized Vehicle Location**
Accessible oversized parking spaces for recreational vehicles (RVs) and buses are located on the shortest accessible route from the oversized vehicle parking facility to an accessible entrance. Accessible spaces are 200 feet or less from entrance.
e. ☐Yes ☐No ☐N/A **Employee Parking Location**
Accessible employee parking spaces are located on the shortest accessible route from the employee parking area to an accessible employee entrance. Accessible spaces are 200 feet or less from entrance.
f. ☐Yes ☐No ☐N/A **Dispersed Locations**
Where parking serves more than 1 accessible entrance or program, accessible parking spaces are dispersed and located on the shortest accessible route (200 feet or less) to the accessible entrances or program.

10. F209 Passenger Loading Zones and Bus Stops

a. ☐Yes ☐No ☐N/A 503 Passenger Loading Zones

11. F211 Drinking Fountains

a. ☐Yes ☐No ☐N/A F211.2 Minimum Number

12. F213 Toilet Facilities and Bathing Facilities

a. ☐Yes ☐No ☐N/A F213.3.1 Toilet Compartments
b. ☐Yes ☐No ☐N/A **1109.2.1 (IBC) Unisex toilet rooms**
In assembly and mercantile occupancies, an accessible unisex toilet room is provided where an aggregate of 6 or more male and female water closets is required.
c. ☐Yes ☐No ☐N/A F213.3.3 Urinals
d. ☐Yes ☐No ☐N/A F213.3.4 Lavatories
e. ☐Yes ☐No ☐N/A F213.3.5 Mirrors
f. ☐Yes ☐No ☐N/A F213.3.6 Bathing Facilities
g. ☐Yes ☐No ☐N/A F213.3.7 Coat Hooks and Shelves

13. F215 Fire Alarm Systems

a. ☐Yes ☐No ☐N/A F215.2 Public and Common Use Areas
b. ☐Yes ☐No ☐N/A F215.3 Employee Work Areas
c. ☐Yes ☐No ☐N/A F215.4 Transient Lodging
d. ☐Yes ☐No ☐N/A F215.5 Residential Dwelling Units

14. F216 Signs

a. ☐Yes ☐No ☐N/A F216.2 Designations

b. ☐Yes ☐No ☐N/A F216.4 Means of Egress

c. ☐Yes ☐No ☐N/A F216.4.1 Exit Doors
d. ☐Yes ☐No ☐N/A F216.4.2 Areas of Refuge
e. ☐Yes ☐No ☐N/A F216.4.3 Directional Signs

f. ☐Yes ☐No ☐N/A F216.5 Parking

g. ☐Yes ☐No ☐N/A F216.5 Parking > Exception 1

h. ☐Yes ☐No ☐N/A F216.6 Entrances

i. ☐Yes ☐No ☐N/A F216.10 Assistive Listening Systems

15. F219 Assistive Listening Systems

a. ☐Yes ☐No ☐N/A F219.2 Required Systems
b. ☐Yes ☐No ☐N/A F219.3 Receivers

16. F221 Assembly Areas and Outdoor Seating Areas

Number of Wheelchair Spaces in Assembly Areas: Refer to **Table F221.2.1.1** under F221.2.1.1 General Seating.

Number of seats in assembly area (theater or seating area, bench length/24 inches): Click or tap here to enter text.
Minimum number of required wheelchair spaces in aseembly area: Click or tap here to enter text.
Number of seats in exterior seating area: Click or tap here to enter text.
Minimum number of required wheelchair spaces in exterior seating area: Click or tap here to enter text.

a. ☐Yes ☐No ☐N/A F221.1 General

b. ☐Yes ☐No ☐N/A F221.2.1 Number and Location

c. ☐Yes ☐No ☐N/A F221.2.2 Integration

d. ☐Yes ☐No ☐N/A F221.2.3 Lines of Sight and Dispersion

e. ☐Yes ☐No ☐N/A F221.2.3.1 Horizontal Dispersion
F221.2.3.2 Vertical Dispersion

f. ☐Yes ☐No ☐N/A F221.3 Companion Seats

g. ☐Yes ☐No ☐N/A F221.4 Designated Aisle Seats

h. ☐Yes ☐No ☐N/A F221.5 Lawn Seating

i. ☐Yes ☐No ☐N/A Exterior Seating Areas
Site seating areas accommodating 4 or more persons (2 benches or more) provide integrated wheelchair seating.

17. F226 Dining Surfaces and Work Surfaces

a. ☐Yes ☐No ☐N/A F226.1 General
b. ☐Yes ☐No ☐N/A F226.2 Dispersion

18. F229 Windows

a. ☐Yes ☐No ☐N/A F229.1 General

b. ☐Yes ☐No ☐N/A **Window Coverings**

Window coverings, blinds, etc. provided in accessible rooms or spaces are designed to be operable at accessible reach ranges (308) less than 48 inches above floor, allow adequate clear floor space for operation and comply with 309.

19. Notes

Click or tap here to enter text.

Statement of Structural Tests and Special Inspections

National Park Service (NPS) - Denver Service Center (DSC) | 8-22-24

Park: Rocky Mountain National Park (ROMO)

Project Management Information System (PMIS) Number: 326235

Project Name: Rehabilitate Kawuneeche Visitor Center

Structural Engineering Firm: JVA, Inc.

This Statement of Structural Tests and Special Inspections is being submitted as required by Chapter 17 of the **2024 International Building Code** (IBC 2024). It includes the following:

1. Seismic requirements
2. Wind requirements
3. Qualification Requirements for Inspectors and Testing Technicians
4. Listing of Required Structural Tests and Special Inspections

The Construction Contractor's Quality Control Supervisor will provide copies of all special inspection reports and associated documentation to the Contracting Officer (CO). The Construction Contractor will be required to correct all deficiencies discovered in the Special Inspection and Structural Testing program.

Prepared By: Ian R. Glaser, P.E.
(Type or print name)

Signature: _____ Date: 01/16/2026

Stamped by Professional Engineer (PE) or Structural Engineer (SE)

Seismic and Wind Requirements

Seismic Requirements, IBC 2024 Section 1704.3.2

Description of seismic-force-resisting system and designated seismic systems subject to special inspections:

Since the structure consists of light-frame construction, the design spectral response acceleration at short periods (S_{DS}) is 0.22 (less than 0.5) and the building height of the structures is 20 feet (less than 35 feet), special inspections for seismic resistance are not required per exception 1 of section 1705.13.1.

Wind Requirements, IBC 2024 Section 1704.3.3

Description of wind-force-resisting system and designated wind systems subject to special inspections:

Since the structure has a wind Exposure Category of C and the basic wind speed is 115 mph (less than 140 mph), special inspections of wind resistance are not required per exception 2 of section 1705.12.

Instructions:

1. Under Listing of Required Structural Tests and Special Inspections:
    a. **Required?** - Place an **X** for all Special Inspections and Tests required for this project.
    b. **Required Qualifications** - Provide qualifications for the special inspector, using the Qualification Requirements for Inspector and Testing Technicians list below, for all required Structural Tests and Special Inspections.
    c. **Continuous** - If marked with an **X**, continuous special inspection shall be as defined in Chapter 2, IBC 2024.
    d. **Periodic** - If marked with an **X**, provide the minimum number of tests, i.e. 20% of all field welds, or the amount of work to be inspected (e.g. 10% of all wall surfaces).
2. Attach completed Statement of Structural Tests and Special Inspections to the end of NPS DSC Division 1 Specifications **Section 01 40 00 Quality Requirements**.

Qualification Requirements for Inspectors and Testing Technicians

PE/SE	Structural Engineer – licensed PE or SE specializing in the design of buildings and structures
PE/GE	Geotechnical Engineer – licensed PE specializing in soil mechanics and foundations
EIT	Engineer-In-Training – graduate engineer who has passed the Fundamentals of engineering examination

American Concrete Institute (ACI) Certification

ACI-CCSI	Concrete Construction Special Inspector
ACI-LTT	Concrete Laboratory Testing Technician Level 1 or 2
ACI-STT	Concrete Strength Testing Technician
ACI-FTT	Concrete Field Testing Technician – Grade I

American Society of Non-Destructive Testing (ASNT) Certification

Non-Destructive Testing Technician – Level II or III

American Welding Society (AWS) Certification

AWS-CWI	Certified Welding Inspector

Exterior Design Institute (EDI) Certification

EDI-EIFS	Certified EIFS inspector

International Code Council (ICC) Certification

ICC-PCSI	Prestressed Concrete Special Inspector
ICC-RCSI	Reinforced Concrete Special Inspector
ICC-SSI	Soils Special Inspector
ICC-SFSI	Spray-applied Fireproofing Special Inspector
ICC-SMSI	Structural Masonry Special Inspector
ICC-SSBSI	Structural Steel and Bolting Special Inspector
ICC-SWSI	Structural Welding Special Inspector

National Institute for Certification in Engineering Technologies (NICET) Certification

NICET-CT	Concrete Technician – Levels I, II, III and IV
NICET-GET	Geotechnical Engineering Technician - Levels I, II, III and IV
NICET-ST	Soils Technician - Levels I, II, III and IV

Other

Listing of Required Structural Tests and Special Inspections

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	Structural Steel (IBC 2024 Section 1705.2; American Institute of Steel Construction: AISC 360-22 Chapter N, AISC 341-22 Chapter J)				
	Prior to Welding (AISC 360-22 Table C-N5.4-1)				
X	1. Welder qualification records and continuity records.		X		
X	2. Welding procedure specifications (WPS) available.		X		
X	3. Manufacturer certifications for welding consumables available.		X		
X	4. Material identification (type/grade).		X		
X	5. Welder identification system.		X		
	6. Fit-up of groove welds (including joint geometry).				
	a. Joint preparation.			X	
	b. Dimensions (alignment, root opening, root face, bevel).			X	
	c. Cleanliness (condition of steel surfaces).			X	
	d. Tacking (tack weld quality and location).			X	
	e. Backing type and fit (if applicable).			X	
	7. Fit-up of CJP (complete joint penetration) groove welds of HSS (hollow structural sections) T-, Y- and K-joints without backing (including joint geometry).				
	a. Joint preparation.				
	b. Dimensions (alignment, root opening, root face, bevel).				
	c. Cleanliness (condition of steel surfaces).				
	d. Tacking (tack weld quality and location).				

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	8. Configuration and finish of access holes.			X	
	9. Fit-up of fillet welds.				
X	a. Dimensions (alignment, gaps at root).		X		
X	b. Cleanliness (condition of steel surfaces).		X		
X	c. Tacking (tack weld quality and location).		X		
X	10. Check welding equipment.		X		
	During Welding (AISC 360-22 Table C-N5.4-2)				
	1. Control and handling of welding consumables				
X	a. Packaging.		X		
X	b. Exposure control.		X		
X	2. No welding over cracked tack welds.		X		
	3. Environmental conditions.				
X	a. Wind speed within limits.		X		
X	b. Precipitation and temperature.		X		
	4. WPS followed.				
X	a. Settings on welding equipment.		X		
X	b. Travel speed.		X		
X	c. Selected welding materials.		X		
X	d. Shielding gas type/flow rate.		X		
X	e. Preheat applied.		X		
X	f. Interpass temperature maintained (minimum/maximum).		X		
X	g. Proper position (F, V, H, OH).		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
X	h. Intermix of filler metals avoided unless approved (AISC 341-22 Section J7).		X		
X	5. Use of qualified welders.		X		
	6. Welding techniques.				
X	a. Interpass and final cleaning.		X		
X	b. Each pass within profile limitations.		X		
X	c. Each pass meets quality requirements.		X		
	7. Placement and installation of headed stud anchors.		X		
	After Welding (AISC 360-22 Table C-N5.4-3)				
X	1. Welds cleaned.		X		
X	2. Size, length and location of welds.		X		
	3. Welds meet visual acceptance criteria.				
X	a. Crack prohibition.		X		
X	b. Weld/base-metal fusion.		X		
X	c. Crater cross section.		X		
X	d. Weld profiles.		X		
X	e. Weld size.		X		
X	f. Undercut.		X		
X	g. Porosity.		X		
X	4. Arc strikes.		X		
X	5. k-area.		X		
X	6. Weld access holes in rolled heavy shapes and built-up heavy shapes.		X		
X	7. Backing removed and weld tabs removed (if required).		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
X	8. Repair activities.		X		
X	9. Document acceptance or rejection of welded joint or member.		X		
X	10. No prohibited welds have been added without the approval of the EOR (Engineer of Record).		X		
X	11. Placement of reinforcing or contouring fillet welds (if required) (AISC 341-22 Table J7.1).		X		
	Nondestructive Testing (AISC 360-22 Section N5 and AISC 341-22 Section J7)				
	1. Risk Category II Structures - Perform Ultrasonic Testing on 10% of CJP groove welds in butt, T- and corner joints subject to transversely applied tension loading, in materials 5/16 inch thick or greater.			X	
	2. Risk Category III or IV Structures - Perform Ultrasonic Testing on all CJP groove welds subject to transversely applied tension loading in butt, T- and corner joints, in materials 5/16 inch thick or greater.		X		
	3. Access Holes - Perform Magnetic Particle Testing or Liquid Penetrant Testing when the flange thickness exceeds 1.5 inches for rolled shapes, or when the web thickness exceeds 1.5 inches for built-up shapes.		X		
	4. Welded Joints Subject to Fatigue - Perform testing per AISC 360-22 Section N5c.		X		
	Nondestructive Testing (AISC 341-22 Section J7)				
	Column Splice and Column to Base Plate PJP Groove Weld (AISC 341-22 Section J7 2b)				
	1. Perform Ultrasonic Testing on 100% of PJP (partial-joint-penetration) groove welds in column splices and column to base plate welds.		X		
	2. CJP Groove weld.		X		
	3. Lamellar tearing.		X		
	4. Beam cope and access hole.		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	5. Reduced beam section repair.		X		
	6. Weld tab removal.		X		
	Prior to Bolting (AISC 360-22 Table C-N5.6-1)				
	These inspections are not required for snug-tight joints.				
	1. Manufacturer's certifications available for fastener materials.		X		
	2. Fasteners marked in accordance with ASTM requirements.			X	
	3. Correct fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane).			X	
	4. Correct bolting procedure selected for joint detail.			X	
	5. Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements.			X	
	6. Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used.			X	
	7. Protected storage provided for bolts, nuts, washers and other fastener components.			X	
	During Bolting (AISC 360-22 Table C-N5.6-2)				
	These inspections are not required for snug-tight joints.				
	These inspections are not required for pretensioned joints and slip-critical joints, when the installer is using the turn-of-nut method with matchmarking techniques, the direct-tension-indicator method, or the twist-off-type tension control bolt method.				
	1. Fastener assemblies, of suitable condition, placed in all holes and washers (if required) are positioned as required.			X	
	2. Joint brought to the snug-tight condition prior to the pretensioning operation.			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	3. Fastener component not turned by the wrench prevented from rotating.			X	
	4. Fasteners are pretensioned in accordance with the RCSC (Resource Council on Structural Connections) Specification, progressing systematically from the most rigid point toward the free edges.			X	
	After Bolting (AISC 360-22 Table C-N5.6-3)				
	Document acceptance or rejection of bolted connections.		X		
	Galvanized Structural Steel Main Members (AISC 360-22 Table C-N5.6-3)				
	Inspect per AISC 360-22 Section N5.7.			X	
	Other Inspection Tasks (AISC 360-22 Section N5.8 and AISC 341-22 Section J9)				
X	1. Verify compliance of fabricated steel with the details shown on the approved shop drawings.			X	**Before elements are concealed**
X	2. Verify compliance of the erected steel frame with the details shown on the approved erection drawings, including braces, stiffeners, member locations and joint details.			X	**Before elements are concealed**
	3. Anchor rods and other embedments support structural steel.				
X	a. Verify the diameter, grade, type and length of the anchor rod or embedded item.			X	**Prior to each concrete pour**
X	b. Verify the extent or depth of embedment into the concrete.			X	**Prior to each concrete pour**
	4. RBS (reduce beam section) requirements, if applicable. (AISC 341-22)				
	a. Contour and finish.			X	
	b. Dimensional tolerances.			X	
	5. Protected zone - no holes or unapproved attachments made by fabricator or erector, as applicable. (AISC 341-22)			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	Inspection of H-Piles (AISC 341-22 Section J11)				
	1. Protected zone - no holes or unapproved attachments made by the responsible contractor, as applicable. (AISC 341-22 Table J11.1)			X	
	Structural Stainless Steel (IBC 2024 1705.2.2)				
	1. Special inspections and nondestructive testing in accordance with AISC 370-21.			X	
	Cold-formed Steel Deck (IBC 2024 1705.2.3)				
	2. Special inspections in accordance with QA/QC-2022 Standard for Quality control (QC) and Quality assurance (QA) for Installation of Steel Deck.			X	
	Open-Web Steel Joists and Joist Girders (IBC 2024 Table 1705.2.4)				
	1. Installation of open-web steel joists and joist girders.				
	a. End connections - welding or bolted.			X	
	b. Bridging - horizontal or diagonal.				
	1. Standard bridging.			X	
	2. Bridging that differs from the SJI (Steel Joist Institute) specifications listed in Section 2207.1.			X	
	Inspection of Composite Structures Prior to Concrete Placement (AISC 341Table J10.1)				
	1. Material identification of reinforcing steel (Type/Grade).			X	
	2. Determination of carbon equivalent for reinforcing steel other than ASTM A706.			X	
	3. Proper reinforcing steel size, spacing and orientation.			X	
	4. Reinforcing steel has not been rebent in the field.			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	5. Reinforcing steel has been tied and supported as required.			X	
	6. Required reinforcing steel clearances have been provided.			X	
	7. Composite member has required size.			X	
	Inspection of Composite Structures During Concrete Placement (AISC 341-22 Table J10.2)				
	1. Concrete: Material identification (mix design, compressive strength, maximum large aggregate size, maximum slump).			X	
	2. Limits on water added at the truck or pump.			X	
	3. Proper placement techniques to limit segregation.			X	
	Inspection of Composite Structures After Concrete Placement (AISC 341-22 Table J10)				
	1. Achievement of minimum specified concrete compressive.			X	
	Cold-formed Steel Trusses Spanning 60-feet or Greater (IBC 2024 Section 1705.2.45)				
	1. Verify temporary installation restraint/bracing installed in accordance with the approved shop drawings.			X	
	2. Verify permanent individual truss member restraint/bracing installed in accordance with the approved shop drawings.			X	
	Metal Building Systems (IBC 2024 Section 1705.2.6 - Inspect per Structural Steel requirements above as applicable plus requirements in IBC 2024 Table 1705.2.6)				
	1. Installation of rafter/beam flange braces and column flange braces.			X	
	2. Installation of purlins and girts, including specified lapping.			X	
	3. Purlin and girt restraint/bridging/bracing.			X	
	4. Installation of X-bracing, tightened to remove any sag.			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	Concrete Construction (IBC 2024 Section 1705.3)				
X	1. Inspect reinforcing steel, including prestressing tendons, and verify placement.			X	**Prior to each concrete pour**
	2. Inspection of reinforcing steel welding				
X	a. Verify weldability of reinforcing bars other than ASTM A706.			X	**Prior to each concrete pour**
	b. Inspect welding of reinforcement for special moment frames, boundary elements of special structural walls and coupling beams.		X		
	c. Inspect welded reinforcement splices.		X		
	d. Inspect welding of primary tension reinforcement in corbels.		X		
X	e. Inspect single pass fillet welds, maximum 5/16 inch.			X	**Prior to each concrete pour**
X	f. Inspect all other weds.			X	**Prior to each concrete pour**
X	3. Inspection of anchors cast in concrete.			X	**Prior to each concrete pour**
	4. Inspection of anchors post-installed in hardened concrete members.				
	a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension load.		X		
X	b. Mechanical anchors and adhesive anchors not defined in 4a.			X	**All anchors**
X	5. Verify use of approved design mix.			X	**All mix designs**
X	6. Prior to placement fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.		X		**All mix designs**
	7. Inspect concrete and shotcrete placement for proper application techniques.		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	8. Inspect for maintenance of specified curing temperature and techniques.			X	
	9. Inspection of prestressed concrete:				
	a. Application of prestressing forces.		X		
	b. Grouting of bonded prestressing tendons in the seismic-force-resisting system.		X		
	10. Erection of precast structural members.			X	
	11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E, or F, inspect such connections and reinforcement in the field for:				
	a. Installation of the embedded parts.		X		
	b. Completion of the continuity of reinforcement across joints.		X		
	c. Completion of connections in the field.		X		
	12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5 (American Concrete Institute).			X	
	13. Verification of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.			X	
X	14. Inspection formwork for shape, location and dimensions of the concrete member being formed.			X	**Prior to each concrete pour**
	Masonry Construction (IBC 2024 Section 1705.4)				
	1. Inspect masonry construction in accordance with IBC 2024 Section 1705.4 and TMS 402-22 and TMS 602-22 (The Masonry Society).				
	Level 1 Quality Assurance				
	Verification Requirements:				

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	1. Prior to construction, verification of compliance of submittals.			X	
	Level 2 Quality Assurance				
	Verification Requirements:				
	1. Prior to construction, verification of comliance submittals.			X	
	2. Prior to construction, verification of f'_m and f'_{AAC} except where specifically exempted by the code.			X	
	3. During construction, verification of slump flow and Visual Stability Index (VSI) when self-consolidating grout is delivered to the project site in accordance with TMS 602-22 Specification Article 1.5 & 1.6.3.			X	
	Inspection Tasks:				
	1. As masonry construction begins, verify the following are in compliance:				
	a. Proportions of site-prepared mortar.			X	
	b. Grade and size of prestressing tendons and anchorages.			X	
	c. Grade, type and size or reinforcement, connectors, anchor bolts, and prestressing tendons and anchorages.				
	d. Prestressing technique.			X	
	e. Properties of thin-bed mortar for AAC (autoclaved aerated concrete) masonry.		X	X	Continuous inspection is required for the first 5000 square feet of AAC masonry. Periodic inspection is required after the first 5000 square feet of AAC masonry.

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	f. Sample panel construction.			X	
	2. Prior to grouting, verify the following are in compliance:				
	a. Grout space.			X	
	b. Placement of prestressing tendons and anchorages.			X	
	c. Placement of reinforcement, connectors, and anchor bolts.			X	
	d. Proportions of site-prepared grout and prestressing grout for bonded tendons.			X	
	3. Verify the compliance of the following during construction:				
	a. Materials and procedures with the approved submittals.			X	
	b. Placement of masonry units and mortar joint construction.			X	
	c. Size and location of structural members.			X	
	d. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.			X	
	e. Welding of reinforcement.		X		
	f. Preparation, construction and protection of masonry during cold weather (temperature below 40 degrees Fahrenheit) or hot weather (temperature above 90 degrees Fahrenheit).			X	
	g. Application and measurement of prestressing force.		X		
	h. Placement of grout and prestressing grout for bonded tendons is in compliance.		X		
	i. Placement of AAC masonry units and construction of thin-bed mortar joints.		X	X	Continuous inspection is required for the first 5000 square feet of AAC masonry.

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
					Periodic inspection is required after the first 5000 square feet of AAC masonry.
	4. Observe preparation of grout specimens, mortar specimens and/or prisms.			X	
	Level 3 Quality Assurance				
	Verification Requirements:				
	1. Prior to construction, verification of compliance of submittals.			X	
	2. Prior to construction, verification of f'_m and f'_{AAC} except where specifically exempted by the Code.			X	
	3. During construction, verification of Slump flow and Visual Stability Index (VSI) when self-consolidating grout is delivered to the project site in accordance with TMS 602-22 Specification Article 1.5 & 1.6.3.			X	
	4. During construction, verification of f'_m and f'_{AAC} for every 5000 square feet.			X	
	5. During construction, verification of proportions of materials as delivered to the project site for premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout.			X	
	Inspection Tasks:				
	1. As masonry construction begins, verify the following are in compliance:				
	a. Proportions of site-prepared mortar.			X	
	b. Grade and size of reinforcement, connectors, anchor bolts, and prestressing tendons and anchorages.			X	
	c. Grade, type and size or reinforcement, connectors, anchor bolts, and prestressing tendons and anchorages.			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	d. Prestressing technique.			X	
	e. Properties of thin-bed mortar for AAC (autoclaved aerated concrete) masonry.		X		
	f. Sample panel construction.		X		
	2. Prior to grouting, verify the following are in compliance:				
	a. Grout space		X		
	b. Placement of prestressing tendons and anchorages.			X	
	c. Placement of reinforcement, connectors, and anchor bolts.		X		
	d. Proportions of site-prepared grout and prestressing grout for bonded tendons.			X	
	3. Verify compliance of the following during construction:				
	a. Materials and procedures with the approved submittals.			X	
	b. Placement of masonry units and mortar joint construction.			X	
	c. Size and location of structural members.			X	
	d. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.		X		
	e. Welding of reinforcement.		X		
	f. Preparation, construction and protection of masonry during cold weather (temperature below 40 degrees Fahrenheit) or hot weather (temperature above 90 degrees Fahrenheit).			X	
	g. Application and measurement of prestressing force.		X		
	h. Placement of grout and prestressing grout for bonded tendons is in compliance.		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	i. Placement of AAC masonry units and construction of thin-bed mortar joints.		X		
	4. Observe preparation of grout specimens, mortar specimens and/or prisms.		X		
	Wood Construction (IBC 2024 Section 1705.5)				
	1. Inspect prefabricated wood structural elements in accordance with Section 1704.2.5.			X	
	2. High load diaphragms:				
	a. Verify sheathing grade and thickness.			X	
	b. Verify nominal size of framing members at adjoining panel edges.			X	
	c. Verify nail or staple diameter and length.			X	
	d. Verify number of fastener lines.			X	
	e. Verify spacing between fasteners in each line and at panel edges.			X	
	3. Shearwalls:				
	a. Verify sheathing grade and thickness.			X	
	b. Verify nominal size of framing members at adjoining panel edges.			X	
	c. Verify nail or staple diameter and length.			X	
	d. Verify number of fastener lines.			X	
	e. Verify spacing between fasteners in each line and at panel edges.			X	
	f. Location and size of holdowns.			X	
	4. Verify nailing, bolting, anchoring and fastening of:				
	a. Drag struts and collectors.			X	
	b. Braces.			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	c. Hold-downs.			X	
	5. Metal-plate-connected wood trusses spanning 60 feet or greater:				
	a. Verify temporary installation restraint/bracing installed in accordance with the approved shop drawings.			X	
	b. Verify permanent individual truss member restraint/bracing installed in accordance with the approved shop drawings.			X	
	Mass Timber Construction (IBC 2024 Section 1705.5.3) Mass timber elements in Types IV-A, IV-B and IV-C:				
	1. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.			X	
	2. Inspect erection of mass timber construction.			X	
	3. Inspection of connections where installation methods are required to meet design loads.			X	
	4. Threaded fasteners:				
	a. Verify use of proper installation equipment.			X	
	b. Verify use of pre-drilled holes where required.			X	
	c. Inspect screws, including diameter, length, head type, spacing, installation angle and depth.			X	
	5. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.		X		
	6. Adhesive anchors not defined in preceding cell.			X	
	7. Bolted connections.			X	
	8. Concealed connections.			X	

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	Soils (IBC 2024 Section 1705.6)				
X	1. Verify materials below shallow foundations are adequate to achieve the required bearing capacity.			X	**Before each foundation pour**
X	2. Verify excavations are extended to proper depth and have reached proper material.			X	**Before each foundation pour**
	3. Perform classification and testing of compacted fill materials.			X	
	4. During fill placement, verify use of proper materials and procedure in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill.		X		
	5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.			X	
	Driven Deep Foundation Elements (IBC 2024 Section 1705.7)				
	1. Verify element materials, sizes and lengths comply with the requirements.		X		
	2. Determine capacities of test elements and conduct additional load tests when required. Refer to project specifications.		X		
	3. Inspect driving operations and maintain complete and accurate records for each element.		X		
	4. Verify element locations and plumbness.		X		
	a. Verify type and size of hammer.		X		
	b. Record number of blows per foot of penetration.		X		
	c. Determine required penetration to achieve specified capacity.		X		
	d. Record pile tip and butt elevations.		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	e. Document any damage to any foundation element.		X		
	5. For steel piling, perform additional inspection in accordance with Section 1705.2 and AISC 341-16, Table J10.1.				
	6. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1705.3.				
	7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge as required in the project specifications.				
	Cast-in-Place Deep Foundation (IBC 2024 Section 1705.8)				
	1. Inspect drilling operations and maintain complete and accurate records for each element.		X		
	2. Verify element locations and plumbness.		X		
	a. Verify element diameter.		X		
	b. Verify bell diameter (if applicable).		X		
	c. Verify element lengths.		X		
	d. Verify embedment depth into bedrock (if applicable).		X		
	e. Verify adequate end-bearing strata capacity.		X		
	f. Record concrete or grout volumes.		X		
	3. For concrete elements, perform tests and additional inspections in accordance with Section 1705.3.				
	Helical Piles (IBC 2024 Section 1705.10)				
	1. Verify pile locations.		X		
	a. Verify installation equipment used.		X		

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	b. Verify pile dimensions.		X		
	c. Verify tip elevations.		X		
	d. Verify final depth.		X		
	e. Verify final installation torque.		X		
	f. Other data as required by the project specifications.		X		
	Fabricated Items (IBC 2024 Section 1705.11)				
	1. Inspect fabricated items in accordance with Section 1704.2.5.		X		
	Wind Resistance (IBC 2024 Section 1705.12)				
	1. Provide inspections when required by Section 1705.12.				
	Seismic Resistance (IBC 2024 Section 1705.13)				
	1. Provide inspections when required by Section 1705.13.				
	Testing and Qualification for Seismic Resistance (IBC 2024 Section 1705.14)				
	1. Test and qualify seismic resistance in accordance with IBC 2024 Section 1705.14 and the project specifications.				
	Sprayed Fire-Resistive Materials (IBC 2024 Section 1705.15)				
	1. Inspect sprayed fire-resistant materials in accordance with IBC 2024 Section 1705.15 and the project specifications.				
	Intumescent Fire-Resistive Materials (IBC 2024 Section 1705.16)				

Required?	Structural Test or Special Inspection	Required Qualifications	Continuous	Periodic	Frequency of Periodic Test or Inspection
	1. Perform inspections in accordance with AWCI 12-B (Association of the Wall and Ceiling Industry) and IBC 2024 Section 1705.16.			X	
	Exterior Insulation and Finish Systems (EIFS) (IBC 2024 Section 1705.17)				
	1. Perform inspections in accordance with project specifications and IBC 2024 Section 1705.17.			X	
	Fire-Resistant Penetrations and Joints (IBC 2024 Section 1705.18)				
	1. Perform inspections in accordance with project specifications and IBC 2024 Section 1705.18.			X	
	Smoke Control (IBC 2024 Section 1705.19)				
	1. Perform testing in accordance with project specifications and IBC 2024 Section 1705.19.				
	Sealing of Mass Timber (IBC 2024 Section 1705.20)				
	1. Perform testing in accordance with project specifications and IBC 2024 Section 1705.20.				

SECTION 01 42 00 – REFERENCE STANDARDS

PART 1 - GENERAL

1.1 ENVIRONMENTAL DEFINITIONS

A. Definitions pertaining to sustainable development: As defined in ASTM E2114 and as specified herein.

B. 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: Amount of biobased carbon in the material or product as a percentage of weight (mass) of total organic carbon in the material or product.

C. Chain-of-Custody: Process whereby a product or material is maintained under physical possession or control during its entire life cycle.

D. Deconstruction: Disassembly of buildings for purpose of recovering materials.

E. DFE (Design for the Environment): A technique that includes elements of resource conservation and pollution prevention as applied in various product sectors. A technique that incorporates approaches which are part of product (or assembly) concept, need and design. Considerations involve material selection, material and energy efficiency, reuse, maintainability and design for disassembly and recyclability. Refer to International Organization for Standardization (ISO) Guide 64 for additional clarification.

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 Program.

G. Non-Renewable Resource: A resource that exists in a fixed amount that cannot be replenished on a human time scale. Non-renewable resources have potential for renewal only by geological, physical, and chemical processes taking place over of millions of years. Examples include iron ore, coal, and oil.

H. Perpetual Resource: A resource that is virtually inexhaustible on a human time scale. Examples include solar energy, tidal energy, and wind energy.

I. 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 Federal Trade Commission (FTC) Guide for Use of Environmental Marketing Claims.

J. Renewable Resource: A resource that is grown, naturally replenished, or cleansed, at a rate which exceeds depletion of the usable supply of that resource. A renewable resource can be exhausted if improperly managed. However, a renewable resource can last indefinitely with proper stewardship. Examples include trees in forests, grasses in grasslands, and fertile soil.

1.2 QUALITY ASSURANCE

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into Contract Documents to the extent referenced. Such standards are made a part of Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of Contract Documents, unless otherwise indicated.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and standards may establish different or conflicting requirements for minimum quantities or quality levels, comply with most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Contracting Officer (CO) for decision before proceeding.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless Contract Documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into Contract Documents to the extent referenced. Such standards are made a part of Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with Contract Documents.

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

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities found in Section 01 42 00 Sources for Reference Publications, Unified Facilities Guide Specifications (UFGS) (accessible via Masters website > Downloads section > click on UFGS Master (WBDG Website). Names, telephone numbers, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

XX EXAMPLE Association (The)
www.EXAMPLE.org

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

DIN	Deutsches Institut fur Normung e.V. www.din.de	49 30 2601-3003
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. icc-es.org	(800) 423-6587 (562) 699-0543

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

ABA & ABAAS United States Access Board	Architectural Barriers Act (ABA) Architectural Barriers Act Accessibility Standards (ABAAS) www.access-board.gov
CoE	Army Corps of Engineers www.usace.army.mil
CPSC	Consumer Product Safety Commission www.cpsc.gov
DOC	Department of Commerce www.commerce.gov
DOD	Department of Defense www.defense.gov
DOJ	Department of Justice www.justice.gov
DOE	Department of Energy www.energy.gov
EPA	Environmental Protection Agency www.epa.gov

FCC	Federal Communications Commission www.fcc.gov
GSA	General Services Administration www.gsa.gov
LBL	Lawrence Berkeley National Laboratory www.lbl.gov
NIST	National Institute of Standards and Technology www.nist.gov
OSHA	Occupational Safety & Health Administration www.osha.gov
PHS	U.S. Department of Health and Human Services www.hhs.gov
RUS	Rural Utilities Service (See USDA (Department of Agriculture))
SD	State Department www.state.gov
TRB	Transportation Research Board www.nationalacademies.org/trb/transportation-research-board
USDA	Department of Agriculture www.usda.gov
USP	U.S. Pharmacopeia www.usp.org
USPS	Postal Service www.usps.com

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

ABAAS	Architectural Barriers Act Accessibility Standards www.access-board.gov
CFR	Code of Federal Regulations Available from Government Printing Office www.govinfo.gov/app/collection/cfr

FED-STD	Federal Standard (See FS (Federal Specification))
FS	Federal Specification Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/ Available from General Services Administration www.gsa.gov Available from National Institute of Building Sciences www.nibs.org
FTMS	Federal Test Method Standard (See FS (Federal Specification))
MIL	(See MILSPEC (Military Specification and Standards))
MIL-STD	(See MILSPEC (Military Specification and Standards))
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-aba-standards/ufas *(UFAS is **only** for housing projects per Fair Housing Act. See also the Fair Housing Act Design Manual, www.huduser.gov/portal/publications/destech/fairhousing)*

1.5 ENVIRONMENTAL REFERENCE STANDARDS

A. American Forest and Paper Association:

1. Sustainable Forestry Initiative

B. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):
- **ASHRAE 52.2,** *Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size*
- **ASHRAE 55,** *Thermal Environmental Conditions for Human Occupancy*
- **ASHRAE 62.1,** *Ventilation for Acceptable Indoor Air Quality*

C. American Association of State Highway and Transportation Officials (AASHTO):
- **MP009-06 Standard Specification for Compost for Erosion/Sediment Control (Filter Berms and Filter Socks)**
- **MP010-03 Standard Specification for Compost for Erosion/Sediment Control (Compost Blankets)**

D. American Society for Testing and Materials International (ASTM):
- A478 Standard Specification for Chromium-Nickel Stainless Steel Weaving and Knitting Wire

- A580/A580M Standard Specification for Stainless Steel Wire
- A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- B813 Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
- C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures
- C128 Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
- C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- C1319 Standard Specification for Concrete Grid Paving Units
- C1338 Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
- C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C1371 Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
- C1386 Standard Specification for Precast Autoclaved AERATED Concrete (PAAC) Wall Construction Units
- C1483 Standard Specification for Exterior Solar Radiation Control Coatings on Buildings
- C1549 Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
- C289 Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
- C311 Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete
- C33 Standard Specification for Concrete Aggregates
- C593 Standard Specification for Fly Ash and Other Pozzolans for Use With Lime
- C595 Standard Specification for Blended Hydraulic Cements
- C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
- C989 Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
- D1435 Standard Practice for Outdoor Weathering of Plastics
- D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 foot pound force per cubic foot (ft-lbf/ft3) (2,700 kilonewton meter per cubic meter (kN-m/m3))
- D1972 Standard Practice for Generic Marking of Plastic Products
- D198 Standard Test Methods of Static Tests of Lumber in Structural Sizes
- D2103 Standard Specification for Polyethylene Film and Sheeting
- D217 Standard Test Methods for Cone Penetration of Lubricating Grease
- D2369 Standard Test Method for Volatile Content of Coatings
- D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
- D3792 Standard Test Method for Water Content of Coatings by Direct Injection Into a Gas Chromatograph
- D3864 Standard Guide for Continual On-Line Monitoring Systems for Water Analysis

- D3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- D4017 Standard Test Method for Water in Paints and Paint Materials by Karl Fischer Method
- D4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
- D4444 Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters
- D4491 Standard Test Methods for Water Permeability of Geotextiles by Permittivity
- D4552 Standard Practice for Classifying Hot-Mix Recycling Agents
- D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- D4716 Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
- D4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Product
- D4840 Standard Guide for Sampling Chain-of-Custody Procedures
- D4887 Standard Test Method for Preparation of Viscosity Blends for Hot Recycled Bituminous Materials
- D5106 Standard Specification for Steel Slag Aggregates for Bituminous Paving Mixtures
- D5116 Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products
- D5199 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
- D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles
- D5268 Standard Specification for Topsoil Used for Landscaping Purposes
- D5359 Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber
- D5505 Standard Practice for Classifying Emulsified Recycling Agents
- D5509 Standard Practice for Exposing Plastics to a Simulated Compost Environment
- D5512 Standard Practice for Exposing Plastics to a Simulated Compost Environment Using an Externally Heated Reactor
- D5539 Standard Specification for Seed Starter Mix
- D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations
- D5603 Standard Classification for Rubber Compounding Materials—Recycled Vulcanizate Particulate Rubber
- D5663 Standard Guide for Validating Recycled Content in Packaging Paper and Paperboard
- D5759 Standard Guide for Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
- D5792 Standard Practice for Generation of Environmental Data Related to Waste Management Activities: Development of Data Quality Objectives
- D5834 Standard Guide for Source Reduction Reuse, Recycling, and Disposal of Solid and Corrugated Fiberboard (Cardboard)
- D5851 Standard Guide for Planning and Implementing a Water Monitoring Program
- D5852 Standard Test Method for Erodibility Determination of Soil in the Field or in the Laboratory by the Jet Index Method
- D6002 Standard Guide for Assessing the Compostability of Environmentally Degradable Plastics
- D6006 Standard Guide for Assessing Biodegradability of Hydraulic Fluid
- D6007 Standard Test Method for Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber

- D6046 Standard Classification of Hydraulic Fluids for Environmental Impact
- D6081 Standard Practice for Aquatic Toxicity Testing of Lubricants: Sample Preparation and Results Interpretation
- D6155 Standard Specification for Nontraditional Coarse Aggregates for Bituminous Paving Mixtures
- D6245 Standard Guide for Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation
- D6261 Standard Specification for Extruded and Compression Molded Basic Shapes Made from Thermoplastic Polyester (TPES)
- D6262 Standard Specification for Extruded, Compression Molded, and Injection Molded Basic Shapes of Poly(aryl ether ketone) (PAEK)
- D6270 Standard Practice for Use of Scrap Tires in Civil Engineering Applications
- D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers
- D6330 Standard Practice for Determination of Volatile Organic Compounds (Excluding Formaldehyde) Emissions from Wood-Based Panels Using Small Environmental Chambers Under Defined Test Conditions
- D6345 Standard Guide for Selection of Methods for Active, Integrative Sampling of Volatile Organic Compounds in Air
- D6400 Standard Specification for Compostable Plastics
- D6629 Standard Guide for Selection of Methods for Estimating Soil Loss by Erosion
- D6712 Standard Specification for Ultra-High-Molecular-Weight Polyethylene (UHMW-PE) Solid Plastic Shapes
- D6886 Standard Test Method for Speciation of the Volatile Organic Compounds (VOCs) in Low VOC Content Waterborne Air-Dry Coatings by Gas Chromatography
- D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
- D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
- D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
- D7186 Standard Practice for Quality Assurance Observation of Roof Construction and Repair
- E1105 Standard 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
- E1333 Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Under Defined Test Conditions Using a Large Chamber
- E1433 Standard Guide for Selection of Standards on Environmental Acoustics
- E1609 Standard Guide for Development and Implementation of a Pollution Prevention Program
- E1686 Standard Guide for Selection of Environmental Noise Measurements and Criteria
- E1690 Standard Test Method for Determination of Ethanol Extractives in Biomass
- E1721 Standard Test Method for Determination of Acid-Insoluble Residue in Biomass
- E1755 Standard Test Method for Ash in Biomass
- E1758 Standard Test Method for Determination of Carbohydrates in Biomass by High Performance Liquid Chromatography
- E1780 Standard Guide for Measuring Outdoor Sound Received from a Nearby Fixed Source

- E1821 Standard Test Method for Determination of Carbohydrates in Biomass by Gas Chromatography
- E1861 Standard Guide for Use of Coal Combustion By-Products in Structural Fills
- E1918 Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
- E1971 Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings
- E1980 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- E1991 Standard Guide for Environmental Life Cycle Assessment of Building Materials/Products
- E2114 Standard Terminology for Sustainability Relative to the Performance of Buildings
- E2128 Standard Guide for Evaluating Water Leakage of Building Walls
- E2129 Standard Practice for Data Collection for Sustainability Assessment of Building Products
- E241 Standard Guide for Limiting Water-Induced Damage to Buildings
- E2432 Standard Guide for General Principles of Sustainability Relative to Buildings
- E408 Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
- E413 Standard Classification for Rating Sound Insulation
- E477 Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers
- E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
- E683 Standard Practice for Installation and Service of Solar Space Heating Systems for One- and Two-Family Dwellings
- E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
- E781 Standard Practice for Evaluating Absorptive Solar Receiver Materials When Exposed to Conditions Simulating Stagnation in Solar Collectors With Cover Plates
- E782 Standard Practice for Exposure of Cover Materials for Solar Collectors to Natural Weathering Under Conditions Simulating Operational Mode
- E823 Standard Practice for Nonoperational Exposure and Inspection of a Solar Collector
- E881 Standard Practice for Exposure of Solar Collector Cover Materials to Natural Weathering Under Conditions Simulating Stagnation Mode
- E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- E903 Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
- F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
- F2034 Standard Specification for Sheet Linoleum Floor Covering
- F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

E. Bat Conservation International:
- Bat Approved Bat Houses

F. Carpet and Rug Institute

- Green Label & Green Label Plus Testing Programs, carpet-rug.org/testing/green-label-plus

G. Center for Resource Solutions
- Green-e program

H. Environmental Protection Agency (EPA):
- **Comprehensive Procurement Guidelines**
- **ENERGY STAR**
- **Environmentally Preferable Purchasing Program Final Guidance**
- **GreenScapes program**
- **Heat Island Initiative**
- **Indoor Air Quality Building Education and Assessment Model (I-BEAM)**
- **National Environmental Performance Track**
- **Pollution Prevention (P2)**
- **Product Stewardship Program**
- **Significant New Alternatives Policy (SNAP) Program**

I. Federal Trade Commission:
- **Guide for the Use of Environmental Marketing Claims**

J. Forest Stewardship Council:
- **Chain-Of-Custody**
- **Forest Management**

K. Green Seal:
- **GC-03 Anti-Corrosive Paints**
- **GC-12 Occupancy Sensors**
- **GS-11 Paints**
- **GS-13 Windows**
- **GS-14 Window Films**
- **GS-36 Commercial Adhesives**
- **GS-37 Industrial & Institutional Cleaners**

L. International Iron and Steel Institute:
- **CO2 Breakthrough Program**

M. International Organization of Standardization:
- **Guide 64; Guide for Inclusion of Environmental Aspects in Product Standards**
- **9660 Information processing -- Volume and file structure of CD-ROM for information interchange**
- **14001 Environmental management systems – Specification with guidance for use**
- **14004 Environmental Management Systems – General Guidelines on Principles, Systems and Supporting Techniques**
- **14020 Environmental labels and declarations – General principles**
- **14024 Environmental labels and declarations – Type I environmental labelling - Principles and procedures**
- **14040 Environmental management – Life cycle assessment – Principles and framework**

N. National Association of Home Builders:
- **Advanced Framing Techniques: Optimum Value Engineering**

O. National Institute of Building Sciences:
- **MOIST program for transfer of heat and moisture**
- **Whole Building Design Guide**

P. National Institute of Standards and Technology:
- **BEES (Building for Environmental and Economic Sustainability) Lifecycle Decision Support Tool**

Q. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
- **IAQ Guidelines for Occupied Buildings Under Construction**

R. Southcoast Air Quality Management District:
- **1168 Adhesive And Sealant Applications**

S. US Composting Council:
- Seal of Testing Assurance Program

T. US Department of Agriculture:
- **Biobased Products – Definitions and Descriptions**

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities. Temporary facilities and controls are to be located in three locations. Refer to enlarged staging plan within drawings for locations.

1.2 DEFINITIONS

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

1.3 SUBMITTALS

A. Product Data: Manufacturer's catalog data.

B. Shop Drawings and Design data
   1. Manufacturer's descriptive and technical literature
   2. Manufacturer's building design analysis

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in Contract Sum as required.

B. Water Service: Potable Water from existing water system is available for use with metering and with payment of use charges. Provide connections and extensions of services as required for construction operations with any additional permit costs. Use of up to 1,000 gallons per day permitted. Contractor to coordinate with Town of Grand Lake in their name.

C. Electric Power Service: Electric power from existing system is available for use with metering and with payment of use charges. Provide connections and extensions of services as required for construction operations with any additional permit costs. Contractor to coordinate with Mountain Parks Electric in their name.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with National Electrical Contractors Association (NECA), National Electrical Manufacturers Association (NEMA), and Underwriter Laboratories (UL) standards and regulations for temporary electric service. Install service to comply with National Fire Protection Association (NFPA) 70.

B. Environmental Protection: Provide environmental protection as required by agency(ies) with jurisdiction and as indicated in Contract Documents. Coordinate with requirements of the following:

1. Regulatory Requirements
2. Indoor Air Quality (IAQ) Management
3. Noise and Acoustics Management
4. Environmental Management
5. Construction Waste Management

C. Accessible Temporary Egress: Comply with applicable provisions in the United States (U.S.) Architectural & Transportation Barriers Compliance Board's Architectural Barriers Act Accessibility Standard (ABAAS) Accessibility Guidelines.

1.6 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 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," "Site Concrete", and "Paving Specialties".

C. Portable Chain-Link Fencing: Minimum 2 inch (50 millimeters), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 millimeters) high with galvanized steel pipe posts; minimum 2-3/8 inch (60 millimeters) OD line posts and 2-7/8 inch (73 millimeters) OD corner and pull posts, with 1-5/8 inch (42 millimeters) OD top and bottom rails. Provide concrete or galvanized steel bases for supporting posts. No slats or screening.

D. Safety Barrier Fence: Orange plastic fence, minimum height, 4 feet.

E. Barrier Tape: Yellow tape Imprinted with "CAUTION: CONSTRUCTION AREA," minimum 2" tall lettering, weather-resistant 3 mil. low density polyethylene film product.

F. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry"

G. Gypsum Board: Minimum 1/2 inch (12.7 millimeters) thick by 48 inches (1219 millimeters) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.

H. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

I. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mil (0.25-millimeter) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

J. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 millimeters).

2.2 TEMPORARY FACILITIES

A. All temporary facilities are to:
   1. Meet or exceed standards as defined in 2024 IBC.
   2. Include stairs and ramps constructed to meet or exceed ABAAS.
   3. Meet or exceed all loads as indicated on drawings for this location (wind, snow, seismic, etc.)
   4. Shall not have advertising displayed on the exterior or interior of the trailers.

B. Two Temporary Offices for NPS Staff: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading, including snow loads, where indicated on drawings. Include single user accessible restroom facility and entrance ramp in each field office unit.

   1. Prefabricated, job built, or a mobile unit; excellent condition, structurally sound, non-flammable exterior construction, weather tight. Size as indicated on drawings.
   2. Operable windows and security screens, adjustable ventilation.
   3. Restroom (minimum of lavatory and toilet, with exhaust fan if room is windowless).
   4. Air conditioner and heater.
   5. Interior partition with lockable door to divide office
   6. Paneling or freshly painted walls, acoustical tile or painted ceilings, and resilient flooring.
   7. Two exterior doors with dead bolts keyed from outside and accessible ramp at one door.
      a. Minimum 20-square-foot landing and steps at one exterior door.

C. Contracting Officers Field Office: Field office shall be a separate structure from Contractor's office. Prefabricated or mobile unit with serviceable finishes, temperature controls, and foundations adequate for normal loading, including snow loads, where indicated on drawings.

   1. Prefabricated, job built, or a mobile unit; excellent condition, structurally sound, non-flammable exterior construction, weather tight, minimum 300 square feet.
   2. Operable windows and security screens, adjustable ventilation.
   3. Restroom (minimum of lavatory and toilet, with exhaust fan if room is windowless).
   4. Air conditioner and heater.
   5. Interior partition with lockable door to divide office
   6. Paneling or freshly painted walls, acoustical tile or painted ceilings, and resilient flooring.
   7. Two exterior doors with dead bolts keyed from outside,
      a. Minimum 20-square-foot landing and steps at each exterior door.

   8. Outlets: Minimum of two, quad outlets with surge protection.
   9. Refrigerator: Under counter, 3.2-cubic-foot volume with 0.8-cubic-foot freezer with dedicated power receptacle.

10. Fire Extinguisher: UL listed and FM (Fire Pump Motors) approved, minimum rating of 2-A:10-B:C, dry chemical.
11. First-Aid Kit: General office/light industrial kit.
12. Two desks with five drawers each and two chairs with casters; two drafting tables (minimum 40 inches wide by 5 feet long) and two stools; drawing rack; two 2-drawer and one 4-drawer legal size locking filing cabinets with keys; 8 feet of 12 inch deep shelving; coat rack; two additional guest chairs; two desk lamps; two drafting table lamps; and a maximum/minimum thermometer.
13. Manufactured computer work station, capable of containing CPU (central processing unit), monitor, keyboard, printer; work station chair.
14. Additional tables necessary for FAX machine and copier.
15. Two 5-gallon trash cans and one 30-gallon trash can with lid.
16. Ceiling mounted general lighting fixtures.

D. Storage and Fabrication Sheds: Temporary weather tight sheds or other covered facilities for storage of materials subject to weather damage. Number and size of structures shall be subject to Contracting Officer's approval. Snow loading should be anticipated as indicated on drawings.
   1. Storage containers shall be 20’x 40’ standard weather tight containers located as indicated on drawings.

E. Visitor Contact Station: Visitor Contact Station shall be a separate structure from Contracting Officer’s office in location indicated on drawings. Prefabricated or mobile unit with serviceable finishes, temperature controls, and foundations adequate for normal loading, including snow loads, where indicated on drawings.

   1. Prefabricated, job built, or a mobile unit; excellent condition, structurally sound, non-flammable exterior construction, weather tight. Size as indicated on drawings.
   2. Operable windows and security screens, adjustable ventilation.
   3. Air conditioner and heater.
   4. Interior partition with lockable door to divide space as requested by park.
   5. Paneling or freshly painted walls, acoustical tile or painted ceilings, and resilient flooring.
   6. Two exterior doors with dead bolts keyed from outside,
   7. Minimum 20-square-foot landing and steps at each exterior door and one accessible ramp.

F. Park Staff Toilets: Sufficiently lighted and ventilated toilet facility in weatherproof, sight proof, accessible, sturdy enclosure with privacy locks located within temporary visitor center area as indicated on drawings.

G. Contractor Toilets: Sufficiently lighted and ventilated toilet facilities in weatherproof, sight proof, accessible, sturdy enclosures with privacy locks located within staging area.

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

I. Heating, Ventilation, and Air Conditioning (HVAC) Equipment: Unless Contracting Officer authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to agency(ies) with jurisdiction, and marked for intended use.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with Minimum Efficiency Reporting Value (MERV) of 8 at each return air grille in system and remove at end of construction.

J. Internet Connection: Furnish, install and maintain a high-speed connection (Digital Subscriber Line (DSL) or similar) between the project's DDC system and the internet through a Contractor furnished internet service provider for the Contracting Officers Field Office. Contractor is responsible for maintenance of this connection and costs associated with internet service provider through warranty period of this contract. Upon completion of warranty period, service shall be transferable to the Government at which time future costs for connection will no longer be the responsibility of Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

1. Locate facilities to limit site disturbance and as directed by the Contracting Officer.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, NPS, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services. Acquire necessary permits.

B. Storm Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by the agency(ies) with jurisdiction.

C. Non-potable water for construction is not available within the park boundaries. Contractor shall furnish non-potable water from a source outside park boundary.

D. Potable water is available on site. Make connections to existing facilities as needed. Facilities must be cleaned and maintained in a condition acceptable to NPS. At Substantial Completion, restore these facilities to condition existing before initial use.

E. 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.
4. Toilets: Use of existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to NPS. At Substantial Completion, restore facilities to condition existing before initial use.

F. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Use of permanent heating system will not be allowed without written authorization from Contracting Officer. When the permanent heating system is approved for use as temporary heating, pay costs until final acceptance. Permanent heating system shall be sufficiently complete, including controls, to permit safe operation
2. Provide and maintain adequate approved facilities, as required for safety and construction requirements, during the work. Provide ample clearance around stoves, heaters, chimney and vent connections to prevent ignition of combustible material
3. Install and maintain temporary filters when air handing equipment is used for temporary heating. Install new filters before final acceptance in addition to any extra sets of filters required. Clean coils as determined by Contracting Officer.
4. Warranties for equipment used for temporary heating shall start on date of Final Acceptance.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead or surface protected runs, unless otherwise indicated.

I. 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.

J. Telephone Service: No telephone service is available on site for Contractor's use. Make arrangements with Telephone Company and pay costs.

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. Temporary Offices for NPS Staff and Visitor Contact Trailer:

1. Provide Heat, lights, power, air conditioning, temporary water pressure, and backflow preventer with connection to existing sewer line.
2. Provide office, furnishings, and utility connections no later than 7 days after date of Notice to Proceed. Refer to drawings for location east of Trail Ridge Road. Exact location will be confirmed by Contracting Officer.
3. Maintain equipment, furnishings, and structures. Provide equipment replacement elements as needed. Provide weekly cleaning services and trash disposal.

C. Contracting Officers Field Office:

1. Provide Heat, lights, power, air conditioning, temporary water pressure, and backflow preventer with connection to existing sewer line.
2. Provide office, furnishings, and utility connections no later than 7 days after date of Notice to Proceed. Exact location will be determined by Contracting Officer.
3. Maintain equipment, furnishings, and structures. Provide equipment replacement elements as needed. Provide weekly cleaning services and trash disposal.

D. Traffic Controls: Erect and maintain barricades, lights, danger signals, and warning signs in accordance with Manual on Uniform Traffic Control Devices (MUTCD), Part 6, 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.

E. Parking: Use designated areas of existing parking lot shown on drawings for construction personnel. Maintain public parking as shown on drawings for access to temporary Visitor Contact trailers.

F. 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 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.

G. 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.

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of agency(ies) with jurisdiction including bear-proof receptacles.

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

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 minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Cleaning of Equipment: Contractor shall ensure prior to moving on to Project Area, equipment, is free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. Ensure equipment has been pressure washed and is free of exotic species. Equipment shall be considered free of soil, seeds, and other debris when 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 to minimize attraction and harboring of rodents, roaches, and other pests and perform extermination and control procedures at regular intervals so Project will be free of pests and residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

F. Site Enclosure Fence: Before construction operations begin, furnish and install chain link fencing to prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As indicated on Drawings.
2. Locate vehicular gates to avoid interference with traffic on public thoroughfares.
3. Locate pedestrian entrance gates as required to provide controlled personnel entry.

4. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Contracting Officer with one set of keys.
5. Contractor to provide installed construction combination locks and supply code to NPS.
6. Fence height - minimum of 6 ft.
7. Include signage on gate indicating that the area is closed to the public.

G. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

H. Barricades, Warning Signs, and Lights: Comply with requirements of Manual on Uniform Traffic Control Devices (MUTCD), Part 6, latest edition for erecting structurally adequate barricades, including warning signs and lighting.

I. 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.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Responsible Person: Capable and qualified person shall be placed in charge of fire protection. Responsibilities shall include locating and maintaining fire protective equipment and establishing and maintaining safe torch cutting and welding procedures.
2. Tobacco Use, Smoking, and Vaping: Smoking within buildings or temporary storage sheds is prohibited.
3. Supervise hot work (welding operations, combustion-type temporary heating units, and similar sources of fire ignition) according to requirements of Agency(ies) with Jurisdiction. A hot work permit, issued by the park, is required.
4. Develop and supervise overall fire-prevention and -protection program for personnel at Project Site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
5. Provide temporary standpipes and hoses for fire protection. Hang hoses with warning sign stating hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
6. Hazard Control: Take necessary precautions to prevent fire during construction. Do not store flammable or combustible liquids in historic structures. Provide adequate ventilation during use of volatile or noxious substances. Ensure cleanup procedures and storage requirements are followed at close of every work session.
7. Spark Arresters: Equip gasoline or diesel-powered equipment used during periods of potential fire hazards or in potential forest and grass fire locations with spark arresters approved by United States Department of Agriculture (USDA) Forest Service.

    a. Written determinations of periods and areas of potential fire hazard will be issued by Contracting Officer.

8. Buildings: Furnish a minimum of one extinguisher for each 1,500 square feet of area or major fraction thereof.

    a. Travel distance from any work station to nearest extinguisher shall not exceed 75 feet.

9. Vehicles and Equipment: Provide one extinguisher on each vehicle or piece of equipment.
10. Service and Refueling Areas: Not permitted.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. 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 24-hour basis where required to achieve indicated results and 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. The temporary control measures should not be removed prior to permanent stabilization.

    2. Materials and facilities that constitute temporary facilities are property of Contractor. NPS reserves right to take possession of Project identification signs.
    3. 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 regulated as a hazardous material in accordance with 49 CFR 173 (Code of Federal Regulations), 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): Composition and characteristics of air in an enclosed space that affect occupants of that space. Indoor air quality of a space refers to 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 impact on thermal comfort such as air temperature, relative humidity and air speed.

E. Interior final finishes: Materials and products exposed to interior occupied spaces; including flooring, wall covering, finish carpentry, and ceilings.

F. Packaged dry products: Materials and products installed in dry form delivered 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 materials which require curing.

1.3 QUALITY ASSURANCE

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

1.4 SUBMITTALS

A. Indoor Air Quality (IAQ) Management Plan: After award and before Pre-construction conference, prepare and submit IAQ Management Plan, including:

1. Procedures for control of emissions during construction.

    a. Identify schedule for application of interior finishes: Identify each interior finish that generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors. 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 Heating 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 (CO).

    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 (MSDS): Submit MSDSs for inclusion in Operation and Maintenance Manual for:

    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 greatest extent possible, isolate and/or shut down return side of HVAC system during construction. When ventilation system must be operational during construction activities, provide temporary filters at air inlets (returns) and at locations for filters prescribed in the design.
4. Contractor shall bear 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 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

Fahrenheit minimum to 90-degree Fahrenheit maximum continuously during ventilation period. Do not ventilate within limits of disturbance 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 cubic feet. of outdoor air per square feet of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit 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 specified contaminants is conducted during or after flush-out, then flush-out process must be restarted.
3. Install new HVAC filtration media in locations identified to have permanent filtration in 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 installed materials and products are dry prior to sealing and weatherproofing 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 after each rain event.

    a. If stored 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. Site drainage: Verify final grades of site work and landscaping drain surface water and ground water away from building.
5. Weatherproofing: Inspect moisture control materials as they are being installed. Include:

    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 flashing for roof, walls, windows, doors, and other penetrations.
    c. Vapor Barrier: Verify vapor barrier is installed in accordance with 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.

6. Plumbing: Verify satisfactory pressure test of pipes and drains is performed before closing in and insulating lines.
7. 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. refrigerant line insulation is installed and sealed.

C. Schedule:

1. Schedule work such that absorptive materials, such as 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 earliest possible time.

D. Testing for Moisture Content: Test moisture content of porous materials and absorptive materials to ensure 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 9.

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 less than 20% at center of piece; less than 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. Water Leakage: Review as per ASTM E2128 Standard Guide for Evaluating Water Leakage of Building Walls.

END OF SECTION 01 57 19.11

SECTION 01 57 19.12 – NOISE AND ACOUSTICS MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Special requirements for noise and acoustics management during renovation operations.

1.2 DEFINITIONS

A. Ambient noise level: The total noise associated with a given environment, being usually a composite of normal or existing sounds from all sources near and far, excluding the noise source at issue.

B. Daytime: The hours from 7 A.M. to 9 P.M. on weekdays and 9 A.M. to 9 P.M. on weekends and holidays.

C. Nighttime: All non-daytime hours.

D. Property line: The real or imaginary line along the ground surface and its vertical extension, which separates real property owned or controlled by one person from contiguous real property owned or controlled by another person or from any public right-of-way or from any public space.

E. Receiving noise area: Any real property where people live or work and where noise is heard, excluding the project or source area.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 NOISE MANGEMENT

A. Noise Control: Perform renovation operations to minimize noise. Perform noise-producing work in less sensitive hours of the day or week as directed by the Contracting Officer CO).

B. Repetitive and/or intermittent, high-level noise: Permitted only during Daytime.

1. Do not exceed the following dB(A) limitations at 50 feet:

Sound Level in dB(A)	Time Duration of Impact Noise
70	More than 12 minutes in any hour
80	More than 3 minutes in any hour

2. Maximum permissible construction equipment noise levels at 50 feet:

EARTHMOVING	dB(A)
Front Loaders	75
Backhoes	75
Dozers	75
Tractors	75
Scrapers	80
Graders	75
Trucks	75
Pavers, Stationary	80
Pumps	75
Generators	75
Compressors	75

MATERIALS HANDLING	dB(A)
Concrete Mixers	75
Concrete Pumps	75
Cranes	75
Derricks Impact	75
Pile Drivers	95
Jack Hammers	75
Rock Drills	80
Pneumatic Tools	80
Saws	75
Vibrators	75

C. Ambient Noise:

1. Maximum noise levels (dB (decibel)) for receiving noise area at property line shall be as follows:

   a. Residential receiving area
      Daytime: 65 dB
      Nighttime: 45 dB

   b. Commercial/Industrial receiving area
      Daytime: 67 dB
      Nighttime: 65 dB

   c. In the event the existing local ambient noise level exceeds the maximum allowable receiving noise level (dB), the receiving noise level maximum for construction operations shall be adjusted as follows:

   d. Residential receiving area: Maximum 3 additional dB above the local ambient as measured at property line.

   e. Commercial/Industrial receiving area: Maximum 5 additional dB above the local ambient as measured at the property line.

3.2 FIELD QUALITY CONTROL

A. Assess potential effects of construction noise on adjacent neighbors in accordance with ASTM E1686 and as follows:

1. Ambient noise measurement: Measure at property line at a height of at least four (4) feet above the immediate surrounding surface. Average the ambient noise level over a period of at least 15 minutes.
2. Ambient noise measurement at urban sites: Conduct during morning peak traffic hour between 7 A.M. and 9 A.M. and afternoon peak traffic hour between 4 P.M. and 6 P.M. In addition, conduct a 24-hour measurement at the proposed project site to document the noise pattern throughout the day. Adjust and weight for seasonal and climatic variations.

B. Monitor noise produced from construction operations in accordance with ASTM E1780.

END OF SECTION 01 57 19.12

SECTION 01 57 23 - TEMPORARY STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 SUMMARY

A. Federal Regulations for controlling discharges of pollutants (including chemicals, erodible material, and trash) from municipal separate storm sewer systems, construction sites, and industrial activities, were brought under the National Pollution Discharge Elimination System (NPDES) permit process by amendments to the Clean Water Act (CWA), and promulgation of federal stormwater regulations issued by the United States Environmental Protection Agency (USEPA). The USEPA uses amount of ground disturbance as a measure of a project potential to generate pollution from erosion. NPDES Phase I regulates discharges from construction sites that disturb 5 acres or more. NPDES Phase II regulations expand existing General Permit requirements under Phase I to include/regulated discharges from construction sites that disturb land equal to or greater than one (1) acre and less than 5 acres, known as Small Construction Activity. Construction disturbances 1 acre and above typically require a formal NPDES permit and a formal Stormwater Pollution Prevention Plan (SWPPP) must be submitted to Agency(ies) with Jurisdiction for review and approval.

B. Work of this section consists of implementing measures to Temporary Storm Water Pollution during construction activities~~, either~~ through compliance with NPDES permit program.

1.2 DEFINITIONS

A. Definitions pertaining to sustainable development: As defined in ASTM E2114.

B. 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 utility of the environment for aesthetic, cultural, or historical purposes.

C. National Pollution Discharge Elimination System (NPDES) Phase I: Regulates discharges from construction sites that disturb 5 acres or more.

D. NPDES Phase II: Regulations expand existing General Permit requirements under Phase I to include and regulate discharges from construction sites that disturb land equal to or greater than one (1) acre and less than 5 acres, known as Small Construction Activity.

E. Storm Water Pollution Prevention Plan (SWPPP): Developed and implemented stormwater management measures to protect surface water from pollutants during construction activities disturbing an acre or more in compliance with federal, state, and local requirements for permit approval under NPDES program.

1.3 SUBMITTALS

A. After contract award and before pre-construction conference, prepare and submit:
   1. A SWPPP showing SWPPP satisfies Federal and State NPDES permit requirements.

B. Inspection Schedule: Submit schedule for inspection and monitoring of storm water 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 other materials proposed for use on this project.

1.4 QUALITY ASSURANCE

A. Contractor shall prepare and submit a plan to Contracting Officer (CO) for review and concurrence.

B. Orientation Meeting: Contractor shall arrange and conduct an Erosion and Sediment Control meeting/briefing to inform parties, scheduled to be on-site during project, of measures to be implemented for proper erosion and sediment control (may be included as part of Pre-Construction Meeting).

1. Installation of silt fences, storm drain protection, and other forms of erosion and sediment control shall not begin until after this meeting has occurred.

C. Pollution Prevention and Erosion Control Manager: Contractor shall designate Pollution Prevention and Erosion Control Manager responsible for implementation, inspection, maintenance, and amendments to approved plan.

1. Pollution Prevention and Erosion Control Manager shall be familiar with temporary storm water pollution prevention procedures and Best Management Practices and ensure emergency procedures and plan are updated as needed and available for inspection.

2. When changes in approved plan are required, Pollution Prevention and Erosion Control Manager shall prepare and certify an amendment and submit to Contracting Officer for review and concurrence.

PART 2 - PRODUCTS

2.1 TEMPORARY STORM WATER POLLUTION PREVENTION PLAN

A. Provide SWPPP which satisfies Federal and State NPDES permit requirements and includes:

1. Site description.
2. Identification and contract information for Pollution Prevention and Erosion Control Manager.
3. Expected sequencing of operations and construction schedule.
4. Weather monitoring procedure.
5. Descriptions and details Best Management Practices for of pollution prevention and erosion controls, including dust control.
6. Pollution prevention and erosion control plans.
7. Controls for other potential onsite storm water pollutants.
8. Applicable specifications.

9. Maintenance and inspection procedures and forms.
10. Description of potential non-storm water discharges at site.
11. Notice of Intent (NOI) form.
12. Notice of Termination (NOT) form.
13. Contractor and Sub-contractor Certification forms.
14. Other record keeping forms and procedures.
15. Housekeeping Best Management Practices, including vehicle wash-down areas, protection of equipment storage and maintenance areas, and sweeping of roadways related to hauling activities.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL PROTECTION

A. Protection of Natural Resources: Comply with applicable regulations and these specifications. Preserve natural resources within project boundaries and outside limits of disturbance performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by Contracting Officer.

B. Construction Zone: Arrange construction activities to minimize pollution (i.e., erosion, trash, etc.) to maximum practical extent.

1. Clearing, excavation, and grading shall be limited to those areas of project site necessary for construction. Minimize area exposed and unprotected.
2. Clearly mark and delineate limits of disturbance activities.
3. Equipment shall not be allowed to operate outside limits of disturbance or to disturb existing vegetation.
4. Excavation and grading shall be completed during dry season to maximum extent possible.
5. Material shall be stored away from locations where water is present to greatest extent practicable.

3.2 REGULATORY REQUIREMENTS

A. Permits: Contractor shall obtain required NPDES permits resulting in no impacts to scheduled work. Contractor shall account for possibility of significant lead time in scheduling and executing work.

1. Implement requirements of NPDES permit for erosion control due to storm water runoff during construction.
2. Implement good housekeeping practices, inspections and record keeping.
3. Prior to construction, Contractor and Subcontractors shall sign certifications (included in the plan) that they understand requirements of NPDES permit.
4. Subcontractors shall comply with requirements of NPDES under supervision of Contractor.
5. Accepted plan shall comply with terms and conditions of EPA permit.

B. Notice of Intent (NOI): Contractor shall file a Notice of Intent and formal SWPPP as required to the Agency(ies) with Jurisdiction.

C. Notice of Termination (NOT): After Substantial Completion of Work, file a Notice of Termination (NOT) with the Agency(ies) with Jurisdiction.

D. Contracting Officer Notification: Contractor shall notify Contracting Officer in writing and by telephone of these events:

1. Erosion and sediment control meeting/briefing.
2. Following installation of required sediment control structures.
3. Prior to removal of or modification to sediment control structures.
4. Prior to removal of sediment control structures.

3.3 TEMPORARY STORM WATER POLLUTION PREVENTION PLAN

A. Review and Acceptance: Contractor and Contracting Officer will jointly review draft Plan and agree to needed revisions. Contractor shall incorporate revisions, sign, and submit final Plan to Contracting Officer. Final Plan will be the document enforced on the project.

1. Accepted Plan will describe and ensure implementation of practices to be used to reduce pollutants in storm water discharges.
2. Contractor shall maintain current copy of Plan and associated records and forms at jobsite throughout duration of project.
3. Plan shall be available for public inspection and inspection and use of Contracting Officer.
4. Approval of Contractor's Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.

B. Implementation: Implement Plan as required throughout construction period and maintain erosion control elements in proper working order.

1. Do not perform clearing and grubbing or earthwork until Plan has been implemented.

C. SWPPP (including inspection forms) and data used to complete the NOI shall be provided to Contracting Officer after Substantial Completion of project.

3.4 SITE INSPECTIONS AND PLAN REVISIONS

A. Inspections: Contractor and Contracting Officer will perform a weekly inspection onsite.

1. Inspection shall include disturbed areas not completely stabilized, areas used for storage of materials, locations where vehicles enter or exit site, and other erosion and sediment controls included in the Plan.
2. Inspections shall be documented.
3. Inspection forms shall be retained onsite in Plan notebook throughout construction period.

B. Plan Revisions: It may be necessary to revise Plan during construction to make necessary improvements, revisions, or to respond to unforeseen conditions noted during construction or site inspections.

1. Plan shall specify mechanism whereby revisions may be proposed by Contractor or Contracting Officer.

2. Contractor and Contracting Officer will jointly review each revision to Plan before changes incorporated and implemented. Contractor will then provide revised copy of Plan to Contracting Officer.
3. Accepted modifications will be implemented within 7 calendar days following date of 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 Government.

3.5 HOUSEKEEPING AND SITE MANAGEMENT

A. Store materials onsite in conformance to Federal, state, local, and manufacturer's regulations and specifications. Use Best Management Practices to minimize risk of materials coming into contact with environmental conditions (i.e. water and wind) that could disperse them.

B. Manage solid waste in conformance to Federal, state, and local regulations. Best Management Practices should be used to minimize risk of materials coming into contact with environmental conditions (i.e. water and wind) that could disperse them.

C. Include a spill prevention and control plan with provisions placed in SWPPP.

D. Manage hazardous waste (including contaminated soil) in conformance to Federal, state, local and NPS regulations and guidelines.

3.6 EROSION CONTROL MEASURES

A. Erosion control measures shall consist of Best Management Practices for storm water discharges, including 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 control run-on and run-off into other areas, including creeks, streams, marshes, access roads, well areas, and staging areas.

C. Erosion control measures shall be used to contain only direct precipitation in construction zone. Contained water shall be allowed to percolate into ground or drain slowly through drainage filter sediment traps.

D. Earthen sediment traps or holding ponds shall not be used unless accepted by Contracting Officer.

E. Reduce runoff velocity and direct surface runoff around and away from fuel containment, storage, and borrow areas.

F. Divert surface runoff around and away from cut and fill slopes.

G. Place drainage filters around catch basins to create sediment traps to control run-off from construction area.

H. Excess water used for dust control shall be contained within demolition areas by erosion control measures.

I. Contractor shall prevent deposition of materials onto paved areas. Contractor shall inspect paved areas for deposited materials weekly and remove materials immediately.

J. Furnish, install, maintain, and operate necessary control measures and other equipment necessary to prevent erosion as described in approved SWPPP.

K. Before work begins, sufficient equipment shall be available on site to assure operation and adequacy of erosion control system can be maintained.

3.7 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. Contractor shall remove entrapped sediment from behind excelsior drainage filter after each storm.

3.8 REPORTING

A. If a discharge occurs or if project receives written notice or order from regulatory agency, Contractor shall immediately notify Contracting Officer and shall file written report to Agency(ies) with Jurisdiction within 7 days of discharge event, notice, or order. Corrective measures shall be implemented immediately following discharge, notice, or order. The report to the Agency(ies) with Jurisdiction shall contain:

1. Date, time, location, nature of operation, and type of discharge, including cause or nature of notice or order.
2. Best Management Practices deployed before discharge event, or prior to receiving notice or order.
3. Date of deployment and type of Best Management Practices deployed after discharge event, or after receiving notice or order, including additional Best Management Practices installed or planned to reduce or prevent re-occurrence.
4. An implementation and maintenance schedule for affected Best Management Practices.

3.9 SEDIMENT DISPOSAL

A. Sediment excavated from temporary sediment control structures shall be disposed on site with general fill, or with topsoil. Sediment shall be allowed to dry out as required before reuse.

B. Contractor shall place 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.

3.10 REMOVAL OF TEMPORARY STORM WATER POLLUTION CONTROL MEASURES

A. Temporary control measures shall be removed with permission of Contracting Officer within 20 working days after final acceptance of project, and/or once grading is complete and slopes have stabilized.

END OF SECTION 01 57 23

SECTION 01 67 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. 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 Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number and other designation shown or listed in manufacturer's published product literature, current as of date of 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. Approved Equals: Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have 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. Definitions pertaining to sustainable development: As defined in ASTM E2114.

C. Biobased Materials: As defined in 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) 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: Amount of biobased carbon in material or product as a percentage of weight (mass) of total organic carbon in material or product.

D. Chain-of-Custody: Process whereby a product or material is maintained under physical possession or control during its entire life cycle.

E. Environmentally preferable products: Products and services with lesser or reduced effect on the environment in comparison to conventional products and services. Refer to Environmental

Protection Agency's (EPA) Final Guidance on Environmentally Preferable Purchasing for more information.

F. Stewardship: Responsible use and management of resources in support of sustainability.

G. Sustainability: Maintenance of ecosystem components and functions for future generations.

1. Recycled Content Materials: Products containing pre-consumer or post-consumer materials as all or part of their feedstock. Recycled content claim shall be consistent with International Organization for Standardization (ISO) 140001 Standard for the Use of Environmental Marketing Claims.
2. Rapidly Renewable Material: Material made from plants typically harvested within a ten-year cycle.
3. Regional Materials: Materials manufactured and extracted, harvested, or recovered within a radius of 500 miles from Project location.

1.3 SUBMITTALS

A. Record Submittals as specified in – Sustainable Design Close-Out Documentation, submit:

1. Affirmative Procurement Reporting Form. Submit on form in Appendix A of this Section, or similar form as approved by Contracting Officer (CO).
2. Submit environmental data in accordance with Table 1 of ASTM E2129 for these products:

a. Masonry
b. Finish Carpentry
c. Plastic Fabrications
d. Building Insulation
e. Roofing
f. Joint Sealers
g. Wood Doors
h. Windows
i. Gypsum Board
j. Tile
k. Acoustical Ceilings
l. Carpet
m. Wall Coverings
n. Paints & Coatings
o. Toilet Compartments
p. Furnishings & Accessories
q. Plumbing fixtures and equipment.
r. HVAC equipment
s. Lighting equipment

.Material Safety Data Sheets (MSDS): For each product required by OSHA to have a MSDS, submit an MSDS. MSDS shall be prepared within the previous five years**.** Include information for MSDS Sections 1 to 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 event of accidental release.
m. Section 13: Disposal Considerations. Include data regarding proper disposal of the chemical. Include information regarding recycling and reuse. Indicate whether or not product is considered to be "hazardous waste" according to United States EPA Hazardous Waste Regulations 40 CFR 261 (Code of Federal Regulations).
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 these products:

a. Rough Carpentry
b. Finish Carpentry
c. Wood Doors
d. Windows
e. 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 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 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 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 Contract Documents. Ensure products are undamaged and properly protected.
5. Obtain materials in biodegradable or recyclable/reusable packaging which uses minimum amount of packaging possible.

C. Storage:

1. Allow for inspection and measurement of quantity or counting of units.
2. Store materials in manner to not endanger Project structure.
3. Store products subject to damage by the elements, under cover in 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 well-drained area on solid surfaces to prevent mixing with foreign matter.

1.6 PACKAGING

A. Where Contractor has option to provide one of 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 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 percent post-consumer recycled content and minimum 10 percent recovered fiber content of carrier board in accordance with EPA’s Comprehensive Procurement Guidelines and ASTM D5663.

E. Provide minimum 5 percent post-consumer recycled content and minimum 5 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 greatest extent possible.

1. To greatest extent possible, provide products and materials with 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 use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either Montreal Protocol and Title VI or 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 total value of the materials in project.

1.8 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for product specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare written document containing appropriate terms and identification, ready for execution. Submit 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 Specifications, prepare written document using appropriate form properly executed.
3. Refer to Divisions 2 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products to comply with Contract Documents, undamaged and, unless otherwise indicated, 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 produced and used successfully in similar situations on other projects.
3. Government reserves right to limit selection to products with warranties not in conflict with requirements of Contract Documents.
4. Where products are accompanied by term "as selected," Contracting Officer will make selection.
5. Where products are accompanied by term "match sample," sample to be matched is Governments.
6. Descriptive, performance, and reference standard requirements in Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:

1. Product: Where Specifications name single product and manufacturer, provide named product that complies with requirements or approved equal.
2. Manufacturer/Source: Where Specifications name single manufacturer or source, provide product by named manufacturer or source that complies with requirements or approved equal.
3. Products: Where Specifications include 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 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 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 "Products" Articles for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include 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 "Products" Articles for consideration of an unnamed product.
7. Product Options: Where Specifications indicate sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide specified product, system, or approved equal.
8. Visual Matching Specification: Where Specifications require matching an established Sample, select 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.

9. Visual Selection Specification: Where Specifications include 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 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 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 APPROVED EQUAL PRODUCTS

A. Conditions: Contracting Officer will consider Contractor's request when the following conditions are satisfied. If following conditions are not satisfied, Contracting Officer will return requests without action, except to record noncompliance with these requirements:

1. Evidence proposed product does not require revisions to Contract Documents, that it is consistent with Contract Documents and will produce indicated results and is compatible with other portions of Work.
2. Detailed comparison of significant qualities of proposed product with those named in Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence 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

AFFIRMATIVE PROCUREMENT REPORTING FORM
Recycled Content Materials & Biobased Content Materials

Project Name: _____ Project Number: _____

Contractor Name: _____ License Number: _____

Contractor Address: _____

Product	Total $ value provided	Total $ value with recycled content Pre-consumer	Total $ value with recycled content Post-consumer	Total $ value with biobased content	Exempted indicate 1,2,3,4	Comments
Hydraulic Mulch (paper based)						
Hydraulic Mulch (wood based)						
Compost						
Parking Stops (Concrete w/ fly ash, slag cement or low cement content)						
Concrete with fly ash						
Concrete with slag cement						
Concrete with low cement content						
Building Insulation						
Rock Wool						
Cellulose						
Plastic Rigid Foam						
Phenolic Rigid Foam						
Ceramic tile						
Carpet (PET)						
Paint						
Reprocessed Latex Paint White & Light Colors						
Reprocessed Latex Dark Colors						
Consolidated Latex Paint						
Toilet partitions (plastic or steel)						
Other						

CERTIFICATION

I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials:

1. The product does not meet appropriate performance standards.
2. The product is not available within a reasonable time frame.
3. The product is not available competitively (from two or more sources).
4. The product is only available at an unreasonable price (compared with a comparable non-recycled content product.)

Signature: _____ Date: _____

END OF
AFFIRMATIVE PROCUREMENT REPORTING FORM
Recycled Content Materials & Biobased Content Materials

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes procedural requirements for cutting and patching on portions of buildings that do not contain Historic Fabric as identified and approved by the Contracting Officer.. At the Kawuneeche Visitor Center, this includes, but is not limited to, the EPDM roofing and flashing at the Visitor Center and Admin Wing, standing seam metal roof and framing at the Comfort Station, and interior scope at the Auditorium The majority of the building contains historic fabric and shall be treated as indicated in other specification sections related to historic materials.

1.2 SUBMITTALS

A. Cutting and Patching Plan: Submit Plan describing procedures at least 10 days before cutting and patching will be performed, requesting approval to proceed. Include:

1. Extent: Describe cutting and patching, show how 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 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 (CO) Approval: 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.

~~B.~~ Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

~~C.~~ Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on exterior or in occupied spaces in a manner that would, in Contracting Officer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

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. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that will match the visual and functional performance of in-place materials when installed.

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.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at earliest feasible time. Complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction subsequently. Patch as required to restore surfaces to 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 and 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 exposed or finished side into concealed surfaces.
3. 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.
4. Proceed with patching after construction operations 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 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 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. 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. Section includes general procedural requirements governing execution of Work including:

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 professional engineer certifying location and elevation of improvements comply with requirements.

B. Landfill Receipts: Submit copy of receipts issued by landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

C. Certified Surveys: Submit electronic copies signed by professional engineer.

D. Quantity Surveys: Submit electronic copies showing quantities of work performed and actual construction completed in place.

1.3 QUALITY ASSURANCE

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: 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: Existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existence and location of underground utilities and other construction affecting Work.

1. Before construction, verify 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 following Utility Service providers, sufficiently in advance to avoid delaying the work, to coordinate Contractor's portion of Work, testing requirements, inspections, etc.

1. Electrical: Service Contact: Contact Mountain Park Electric to coordinate Electrical service requirements.

   a. Construction Contractor Responsibilities: Contractor is responsible for coordination with service provider.

2. Water Service Contact: Contact Park to coordinate Water service requirements.

   a. Construction Contractor Responsibilities: Contractor is responsible for coordination with Park.

3. Wastewater Service Contact: Contact Three Lakes Water and Sanitation District to coordinate Wastewater service requirements.

   a. Construction Contractor Responsibilities: Contractor is responsible for coordination with service provider.

4. Telephone Service Contact: Contact Comcast or Vonage to coordinate Telephone service requirements.

    a. Construction Contractor Responsibilities: Contractor is responsible for coordination with service provider.

3.3 PREPARATION

A. Field Measurements: Take field measurements as required to fit Work properly. Recheck measurements before installing each product. Where portions of Work are indicated fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying 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 need for clarification of the Contract Documents caused by differing field conditions outside control of Contractor, submit request for information to Contracting Officer in accordance with Section 01 31 00 "Project Management and Coordination."

3.4 CONSTRUCTION LAYOUT

A. Verification: Verify layout information shown on Drawings, in relation to the existing benchmarks before proceeding to lay out Work. Notify Contracting Officer promptly if discrepancies are discovered.

B. General: Engage a professional engineer to lay out Work using accepted surveying practices.

    1. Establish benchmarks and control points to set lines 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 location, level and plumb, of every major element as Work progresses.
    5. Notify 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 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 log available for review by National Park Service (NPS).

3.5 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning Work. Preserve and protect permanent benchmarks and control points during construction operations. Controls destroyed by Contractor will be replaced by Contractor at their expense.

1. Existing Monuments: All benchmarks, land corners, and triangulation points, established by other surveys, existing within construction area shall be preserved. If existing monuments interfere with Work, secure written permission before removing them.

B. 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 Work and components of 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 for 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 parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm 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 Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Contracting Officer.
2. Allow for building movement, 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 to be embedded in concrete or masonry. Deliver 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 best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials not considered hazardous.

J. Quantity surveys: Shall be conducted, and data derived from these surveys shall be used in computing quantities of work performed and actual construction completed and in place.

1. Contractor shall conduct original and final surveys and surveys for any periods for which progress payments are requested. These surveys shall be conducted under direction of a representative of the Contracting Officer, unless Contracting Officer waives requirement in a specific instance. Government shall make such computations as are necessary to determine quantities of work performed or finally in place. Contractor shall make computations based on surveys for any periods for which progress payments are requested.
2. Promptly upon completing a survey, Contractor shall furnish originals of field notes and other records relating to survey or layout of Work to Contracting Officer. Contractor shall retain copies of all such material furnished to Contracting Officer.

3.7 PROGRESS CLEANING

A. General: Clean Project site, work areas, and common areas daily. 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 National Fire Protection Association (NFPA) 241 for removal of combustible waste materials and debris at the end of every work session.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees Fahrenheit (27 degrees Celsius).
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 level of cleanliness necessary for proper execution of Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of Work, broom-clean or vacuum 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 not hazardous to health or property and will not damage exposed surfaces.

1. Utilize non-toxic cleaning materials and methods.

    a. Comply with Green Seal Standard (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 from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. Clean and protect construction in progress and adjoining materials already in place during handling and installation. 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 remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations so that no part of construction completed or in progress, is subject to harmful, dangerous, damaging, or deleterious exposure during construction period.

K. Final Cleaning: At completion of Work, remove remaining waste materials, rubbish, tools, equipment, machinery and surplus materials. Clean exposed surfaces and 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 factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 01 40 00 "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 Section 01 73 29 "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 specified condition.

C. Remove and replace damaged surfaces 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. Section includes administrative and procedural requirements for:

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 construction, demolition, or renovation of a structure which exceeds 2.5 inch (60 millimeter) 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 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: Presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade utility of environment for aesthetic, cultural, or historical purposes.

G. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

H. Hazardous Materials: Material regulated as a hazardous material in accordance with 49 CFR 173 (Code of Federal Regulations), 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 potential to meet the definition of 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.

K. Single-use plastic products: Plastic items intended to be disposed of immediately after use, including plastic and polystyrene food and beverage containers, bottles, straws, cups, cutlery, and disposable plastic bags.

1.3 PERFORMANCE REQUIREMENTS

A. General: Project shall minimize creation of construction, deconstruction, and demolition waste to protect and restore natural habitat and resources. Minimize factors contributing to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, single-use plastic products, and contamination. A Waste Management Plan shall be developed to ensure that existing site and building materials are reused, salvaged, or recycled. Minimize waste disposal in landfills.

B. Salvage /Recycle Requirements: Develop waste management plan resulting in end-of-Project rates for salvage/recycling of 50 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, palettes
3. Plywood, OSB (oriented strand board), and particle board
4. Concrete (can be ground and used for fill on site where approved by CO)
5. Asphaltic concrete (can be ground and used for fill on site where approved by CO)
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 waste materials encountered during deconstruction/demolition or construction phase are found to contain lead, asbestos, polychlorinated biphenyls (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 deconstruction/demolition phase shall be reused in 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 quality standards set forth in these specifications. Contractor shall ensure 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 Contracting Officer (CO) may designate other objects or materials for reuse.

1.4 SUBMITTALS

A. Waste Management Plan: After award of contract and prior to scheduled Pre-Construction Conference, Contractor shall submit a draft Waste Management Plan to Contracting Officer for approval. Submit electronic copy of plan. Revise and resubmit Plan as required by Contracting Officer. Approval of Contractor's Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.

B. Progress Documentation: Supplemental to Waste Management Plan, document solid waste disposal, diversion, and cost/revenue analysis and submit completed worksheet on a monthly basis. See Project Waste Management Plan Worksheet Sample, attached to the end of the Division 1 Specifications, and report totals to date for column headings.

C. Waste Reduction Calculations: Before request for Substantial Completion, submit electronic copy 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. Qualification Data: For Waste Management Coordinator and refrigerant recovery technician.

I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating refrigerant that was present was recovered and recovery was performed according to Environmental Protection Agency (EPA) regulations. Include name and address of technician and date refrigerant was recovered.

J. Progress payment requirements:

   1. With each Application for payment, submit an 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.

K. Closeout Submittals

1. With Closeout Submittals, submit a summary of a Project Waste Management Plan worksheet for solid waste disposal and diversion.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with record of successful waste management coordination of projects with similar requirements, that employs a LEED™-Accredited Professional, certified by USGBC, as waste management 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 Pre-Construction Conference and comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including:

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 procedures for reduction of single-use plastic products on site.
6. 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 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 salvaged and reused in 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.
7. Reduction of single-use plastic products: Include methods for water distribution to include bottle refilling stations if available for personnel.

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:

1. Landfill tip fees per 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 Contracting Officer. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during entire duration of Contract.

B. Waste Management Coordinator: Engage 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 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 specific area or areas to facilitate separation of materials for potential reuse, salvage, ~~recycling~~, and return.
2. Place waste and recycling bins near each other, and close to point of waste generation but out of traffic pattern.
3. Keep recycling and waste bin areas neat, clean, and clearly marked in order to avoid co-mingling of materials.
4. Protect bins during non-working hours from off-site contamination.
5. Check garbage dumpsters periodically for recyclables being thrown away and undocumented materials that could be recycled.

G. Materials handling procedures: Material to be recycled shall be protected from contamination and shall be handled, stored, and transported in a manner that meets requirements set by designated facilities for acceptance. Establish defined area for operations of each trade, especially woodcutting so off-cuts are 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 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 Sale and Donation: Not permitted on Project site.

C. 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 secure area until delivery to Government.
5. Transport items to storage area designated by Government.
6. 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:

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 maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until 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 ground and protect from weather.
5. Remove recyclable waste off Government property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Grind asphalt to maximum **4 inch (100 millimeter)** 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.

D. Pulverize concrete to maximum **4 inch (100 millimeter)** size.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in dry location.

1. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.

I. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

J. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

K. Plumbing Fixtures: Separate by type and size.

L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

M. Lighting Fixtures: Separate lamps by type and protect from breakage.

N. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

O. Conduit: Reduce conduit to straight lengths and store by type and size.

P. Electronic Products: Ensure 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 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 at landfill facility.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust not containing painted or treated wood.

D. Gypsum Board: Stack large clean pieces on wood pallets and store in 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 in landfill or incinerator acceptable to authorities having jurisdiction.

   1. Except as otherwise specified, do not allow waste materials to accumulate on-site.
   2. Remove and transport debris in manner preventing spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials allowed only at designated areas on Government property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

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

END OF SECTION 01 74 19

Project Waste Management Plan Worksheet Sample

National Park Service (NPS) - Denver Service Center (DSC) | 10-13-21

	A	B	C	D	E	F	G	H	I	J
Material	**Quantity Recycled (in tons)**	**Quantity Salvaged or Reused (in tons)**	**A + B = Total Quantity Diverted from Landfill**	**Quantity to Landfill (in tons)**	**C + D = Total Quantity Generated (in tons)**	**Tip Fee/Ton at Landfill**	**C x F = Tip Fee Savings resulting from Landfill Diversion**	**Cost of Recycling (R), Salvage (S), or Reuse (Re)** (Specify R, S, or Re)	**Revenue from Recycling (R), Salvage (S), or Reuse (Re)** (Specify R, S, or Re)	**G - H + I = Total Cost (-) or Savings (+) from Diversion**
Asphalt/Concrete										
Brick/Masonry/Tile										
Building Materials (doors, windows, fixtures, shingles, lumber, insulation, sheet goods, etc.)										
Carpet										
Carpet Padding, Foam Only										
Cardboard										
Ceiling Tile										
Drywall										
Glass										
Scrap Metal Aluminum										
Copper										
Steel										
Unpainted Wood & Pallets										
Yard Trimmings, Brush, Trees, Stumps, etc.										
Garbage/Trash										
Other										
Column Totals										
	Total Quantity Recycled	Total Quantity Reused or Salvaged	Total Quantity Diverted from Landfill	Total Quantity to Landfill	Total Quantity Generated		Tip Fee Savings from Diversion	Total Cost of Recycling, Salvage, or Reuse	Revenue from Recycling, Salvage, or Reuse	Total Cost (-) or Savings (+) from Diversion

Percentage Diverted = _____ (C divided by E from Column Totals). Should meet 60% diversion goal.

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including:

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 (NPS) 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 Contracting Officer (CO) for inspection at the time of monthly progress payment requests. If project record drawings are not current, Contracting Officer may retain an appropriate amount of progress payment.

C. Submit complete record drawings on completion of total project. Include shop drawings, sketches, and additional drawings to be included in 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. Terms and conditions of the contract require satisfaction of requirements of 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 other similar forms or certificates.
3. Project Record Documents, operation and maintenance manuals, final completion construction digital images recorded on CD-R (compact disc-recordable) or DVD-R (digital video disc-recordable) with index and descriptions, and similar final record information.
4. Environmental Record Documents: As specified in Divisions as follows:

a. IAQ Management Plan: As specified in Section 01 57 19.11 – Indoor Air Quality (IAQ) Management.
b. Product Data for filtration media: As specified in Section 01 57 19.11 - Indoor Air Quality (IAQ) Management.
c. Moisture Control inspections and reports: As specified in Section 01 57 19.11 - Indoor Air Quality (IAQ) Management.
d. Material Safety Data Sheet (MSDS) Data: As specified in Section 01 57 19.11 - Indoor Air Quality (IAQ) Management
e. Commissioning Report: As specified in Section 01 91 14 - Commissioning.

5. 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 manufacturer.
6. 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.

7. Keys and Keying Schedule: Submit keys including duplicates. Wire keys for each lock securely together. Tag and plainly mark with lock number, equipment identification, or panel or switch number, and indicate location, building, and room name or number.
8. Make final changeover of permanent locks and deliver keys to Contracting Officer. Advise Park personnel of changeover in security provisions.
9. Approved pre-functional checklists and functional performance testing reports from commissioning documentation.

   a. Equipment start-up requires coordination with commissioning process. Refer to Section 01 91 14 Equipment shall not be "temporarily" started for commissioning.

10. Test and balance report.
11. Terminate and remove temporary facilities, mockups, construction tools, and similar elements from Project site, complete final cleaning requirements, including touchup painting.
12. Touch up and repair and restore marred exposed finishes to eliminate visual defects.
13. Instruct NPS personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videos.

1.4 FINAL INSPECTION, SUBSTANTIAL COMPLETION AND ACCEPTANCE PROCEDURES

A. Request final inspection in writing when project or designated portion of project is substantially complete. Contracting Officer will proceed with inspection within 10 days of receipt of written request or will advise Contractor of items that prevent project from being substantially complete.

B. If work is determined substantially complete, following final inspection, Contracting Officer will prepare Punch List and issue a Letter of Substantial Completion.

C. If work is not determined substantially complete following final inspection, Contracting Officer will notify Contractor in writing. Contractor shall request new final inspection after completing work. Re-inspection costs may be charged against Contractor in accordance with Inspection of Construction contract clause.

D. Contractor shall complete Punch List within 30 calendar days, documented weather permitting.
   1. Prior to requesting final inspection:
      a. Complete commissioning requirements of Section 01 91 14 unless approved in writing by Contracting Officer.

E. If Contractor completes items of work on Punch List and contractually required items, Contracting Officer will issue Letter of final acceptance of work.

F. If Contractor fails to complete work within the time frame, Contracting Officer may correct work with an appropriate reduction in contract price or charge for re-inspection costs in accordance with Inspection of Construction contract clause.

1.5 PERMIT CLOSURE AND TRANSFER

A. When work covered by the permits is complete, create list of tasks required to close or transfer permits to Park. Submit to Contracting Officer for approval.

B. After substantial completion and Punch List completion, permits shall be closed and documented by Agency(ies) with Jurisdiction for the permit.

C. If responsibility for permits is to be transferred to Park, Park shall be informed of permit provisions completed and responsibilities transferring to Park staff.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Contracting Officer for designated portions of Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on table of contents of Project Manual.

   1. Bind two copies of 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.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify product or installation. Provide typed description of product or installation, including name of product and name, address, and telephone number of Installer.
   3. Identify each binder on front and spine with 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 (portable document format) file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See Division 1 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 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 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 dirt-free condition, free of stains, films, and foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to 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, soil or stains remain.
   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and vision-obscuring materials. Replace chipped or broken glass and transparent materials. Polish mirrors and glass.
   k. Remove labels that are not permanent.
   l. Touch up, 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" (Underwriters Laboratories) and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to 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 and noticeably dimmed bulbs, and defective or 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 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 Section 01 74 19 "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. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including:

1. Manuals, general
2. Emergency manuals
3. Operation manuals for systems, subsystems, and equipment
4. Maintenance manuals for care and maintenance of products, materials, and finishes, systems and equipment

B. See Divisions 2 through 49 Sections for additional operation and maintenance manual requirements for Work in those Sections.

1.2 SUBMITTALS

A. Manual: Submit one electronic copy at least **15** days before final inspection. Contracting Officer (CO) will return copy or edit version with comments within **15** days of receipt.

B. Format: Submit operations and maintenance manuals in following format:

1. PDF (portable document format) electronic file. Assemble each manual into 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 electronic copies of each corrected manual within 15 days of receipt of Contracting Officers comments.

1.3 QUALITY ASSURANCE

A. Coordinate with Section 01 91 14 "Total Building Commissioning." Commissioning Agent shall review Operation and Maintenance Manuals for commissioned systems.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize manual into separate sections for each system and subsystem, and separate sections for each piece of equipment not part of a system. Manual shall contain title page, table of contents, and manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include:

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 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. Assemble instructions for subsystems, equipment, and components of one system into a single binder if needed.

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 millimeter) paper; with clear plastic window sleeve on front and spine to hold label describing contents and pockets inside covers to hold folded oversize sheets.

a. Cover Sheet: Identify binders on front and spine, with 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 contents of a single tabbed section cover 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. No copies produced by facsimile transmission and sheets with stamps, such as submittal approval stamps. 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 reproductions are clear and legible. If

reduced-size drawings are used, identify as "REDUCED SIZE" and provide graphic scales, if applicable.

c. Custom Data: Data supplemented by drawings and schematics necessary to describe systems adequately.
d. Equipment Data Sheet: Data, using form at end of this section.
e. Schedules: Schedules reflecting final, as-installed conditions.
f. Poorly reproduced or illegible data 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 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 EMERGENCY MANUALS

A. Content: Organize manual into separate section for type of emergency, emergency instructions, and emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component for fire, flood, gas leak, water leak, power failure, water outage, equipment failure, and chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of National Park Service (NPS) operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

2.3 OPERATION AND MAINTENANCE MANUALS

A. Operation Requirements

1. Content: In addition to requirements in 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:

    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 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 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 Procedures: Test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, and demonstration and training video if available, detailing essential maintenance and environmental procedures.
5. Maintenance and Service Schedules: Service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
6. Spare Parts List and Source Information: 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.
7. Warranties and Bonds: Copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into 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 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:

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 Project. Include: product model; manufacturer’s name, address, phone, and website; and local technical representative.

a. Verify plastic products to be incorporated into 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 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 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 recommended maintenance procedures and materials.
3) Where proposed maintenance procedures incorporate composting of plastics, assess potential effect of each type of plastic to be included in composting process in accordance with ASTM D5509 or ASTM D6002

c. Identify take-back programs and appropriate contact information for:

1) Carpet
2) Ceiling Tile

d. Material Safety Data Sheets (MSDS): Include MSDSs as specified.

2. Develop environmental management programs for 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. Indoor Air Quality (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 water monitoring program for surface and ground water on project site in accordance with ASTM D5851 and consistent with 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 affect validity of warranties or bonds.

2.5 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 and items detailing 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

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 affect validity of warranties or bonds.

1. Include procedures 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 index. Install and index data in binders within 30 days after delivery of items. As custom written data and test results are produced, add to operation and maintenance data file.

B. List of Operation and Maintenance requirements has been attached at end of the Division 1 Specifications for your convenience. Intent is to provide an overall summary of requirements and not a comprehensive list. Terms and conditions of the contract require satisfaction of requirements of 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 Contracting Officer for inspection at time of monthly progress payment requests. If operation and maintenance binders are not current, Contracting Officer may retain an appropriate amount of the progress payment.

3.2 MANUAL PREPARATION

A. Manual Types

1. Emergency Manual: Assemble 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 complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into Work.
3. Operation and Maintenance Manuals: Assemble 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:

1. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark sheet to identify product or component incorporated into Work. If data include more than one item in a tabular format, identify each item using appropriate references from Contract Documents. Identify data applicable to Work and delete references to information not applicable.
2. Custom Written Data: For data not in manufacturer's standard literature, provide text, drawings, and schematics specifically applicable to installed systems. Include step-by-step descriptions of operating procedures; identification of individual components and their functions; descriptions of how system components relate to one another and operate together to accomplish a common process or function; and sequence of operation for system control circuits. For seasonally operated systems, provide start-up and shutdown instructions.
3. Equipment Data Sheets: For each item of equipment included in operation and maintenance data, provide Equipment Data Sheet using form at the end of this section. For equipment consisting of a driven machine and a driver (for example, a pump and a motor), 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 individual equipment items.
4. 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 control devices. Show control wires and devices remote from control panel.
    b. For each control panel, provide general arrangement drawing showing location of each control component and terminal block on the panel front and interior. Include materials list of 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 control wiring schematic, provide power wiring schematic drawing showing power flow to each motor. Identify each power conductor. Show over-current protection and motor starting devices.

C. Comply with Section 01 77 00 "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 Number: _____ Serial Number: _____	
Manufacturer Address and Phone:	Supplier Address and Phone:
Preventive Maintenance Tasks:	
Nameplate Data:	
Spare Parts Furnished and Other Information:	

Closeout and Operation & Maintenance (O&M) Requirements **Template**

National Park Service (NPS) - Denver Service Center (DSC) | 1-27-21

Topic	Specification Section	Requirement	Submittal Date	Completed	Received by Park
Project Record Drawings	01 77 00	Project Record Documents, operation and maintenance manuals, final completion construction digital images, record drawings			
	01 91 14	Closeout documentation			
	21 00 00	Record Drawings.			
	28 00 01	Record Drawings.			
System Demonstration and Training					
	21 00 00	Instruction to Park Staff in proper operation of equipment and systems.			
	26 09 23	Demonstration of lighting control devices			
	27 41 00	Instruction to Park Staff in proper operation of equipment and systems.			
	28 00 01	Instruction to Park Staff in proper operation of equipment and systems.			
	28 16 00	Instruction to Park Staff in proper operation of equipment and systems.			
	28 20 00	Instruction to Park Staff in proper operation of equipment and systems.			
Tools, Spare Parts, Equipment					
	08 71 00	Complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.			
	08 71 00	Unused materials to Contracting Officer for maintenance purposes.			
	12 32 13	Touchup kit			
	21 13 00	Wrenches for each sprinkler type.			
	28 16 00	Tool Kit, Security Fasteners			
Extra Stock					
	09 03 91	Extra stock			
	09 30 13	Extra stock			
	09 51 23	Extra stock			
	09 65 13	Extra stock			
	09 65 43	Extra stock			
	09 68 13	Extra stock			
	09 91 13	Extra stock			
	09 91 24	Extra stock			
	09 93 01	Extra stock			
	10 14 23.16	Extra stock			
	10 26 00	Extra stock			
	12 20 00	Extra stock			
	12 48 13	Extra stock			
	21 13 00	Spare sprinklers.			
	26 09 43	Electrically Held Relays			
	26 24 16	Keys, Circuit Breakers			
	28 14 00	Credential Reader			
	28 16 00	Intrusion Detection Devices, Fuses			
	01 74 19	Project Waste Management Plan worksheet			
	02 82 13	Closeout Report			
	02 83 33	Closeout Report			
	21 00 00	Approved submittal data with review letters.			
	21 00 00	Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance, certificates of warranties.			
	21 00 00	Water supply flow test used as basis for hydraulic calculations.			
	21 00 00	Hydraulic calculations and sway brace calculations.			
	21 00 00	Contractor's Material and Test Certificates for Aboveground Piping/Underground Piping.			

Topic	Specification Section	Requirement	Submittal Date	Completed	Received by Park
Reports	26 05 19	Field quality-control test reports			
	26 05 26	Field quality-control test reports			
	26 08 00	Construction Checklists			
	26 09 23	Field quality-control test reports			
	26 09 43	Field quality-control test reports			
	26 24 16	Field quality-control test reports			
	26 27 13	Field quality-control test reports			
	26 28 16	Field quality-control test reports			
	26 41 13	Field quality-control test reports, Completion Certificate			
	26 43 13	Field quality-control test reports			
	28 00 01	Copy of approved submittal data with submittal review letters.			
	28 00 01	Copy of start-up and test reports specific to each piece of equipment.			
	28 00 01	Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance, certificates of warranties.			
	28 13 00	Field quality-control test reports			
	28 14 00	Field quality-control test reports			
	28 16 00	Field quality-control test reports			
	28 20 00	Field quality-control test reports			
Keys & Keying Schedule					
	23 54 16.13	Extra filters			
	28 46 00	Spare Keys			
	01 32 33	Complete set of digital image electronic files			
	01 91 14	O&M Data			
	06 40 23	Quality Standard Compliance Certificates			
	07 53 23	Maintenance Data			
	07 53 23	Warranty Information			
	07 62 00	Maintenance Data			
	07 92 00	Maintenance Data			
	07 92 00	Warranty Information			
	08 14 16	Warranty Information			
	08 14 16	Quality Standard Compliance Certificates			
	08 51 13	Warranty Information			
	08 51 23.13	O&M Data			
	08 51 23.13	Warranty Information			
	08 71 13	Maintenance Data			
	08 71 13	Warranty Information			
	08 81 00	O&M Data			
	08 81 00	Warranty Information			
	08 80 00	Warranty Information			
	09 51 23	Maintenance Data			
	09 65 13	Warranty Information			
	09 65 43	Maintenance Data			
	09 65 43	Warranty Information			
	09 68 13	Warranty Information			
	09 68 13	Maintenance Data			
	09 84 33	Maintenance Data			
	09 84 33	Warranty Information			
	10 14 23.16	Maintenance Data			
	10 14 23.16	Warranty Information			
	10 21 00	Maintenance Data			
	10 26 00	Maintenance Data			

Topic	Specification Section	Requirement	Submittal Date	Completed	Received by Park
O&M Data, Warranties, Guarantees	10 28 00	Maintenance Data			
	10 28 00	Warranty Information			
	10 44 13	Maintenance Data			
	10 44 16	O&M Data			
	12 20 00	O&M Data			
	12 20 00	Warranty Information			
	12 32 13	Quality Standard Compliance Certificates			
	12 32 13	Warranty Information			
	12 36 61	Maintenance Data			
	12 48 13	Maintenance Data			
	21 00 00	Copies of certificates of code authority acceptance, code required acceptance tests, test reports and certificates.			
	21 00 00	Cut sheet for each Item of equipment			
	21 00 00	Record Drawings.			
	21 00 00	Product certificates of warranties and guarantees			
	21 00 00	Letter of Conformance			
	21 00 00	Testing and Maintenance Schedule Chart			
	21 00 00	Copy of NFPA 25.			
	21 00 00	Copy of valve charts and whether normally open or normally closed.			
	22 05 00	Maintenance manuals			
	22 11 19	Operation and maintenance manuals			
	22 11 23.21	Operation and maintenance manuals			
	22 13 19	Operation and maintenance manuals			
	22 33 00	Operation and maintenance manuals			
	22 34 00	Operation and maintenance manuals			
	23 05 00	Maintenance manuals			
	23 23 00	Operation and maintenance manuals			
	23 33 00	Operation and maintenance manuals			
	23 34 16	Operation and maintenance manuals			
	23 54 16.13	Operation and maintenance manuals			
	23 81 26	Operation and maintenance manuals			
	23 82 39.19	Operation and maintenance manuals			
	26 05 53	Identification Schedule			
	26 08 00	O&M Data: Electrical Systems and Components			
	26 09 23	O&M Data: Devices and Manuals			
	26 09 43	Coordination Drawings, Software and Firmware Operational Documentation, O&M Data, Warranty			
	26 24 16	O&M Data, Warranty			
	26 27 13	O&M Data			
	26 27 26	O&M Data			
	26 28 16	O&M Data			
	26 41 13	O&M Data			
	26 43 13	Maintenance Data, Warranty			
	26 51 00	O&M Data, Product Information, Warranties			
	27 13 13	O&M Data, Product Information, Warranties			
	27 13 23	O&M Data, Product Information, Warranties			
	27 15 13	O&M Data, Product Information, Warranties			
	27 41 00	O&M Data, Product Information, Warranties			
	28 00 01	Approved submittal data with review letters; indicate installed equipment model numbers.			
	28 00 01	Copy of manufacturer's standard Operations and Maintenance for equipment.			
	28 00 01	Copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.			
	28 00 01	Warranty.			
	28 00 01	Product certificates of warranties and guarantees.			
	28 13 00	O&M Data, Warranties			
	28 14 00	O&M Data, Warranties			
	28 16 00	O&M Data, Warranties			

Topic	Specification Section	Requirement	Submittal Date	Completed	Received by Park
	28 20 00	O&M Data, Warranties			
	28 46 00	Manuals containing the documentation required in NFPA 72; Completion Documentation.			
	28 46 00	One year warranty agreement including parts and labor; begins upon date of substantial completion.			
	28 46 00	Instruction chart.			

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing National Park Service (NPS) personnel, including:

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 2 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 GENERAL REQUIREMENTS

A. List of System Demonstration and Training requirements has been attached at end of Division 1 Specifications for your convenience. Intent is to provide overall summary of requirements and not a comprehensive list. Terms and conditions of contract still require satisfaction of requirements of individual specification sections regardless of what is shown on list.

1.3 SUBMITTALS

A. Instruction Program: Submit electronic copy of outline of instructional program for demonstration and training, including 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, Contractor shall submit for approval a proposed outline of subjects to be covered. Training shall not be conducted until outline is approved.

B. Demonstration and Training Video: Submit electronic copy of training video for training sessions within seven days of end of each training module.

1. Label each video file with date of demonstration or training, instructor's name, and provide an index of contents. Index shall list start and end time of each subject covered during training session. Sequence of training subjects shall follow sequence listed in approved training outline or as actually conducted. Upload video file to Project Teams.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: Firm or individual experienced in training or educating maintenance personnel in training program similar in content and extent for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: Factory-authorized service representative, complying with requirements in Section 01 40 00 "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 (CO).

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and:

1. Environmental Topics

a. Overview of environmental issues related to building industry.
b. Overview of environmental issues related to Project.
c. Review of site-specific procedures and management plans implemented during construction:

1) Regulatory Requirements
2) Indoor Air Quality (IAQ) Management
3) Noise and Acoustics Management
4) Environmental Management
5) Construction Waste Management

d. Review of site-specific procedures and management plans to be implemented during operation and maintenance.

1) Include review of environmentally related aspects of Operations and Maintenance Manual.
2) Integrated Pest Management (IPM)

B. Training Modules: Develop a learning objective and teaching outline for each module. Include description of specific skills and knowledge that participant is expected to master. For each module, include instruction for:

1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
3. Emergencies: Instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.

4. Operations: Startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
5. Adjustments: Alignments and checking, noise, vibration, economy, and efficiency adjustments.
6. Troubleshooting: Diagnostic instructions and test and inspection procedures.
7. Maintenance: Inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
8. Repairs: Diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 INSTRUCTION

A. Facilitator: Engage 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 Contracting Officer with at least fourteen (14) days' advance notice.
2. Conduct training sessions after equipment or system has been accepted and turned over to Government. Coordinate with commissioning requirements.
3. Coordinate with Integrated pest management requirements. Refer to specifications section and approved IPM plan.
4. Individual sections specify duration of training required. If no duration is listed, provide training of sufficient duration to adequately cover subjects.

3.2 DEMONSTRATION AND TRAINING VIDEO

A. General: Engage 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 training module, record each chart containing learning objective and lesson outline.

B. Video Format: Audio Video Interleave (AVI)

C. Video Recording: Record sessions with high resolution equipment. Instructor's voice shall be clearly audible and understandable on DVD. Utilize supplemental microphone worn by instructor.

D. Narration: Describe scenes on video by audio narration by microphone while video is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1. Video files with poor video or audio quality will be rejected and training recorded again.

END OF SECTION 01 79 00

SECTION 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS FOR NON-LEED™ PROJECTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements and procedures for compliance with Federal Sustainability requirements. This project is not seeking Leadership in Energy & Environmental Design (LEED™) certification but shall comply with applicable Federal Sustainability requirements. Requirements include laws (Executive Orders (EO) and regulations), management policies, building codes and standards, Federal directives, and National Park Service (NPS) guidelines.

B. Many Federal requirements can be achieved only through intelligent and integrated design of the project and are beyond control of the Contractor. Certain requirements relate to the products and procedures used for construction, therefore, full cooperation of the Contractor and Subcontractors is essential to successful compliance with Federal requirements.

C. Contractors shall familiarize themselves with relevant requirements and provide necessary information and instruction to subcontractors and installers.

1. Some requirements involve quantifying percentages by weight; these require careful recordkeeping and reporting by Contractor.
2. See Denver Service Center (DSC) Workflows Sustainability Standards for a list of Federal Sustainability requirements. Applicable Federal Sustainability requirements are also summarized on the project's NPS Project Sustainability Checklist. Contractor is responsible for ensuring the elements in the NPS Project Sustainability Checklist, identified by the Architect/Engineer (A/E) team, are incorporated into the construction of the project.

D. Related Sections:

1. See Divisions 1 through 49 Sections for sustainability requirements specific to work of each of these Sections.

1.2 DEFINITIONS

A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying wood used to make products was obtained from forests certified by a Forest Stewardship Council (FSC)-accredited certification body to comply with FSC Standard STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence manufacturer is certified for chain of custody by an FSC-accredited certification body.

B. LEED™: Leadership in Energy & Environmental Design. Sustainability rating system developed by United States Green Building Council (USGBC).

C. Rapidly Renewable Materials: Materials made from plants typically harvested within 10-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.

D. Recycled Content: Recycled content value of a material assembly shall be determined by weight.

1. "Post-consumer" material: Waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of product, which can no longer be used for intended purpose.
2. "Pre-consumer" material: Material diverted from waste stream during manufacturing process. Reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it is excluded.

E. Biopreferred Products: Commercial or industrial products (other than food or feed) composed in whole, or in significant part, of biological products, renewable agricultural materials (including plant, animal, and marine materials), or forestry materials and includes biobased intermediate ingredients or feedstocks.

1.3 FEDERAL SUSTAINABILITY DOCUMENTATION SUBMITTALS

A. Most of Federal sustainability documentation submittals are aggregations of submittals already required in relevant technical specifications. They are mentioned here to ensure they are collected and organized together to efficiently document compliance with sustainability requirements.

B. Provide preliminary submittals to NPS indicating how the following Federal requirements will be met:

1. Recycled Content: List of specified/proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.

2. Certified Wood: Product data and/or chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.

3. Construction Indoor Air Quality (IAQ) Management Plan – During Construction:

a. Construction indoor-air-quality management plan.
b. Product data for temporary filtration media.
c. Product data for filtration media used during occupancy.
d. Construction Documentation: Six photographs at three different times during construction period, along with brief description of the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) approach employed, documenting implementation of indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.

4. Construction IAQ Management Plan – Before Occupancy:

a. Signed statement describing building air flush-out procedures including dates when flush-out was started and completed and statement filtration media was replaced after flush-out.

b. Product data for filtration media used during flush-out and during occupancy.

5. Low Emitting Materials - Adhesives and Sealants: Product data for adhesives and sealants used inside weatherproofing system indicating Volatile Organic Compound (VOC) content of each product used. Indicate VOC content in g/L (grams per liter) calculated according to 40 CFR 59 Subpart D (Code of Federal Regulations).
6. Low Emitting Materials - Paints and Coatings: Product data for paints and coatings used inside weatherproofing system indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59 Subpart D.
7. Low Emitting Materials - Flooring: Product data for products containing composite wood or agrifiber products or wood glues indicating they do not contain urea-formaldehyde resin.
8. Biopreferred Products: Provide list of bio-based products used on project.

PART 2 - PRODUCTS

2.1 RECYCLED CONTENT OF MATERIALS

A. Recycled Content: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 10 percent of cost of materials used for Project.

1. Determine cost of post-consumer recycled content by dividing weight of post-consumer recycled content in item by total weight of item and multiplying by cost of item.
2. Determine cost of pre-consumer recycled content of an item by dividing weight of pre-consumer recycled content in item by total weight of item and multiplying by cost of item.
3. Do not include furniture, mechanical and electrical components, and specialty items such as equipment in calculation.

2.2 BIOPREFERRED PRODUCTS

A. Use bio-based products found on United States Department of Agriculture (USDA) Biopreferred Products list where applicable on project.

2.3 LOW-EMITTING MATERIALS

A. For applications inside the weatherproofing system, use adhesives and sealants that comply with VOC content limits in Specification Divisions 2 through 49.

B. For field applications inside the weatherproofing system, use paints and coatings that comply with VOC content limits in Specification Divisions 2 through 49.

C. Do not use composite wood or agrifiber products or adhesives that contain urea-formaldehyde resin.

PART 3 - EXECUTION

3.1 REFRIGERANT AND CLEAN-AGENT FIRE-EXTINGUISHING-AGENT REMOVAL

A. Remove Chlorofluorocarbons (CFC)-based refrigerants from existing Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC&R) equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in Division 23 Sections.

B. Remove clean-agent fire-extinguishing agents that contain Hydrochlorofluorocarbons (HCFCs) or halons and replace with agent that does not contain HCFCs or halons. See Division 21 Section "Clean-Agent Fire Extinguishing Systems" for additional requirements.

3.2 MEASUREMENT AND VERIFICATION

A. Coordinate with Divisions 2 through 49 for project requirements regarding installation of building level metering equipment to measure energy, water, and electric usage.

3.3 INDOOR-AIR-QUALITY MANAGEMENT

A. Coordinate with Section 01 57 19.11 "Indoor Air Quality Management" for managing indoor air quality during construction and prior to occupancy.

END OF SECTION 01 81 13

SECTION 01 91 14 – TOTAL BUILDING COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings
3. Commissioning reports
4. Use of test equipment, instrumentation, and tools for commissioning.
5. Construction checklists, including, but not limited to, installation checks, startup, and performance tests.
6. Commissioning tests
7. Adjusting, verifying, and documenting identified systems and assemblies.

Work included under this section includes a complete and thorough investigation of equipment and systems indicated in Part 3 of section. In order to ensure proper installation and operation of components and systems. Contractor shall perform commissioning as described herein to accomplish the tasks, and goals of commissioning. Systems to be evaluated include but are not limited to:

8. HVAC (Heating, Ventilation, and Air Conditioning) components and equipment.
9. HVAC system: Interaction of cooling, heating, and comfort delivery systems.
10. Lighting Control System and interface with daylighting.
11. Life Safety Systems (Fire Alarm & Suppression)
12. Electrical and Alternative Energy Systems (propane generator, photovoltaic panels, etc.)
13. Access Control/ Security Systems
14. Lightning Protection

B. Building commissioning activities and documentation are described in the following reference material: United States Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED™) rating program, American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Guideline 0-2005, The Commissioning Process, and National Institute of Building Sciences (NIBS) Guidelines.

C. National Park Service (NPS) personnel, Green Consultant, and Architect/Engineer, are not responsible for construction means, methods, job safety, or management function related to commissioning on job site.

D. Related Sections:

1. 01 31 00 - Project Management and Coordination
2. 01 33 23 - Submittal Procedures
3. 01 40 00 - Quality Requirements
4. 01 57 19.11 - Indoor Air Quality (IAQ) Management
5. 01 57 19.12 - Noise and Acoustics Management

6. 01 77 00 - Closeout Procedures
7. 01 78 23 - Operation and Maintenance Data
8. 01 79 00 - Demonstration and Training
9. 01 81 13 - Sustainable Design Requirements for Non-LEED Projects

1.2 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity.

B. Basis-of-Design Document: Document prepared by Designer that records concepts, calculations, decisions, and product selections to suit applicable regulatory requirements, standards, and guidelines.

C. Total Building Commissioning (TBC): Quality-focused process for verifying and documenting that facility, systems and assemblies are planned, designed, installed, and tested to comply with Basis-of-Design Document. Requirements specified here are limited to construction phase commissioning activities.

D. Construction Checklist: Form used by Contractor to verify appropriate components are on site, ready for installation, correctly installed and functional.

E. Contractor's Commissioning Representative: (CCxR) Contractor's designated individual to coordinate, manage, and execute commissioning processes of the contracting organizations.

F. Commissioning Plan (CCxP): Plan that provides structure, schedule and coordination planning for commissioning process proposed specifically for this project. CCxP includes Personnel, activities, and a description of Infrastructure, and list of instruments and logging devices that will be used during Commissioning.

G. Deficiency: Condition in the installation or function of a component, piece of equipment or system not in compliance with Contract Documents, does not perform properly or is not complying with Basis of Design.

H. Functional Performance Test (FPT): Test of dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional performance testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The CCxR develops the sequentially written functional test procedure forms, and oversees and documents the actual testing, which is performed by the installing contractor or vendor. The CCxR creates worksheets from these forms which include procedures required to accommodate actual equipment, means and methods used in the project. Functional Performance Tests are performed after pre-functional checklists and startup is complete.

I. Manual Test: Using hand-held instruments, control system readouts or direct observation to verify performance (contrasted to analyzing electronically monitored data taken over time to make the "observation").

J. Monitoring: Recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or the trending capabilities of control systems.

K. Pre-functional Checklist: List of items to inspect and elementary component tests to conduct to verify proper installation of equipment. Pre-functional checklists are primarily static inspections and procedures to prepare equipment or system for initial operation (e.g., belt tension, oil levels ok, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring voltage imbalance on a three-phase pump motor of a chiller system). Pre-functional" refers to "before" functional testing. Pre-functional checklists augment and are combined with the equipment manufacturer's start-up checklist.

L. Seasonal Performance Tests: Functional Performance Tests deferred until system(s) will experience seasonal conditions closer to their design conditions.

M. Systems Manual: System focused composite document that includes operational manual, maintenance manual, and additional information of use to Government during Occupancy and Operation Phase.

1.3 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action.

1. CCxR (Contractor's Commissioning Representative): CCxR shall be approved by Contracting Officer and satisfy as many of the following requirements as possible:

   a. Certified in Commissioning by nationally accredited organization (i.e. Associated Air Balance Council (AABC), Association of Energy Engineers (AEE), and National Environmental Balancing Bureau (NEBB))
   b. Acted as principal Commissioning Authority where total building commissioning approach was used for at least three projects of comparable size, type, and scope.
   c. Technical training in Mechanical, Electrical, and/or fire protection engineering.
   d. Past commissioning experience.
   e. Knowledge of national codes.
   f. Leadership in Energy and Environmental Design (LEED) Accredited Professional.
   g. Experience in energy-efficient design and control strategy optimization.
   h. Specific experience with specialty systems relative to particular facility type (i.e. Federal blast and progressive collapse requirements, security systems, etc.).

2. Contractor Quality Control (CQC) Supervisor
3. Other Representatives may include Project superintendents, installers, suppliers, and specialists.

B. Members Appointed by Contracting Officer:

1. Representatives of facility user and operation and maintenance personnel.
2. Architect and engineering design professionals.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf to participate in and perform commissioning process activities including:

1. Perform commissioning tests, as required by technical specifications. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Record and resolve commissioning issues.
3. Attend commissioning team meetings held on variable basis.
4. Integrate and coordinate commissioning process activities with overall project schedule.
5. Review Construction Checklist attached at end of specification section.
6. Complete electronic construction checklists as contract work is completed and provide to Contracting Officer on a weekly basis.
7. Complete commissioning process test procedures.
8. Provide maintenance orientation and inspection for systems, assemblies, equipment, and components based on contract requirements.
9. Provide Commissioning Plan and documentation for final commissioning documentation.
10. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for complete range of testing for required test period.

1.5 COMMISSIONING DOCUMENTATION

A. Provide the following information:

1. Review of systems manual, submittals, documents, and other commissioning reports
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase
3. Commissioning Plan including Process activities and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for systems, assemblies, equipment, and components to be verified and tested
4. Certificate of readiness certifying systems, subsystems, equipment, and associated controls are ready for testing
5. Test and inspection reports and certificates
6. Corrective action documents
7. Testing, adjusting, and balancing reports

1.6 SUBMITTALS

A. Two-week look-ahead schedules: Schedule showing the next two weeks of commissioning related construction activity to include completion dates for each element of commissioning documentation for each major system or subsystem as identified in 1.1.B.

B. Certificates of readiness.

C. Contractor's Commissioning Representative Qualifications.

D. Commissioning Plan: Submit within 30 calendar days of authorization to proceed.

1. Update as necessary during the work to reflect progress on components and systems.

E. Pre functional checklists.

F. Functional performance test forms: Submit minimum 30 calendar days prior to testing

G. List of test instrumentation, equipment, and monitoring devices. Include:

1. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
2. Brief description of intended use.
3. Calibration record showing:

a. Calibration agency, including name and contact information
b. Last date of calibration
c. Range of values for which calibration is valid
d. Certification of accuracy
e. National Institute of Standards and Technology (NIST) traceability certification for calibration equipment.
f. Due date of the next calibration.

H. Deficiency Report and Resolution Record: Document items of non-compliance in materials, installation or operation. Document results from start-up/pre-functional checklists, functional performance testing, and short-term diagnostic monitoring. Include details of components or systems found to be non-compliant with drawings and specifications. Identify adjustments and alterations required to correct system operation and identify who is responsible for making corrective changes.

1. Update as necessary during work to reflect progress on components and systems. Submit updated versions monthly.

I. Closeout Documentation

1. Closeout documents for commissioned equipment and systems shall be submitted prior to functional performance testing. These include:

a. Record Documents and Drawings
b. Start-up certificates for commissioned equipment with start-up requirements
c. Systems Manual
d. Include TAB, startup, and Control System check-out reports.
e. Other documents required by Divisions 2-33

2. Operation and Maintenance (O&M) Submittals (refer to requirements of technical specifications):

a. Training plan: Include for each training session:

1) Dates, start and finish times, and locations
2) Outline of the information to be presented
3) Names and qualifications of presenters
4) List of texts and materials required to support training

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Instrumentation shall:

1. Be of sufficient quality and accuracy to test and measure system performance within tolerances required to determine adequate performance.
2. Be calibrated on manufacturer's recommended intervals calibration tags permanently affixed to instrument being used.
3. Be maintained in good repair and operation condition throughout duration of use on this project.

B. Standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by Contractor for equipment being tested.

C. Required commissioning equipment (sensors, transducers, data loggers, etc.) not integral to the systems or equipment installed shall be provided by Contractors Commissioning Representative and shall not become property of the Government.

2.2 PRE-FUNCTIONAL CHECKLIST:

A. Prepare pre-functional checklists for equipment and systems to be commissioned.

B. Pre-functional checklists shall be complementary to Commissioning Plan and Commissioning Schedule.

2.3 FUNCTIONAL TEST PROCEDURE FORMS: Prepare functional test procedure forms for each piece of equipment and each system to be commissioned.

2.4 FUNCTIONAL PERFORMANCE WORKSHEETS:

A. Prepare Functional Performance worksheets, consisting of test procedures and expected results of testing.

2.5 REPORT FORMAT AND ORGANIZATION

A. General Format and Organization:

1. Bind report in three-ring binders.

2. Label front cover and spine of each binder with report title, volume number, project name, Contractor's name, and date of report.
3. Record report on compact disk.
4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. Commissioning Report:

1. Include table of contents and an index to each test.
2. Include major tabs for each Specification Section.
3. Include minor tabs for each test.
4. Within each minor tab, include:

a. Test specification.
b. Pre-startup reports.
c. Approved test procedures.
d. Test data forms, completed and signed.
e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS

A. Following activities outline general commissioning tasks (requiring development, execution, etc.) and order in which they occur. Specific Commissioning requirements are found in technical Divisions 2-33.

1. Commissioning Scoping Meeting
2. Commissioning Plan
3. Prepare pre-functional checklists.
4. Prepare functional performance worksheets.
5. Perform Start-Up/Pre-Functional Checks in accordance with manufacturer’s recommendations and pre-functional checklists.
6. Functional Performance Testing in accordance with functional performance worksheets
7. Deficiency Report and Resolution Record
8. Operation and Maintenance Documentation
9. Operations and Maintenance Training
10. Deferred Testing

3.2 TOTAL BUILDING COMMISSIONING (TBC) REQUIREMENTS

A. TBC during construction, acceptance, and warranty phases is intended to achieve following specific objectives:

1. Verify that systems and equipment meet Basis-of-Design Document.
2. Verify equipment is what was submitted and approved.
3. Verify and document equipment is installed and started per manufacturer's recommendations, industry accepted minimum standards, and Contract Documents.
4. Verify and document equipment and systems receive complete operational checkout by installing contractors.
5. Verify and document equipment capacity and system efficiency.
6. Verify completeness of operations and maintenance materials.
7. Ensure Governments operating personnel are adequately trained on operation and maintenance of building equipment.

3.3 COMMISSIONING SCOPING MEETING

A. Commissioning Scoping Meeting:

1. Schedule, coordinate, and facilitate a scoping meeting.
2. Review each building system to be commissioned, including intended operation, commissioning requirements, and completion and start-up schedules.
3. Establish scope of work, tasks, schedules, deliverables, and responsibilities for implementation of Commissioning Plan.
4. Attendance: Commissioning Team members.

3.4 COMMISSIONING PLAN

A. Commissioning Plan: Develop commissioning plan to identify how commissioning activities will be integrated into general construction and trade activities. Commissioning plan shall identify how commissioning responsibilities are distributed. Intent of plan is to evoke questions, expose issues, and resolve issues with input from entire commissioning team early in construction.

1. Identify who will be responsible for producing various procedures, reports, Contracting Officer notifications and forms.
2. Include commissioning tasks and activities in overall project schedule. Tag individual activities so they can be filtered at later date.
3. List and describe each test/acceptance procedure, including acceptance criteria.

3.5 START-UP/PRE-FUNCTIONAL CHECKLISTS

A. Start-Up/Pre-Functional Checklists: Complete pre-functional checklists prior to start up. Checklist shall help verify that systems are complete and operational, so functional performance testing can be scheduled.

1. Verify equipment installed is what was approved on Submittal.
2. Manufacturer's start-up checklists and other technical documentation guidelines may be used as basis for pre-functional checklists.

3.6 FUNCTIONAL PERFORMANCE TESTING

A. Functional Performance Testing: Test procedures fully describe system configuration and steps required for each test.

1. Test Methods: Functional performance testing and verification may be achieved by direct manipulation of system inputs (i.e. heating or cooling sensors), manipulation of system inputs with building automation system (i.e. software override of sensor inputs), trend logs of system inputs and outputs using building automation system, or short-term monitoring of system inputs and outputs using standalone data loggers. A combination of methods may be required to completely test complete sequence of operations. CCxR shall determine which method or combination of methods is most appropriate.
2. Setup: Each test procedure shall be performed under conditions that simulate normal operating conditions as closely as possible. Where equipment requires integral safety devices to stop/prevent equipment operation unless minimum safety standards or conditions are met, functional performance test procedures shall demonstrate actual performance of safety shutoffs in real or closely simulated conditions of failure.
3. Sampling: Multiple identical pieces of non-life-safety or non-critical equipment may be functionally tested using a sampling strategy. If, after three attempts at testing the specified sample percentage, failures are still present, remaining units shall be tested at Contractors' expense.

B. Prepare functional performance test procedure forms to accommodate actual installed equipment and systems.

C. Coordinate, execute, and record results of functional performance testing.

1. Coordinate retesting as necessary until satisfactory performance is verified.
2. Verify intended operation of individual components and system interactions under various conditions and modes of operation.

3.7 DEFICIENCY REPORT AND RESOLUTION RECORD

A. Deficiency Report and Resolution Record: Document items of non-compliance in materials, installation or operation.

B. Non-Conformance. Non-conformance and deficiencies observed shall be addressed immediately. Notify responsible parties and provide recommended actions to correct deficiencies.

1. Corrections of minor deficiencies identified may be made during tests at discretion of CCxR. In such cases the deficiency and resolution shall be documented on procedure form.
2. For identified deficiencies:

a. If no dispute on deficiency and responsibility to correct it:

1) CCxR documents deficiency and adjustments or alterations required to correct it. Contractor corrects deficiency and notifies CCxR that equipment is ready to be retested.
2) CCxR reschedules test and test is repeated until satisfactory performance is achieved.

b. If there is a dispute about a deficiency or who is responsible:

1) Deficiency is documented CCxR on non-compliance form.
2) Resolutions are made at lowest management level possible. Additional parties are brought into discussions as needed. Contractor shall have responsibility for resolving construction deficiencies. If a design revision is deemed necessary and approved by Contracting Officer, Architect/Engineer (A/E) shall have responsibility for providing design revision. CCxR documents resolution process.
3) Once interpretation and resolution have been decided, appropriate party corrects deficiency and notifies CCxR that equipment is ready to be retested. CCxR reschedules test and test is repeated until satisfactory performance is achieved.

3. Cost of Retesting: Costs for retesting shall be charged to Contractor.

3.8 OPERATIONS AND MAINTENANCE TRAINING

A. Training: Develop Training Plan. Coordinate and execute training programs with CxA.

1. Stress and enhance importance of system interactions, troubleshooting, and long-term preventive maintenance and operation programs.

3.9 DEFERRED TESTING

A. Unforeseen Deferred Tests: If test cannot be completed due to building structure, required occupancy condition, or other deficiency, functional testing may be delayed upon recommendation of CCxR and approval of Contracting Officer. These tests are conducted in same manner as the seasonal tests, as soon as possible.

B. Seasonal Testing

1. Schedule, coordinate, execute, and document additional testing for seasonal variation in operations and control strategies during appropriate season to verify performance of HVAC system and controls. Complete testing during warranty period to fully test sequences of operation.
2. Update O&M manuals and Project Record Drawings as necessary due to testing.

3.10 EQUIPMENT & SYSTEM SCHEDULE

A. Commissioned Equipment and Systems List: Following is a list of systems and equipment to be commissioned organized by system. It includes the percentage of each category that will undergo testing. The intent is to provide an overall summary of commissioned equipment and systems, and not a comprehensive list. Refer to applicable specification sections for more information.

COMMISSIONED EQUIPMENT AND SYSTEMS LIST			
SYSTEM	**EQUIPMENT**	**CC** (Commissioning Coordinator)	**FPT** (Functional Performance Test)

END OF SECTION 01 91 14

SECTION 02 41 13 – SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Sawcutting and removal or recycling of existing asphalt concrete pavement.
2. Removal or recycling of existing cement concrete walkways and curb.
3. Abandonment of existing water vault.
4. Remove, salvage, and reinstallation of existing site features to include:

a. Wood benches
b. Courtyard bench
c. Courtyard interpretive panel
d. Courtyard memorial
e. Bear box
f. Stop sign
g. Food storage locker

5. Demolition, removal and disposal of the following items:

a. Gravel
b. Timber edging
c. Split rail fence
d. Picnic table
e. Plastic bench
f. Trash/recycling receptacles
g. Lost and found bin
h. Snow poles

6. Demolition, removal, and return of the following items:

a. Picnic table
b. Mail box

B. Related Sections include the following:

1. Section 01 57 23 – Temporary Storm Water Pollution Prevention
2. Section 31 10 00 – Site Clearing
3. Section 31 20 00 – Earth Moving
4. Section 31 25 00 – Erosion and Sediment Controls

5. Section 32 40 00 – Tree and Vegetation Retention and Protection

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated by Contracting Officer to be salvaged, reused, reinstalled, or to remain on Park property.

B. Remove and Salvage for Reinstallation: Remove items indicated; clean, service, and otherwise prepare items for reuse; store and protect against damage. Reinstall items in locations indicated in the plans and specifications or as directed by the CO.

C. Existing to Remain: Protect items identified to remain against damage and soiling during demolition. When permitted by the CO, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.

D. Remove, Salvage, and Return to Park: Items indicated to be removed and salvaged shall be returned to the Park. Remove, clean, and pack or crate items to protect against damage. Stockpile items at a location approved of by the CO.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain on the Park property, demolished materials shall become the Contractor's property and shall be removed and legally disposed of at the Contractor's expense.

B. Materials for removal and reinstallation:

1. The following materials shall be removed, cleaned, and prepared for reinstallation at the project site as indicated in the plans and specifications.

   a. Wood benches
   b. Courtyard bench
   c. Courtyard interpretive panel
   d. Courtyard memorial
   e. Bear box
   f. Stop sign
   g. Food storage locker

C. Materials for removal and disposal:

1. The following materials shall be removed from the site and legally disposed of.

   a. Gravel
   b. Timber edging
   c. Split rail fence
   d. Picnic table
   e. Plastic bench
   f. Trash/recycling receptacles

g. Lost and found bin
h. Snow poles

D. Materials to be returned to Park:

1. The following materials shall be removed, cleaned, and returned to the Park:

a. Picnic table
b. Mail box

1.5 QUALITY ASSURANCE

A. Comply with the local noise ordinances regarding hours of operations and allowable noise levels. Monitor vibrations generated by the demolition activities and received by the existing structures in the immediate vicinity of the project.

1.6 SCHEDULING

A. Notify the Contracting Officer 48 hours prior to beginning demolition work.

B. Contractor is responsible for verifying location of utilities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 UTILITY SERVICES

A. Utility requirements: Locate, identify, disconnect, and seal or cap off indicated utility services where indicated.

1. Arrange to shut off indicated utilities with utility companies.

3.2 PREPARATION

A. Install erosion and sediment control measures prior to demolition.

B. Install site protection fencing prior to demolition.

C. Conduct demolition operations and remove debris to ensure minimum interference with roads, driveways, and other adjacent occupied and used facilities.

1. Do not close or obstruct roads, or other adjacent occupied or used facilities without permission from the CO and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways.

D. Conduct demolition operations to prevent injury to people and damage to facilities to remain. Ensure safe passage of people around demolition area.

1. Erect temporary protection, such as walks, fences, and railings, where required by Contracting Officer.

2. Protect existing improvements, appurtenances, and landscaping to remain.
3. Erect protective fencing around drip line of individual trees or around perimeter drip line of groups of trees to remain according to requirements specified in Section 311000 "Site Clearing."
4. A vertical sawcut shall be made between any existing pavement that is to remain and the portion to be removed. Where sawcutting is required, the sawcut shall be a minimum of 3 inches deep. When the existing pavement is more than 3 inches thick, the portion below 3 inches may be broken after the sawcut is made.

3.3 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not create hazardous or objectionable conditions, such as ice, flooding, and pollution, when using water.

2. The Contractor shall be responsible for ensuring that special precautions are undertaken during sawcutting operations. No concrete (asphalt or cement) or concrete by-products are to be discharged into any storm drain or surface water. Sawcutting operations will increase the pH of water, therefore filtering is not acceptable.

B. Remove and transport debris in a manner that will prevent spillage on site improvements or public roads.

3.4 ABANDONED WATER VAULT

A. Abandoned vaults shall be broken down to a depth of at least 2-feet below the finished surface elevation. Remove all appurtenances and plug all connections to the vault.

B. Abandoned vaults shall be filled with sand and compacted as specified. Debris from breaking the upper part of the vault may be mixed with the sand subject to the approval of the CO.

C. Remove and dispose of vault ring(s) and cover.

3.5 DEMOLITION

A. Filling Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition of existing facilities shown on the plans with soil materials according to requirements specified in Section 31 20 00 – Earth Moving.

B. Damages: Promptly repair damage to adjacent facilities caused by demolition operations.

3.6 DISPOSAL AND RECYCLING OF DEMOLISHED MATERIALS

A. Promptly dispose of, or recycle demolished materials: If recycling requires additional time to accomplish, provide for orderly storage of materials. Comply with the waste management plan.

B. Transport demolished materials off Park property and legally dispose or recycle material.

END OF SECTION 02 41 13

SECTION 02 41 91 - SELECTIVE HISTORIC DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Selective historic demolition work and storing salvaged materials.
2. Removal of non-historic elements.

B. Related Sections:

1. Section 01 35 91 “Historic Preservation Treatment Procedures.”
2. Section 04 03 10 “Historic Masonry Cleaning.”
3. Section 06 03 12 “Historic Wood Repair”
4. Section 08 03 51.23 “Historic Treatment of Wood Windows.”

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 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 they are-not original fabric.

E. "Stabilize": To apply measures designed to reestablish a weather-resistant enclosure and structural reinforcement of an item or portion of the building while maintaining 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 New Materials: Includes replacement with new material of like kind (custom fabricated of manufactured) that is currently in production. It means duplication of appearance using like material.
   2. 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 ready for reuse.

K. "Remove and Reinstall": To detach items from existing construction, store in protected place, 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 according to Section 01 35 91.

B. Schedule:

   1. Mandatory pre-construction meeting with Contracting Officer and park representatives to review all demolition work.
   2. Describe demolition, removal procedures, sequence and schedule.
   3. Include schedule for shutting off and capping utilities and re-establishing utility services.

C. Shop Drawings:

   1. Plans and details of protection measures for building elements protected in situ. Must be reviewed and approved by the CO prior to installation of protection and start of demolition.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with safety requirements for demolition, ANSI A10.6-90.

B. Contractor shall be responsible for repair/replacement of undocumented damage.

1.5 PROJECT/SITE CONDITIONS

A. Dust: Keep dust and dirt pollution to a minimum.

B. Safety:

1. Ensure safety of persons in demolition area.
2. Provide temporary barricades as required.
3. Provide adequate fire protection.
4. Keep clear of hazardous substances and debris.
5. Maintain access to exits at all times.
6. Use and storage of batteries on site shall be per manufacturer's instructions and coordinated with other site operations.

1.6 SCHEDULING

A. Complete demolition that might damage new construction before starting new work.

PART 2 – PRODUCTS (NONE)

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide temporary supports and protection for parts of structure to remain.

B. Provide temporary closures for openings made in exterior walls and roofs.

C. Protect nearby structures and vegetation as necessary.

D. Cap or disconnect utilities.

E. Provide protection prior to demolition and during construction for the following items:

1. Interior woodwork (paneling and trim) to remain.
2. Wood storefront windows to remain.
3. Existing historic exterior benches to remain.
4. Existing exterior memorial to remain.

3.2 REMOVAL

A. Remove items or materials in inverse order of that used in placing.
1. At Exhibit Hall ceiling removal, systematically map and catalogue each board prior to removal for reinstallation in existing locations and in order to coordinate with new systems penetrations.

B. Methods will be changed by Contracting Officer as necessary.

C. Carefully remove or cut fabric in presence of Contracting Officer.

D. Take every precaution to prevent damage to salvaged items, existing structures and surrounding areas.

E. No flame cutting, vibrating equipment, or explosives will be permitted.

F. Should accidental damage occur, promptly repair damaged area to satisfaction of Contracting Officer at no additional expense to Government.

G. It may be necessary to halt work temporarily for architectural or archeological investigation as previously inaccessible areas are exposed.
   1. Contractor shall work elsewhere on project while investigation is conducted, when possible.

I. Before commencing the following work, Contractor shall identify the extent of disturbance required to accomplish work and obtain approval from the Contracting Officer. Every effort shall be made to limit disturbance to only what is necessary to accomplish work stated in the Contract Documents. Surrounding materials outside the extent of disturbance shall be protected for the duration of the work.

   1. Roof deck replacement at Comfort Station.
   2. Electrical, plumbing and fire suppression routing.

J. The following <u>non-historic</u> items (including but not limited to) to be removed shall be disposed of according to Section 01 74 19 Construction Waste Management. Refer to drawings for additional information.

   1. Restroom fixtures, partitions, and accessories.
   2. Non-historic door hardware not scheduled to remain.
   3. Walls as shown on plans.
   4. Non-historic interior wood trim.
   5. Floor finishes.
   6. Built-in casework and shelving.
   7. ACT ceiling panels and system.
   8. Acoustical wall panels.
   9. Room identification signage.
   10. Furniture identified by NPS.
   11. Exhibit casework and accessories.
   12. Standing seam metal roof and associated roof structure.
   13. Mechanical, plumbing and electrical fixtures and equipment as shown on the plans.
   14. Picnic tables
   15. Select benches as indicated on drawings.
   16. Fencing
   17. Wifi Extender
   18. Select mechanical and electrical fixtures and equipment as indicated on drawings.
   19. Exterior drinking fountain.

K. The following <u>non-historic</u> items will be removed by park:

   1. Electronic door counter at main entrance

L. The following <u>historic</u> items to be removed shall be returned to park include but not limited to:

1. Interior doors and door hardware
2. Switch and receptacle plates
3. Mechanical floor registers
4. Steel window sash and frames from Admin Wing
5. Select light fixtures as indicated on drawings.
6. Wood mechanical diffusers from Restrooms 112 and 113.

3.3 IDENTIFICATION AND DOCUMENTATION

A. As each section of historic fabric is removed, Contracting Officer will record the date, location, dimensions, origin, and original use.

3.4 SALVAGE

A. Historic materials to be Salvaged for Reuse:

1. Light fixtures as indicated on drawings.
2. Select doors as indicated on drawings.
3. Metal mechanical diffusers.
4. Interior wood trim.
5. Wood plank ceiling in Exhibit.
6. Select exterior benches as indicated on drawings.
7. Exterior surface mounted restroom lettering (“WOMEN” and “MEN”).

B. Carefully clean and store materials and items to be salvaged or reused.

C. Items to be salvaged or reused shall be protected and stored on-site where directed by Contracting Officer.

3.6 RESTORATION

A. Repair adjacent surfaces damaged or soiled by demolition work.

B. Restore utility services to normal operation.

C. Remove equipment, temporary protection and barriers, and debris and rubbish.

D. Dispose of unsalvageable materials according to Section 01 74 19.

3.7 CLEANING

A. Remove demolished materials from site as work progresses.

B. Leave areas of work in clean condition.

C. Repair existing or new work which is not to be removed and which is damaged due to Contractor’s operations, by and at expense of Contractor.

END OF SECTION 02 41 91

SECTION 02 50 10 - EMPLOYEE OFFICE RELOCATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Appendix D – Temporary Relocation Plan

C. Section 01 50 00 "Temporary Facilities And Controls"

1.2 SUMMARY

A. NPS employees are responsible for removing personal items from their workstations and taking them prior to start of construction.

B. The Contractor shall provide labor and material to remove office furniture, fixtures and equipment remaining.

C. Most furniture (such as desks, bookshelves, empty and partially full filing cabinets) will be removed and disposed of by Contractor. The Contractor shall move and store minimal furniture as indicated by NPS for the duration of the project in one 20'x40' standard storage container. Contractor shall return stored furniture to location designated by Contracting Officer when the work is complete.

D. The server shall remain in place and operational throughout construction. Protection of server including dedicated ventilation and dust mitigation are required. Coordination with CO of installation of new server racks is to be conducted so as to limit downtime when moving existing server to new location.

1.3 LOCATION AND PERIOD OF PERFORMANCE

A. Location: The Temporary Modular Offices are located as shown on the site drawings.

B. Period: Temporary Modular Offices shall be in place, all office materials and equipment moved, and temporary offices occupied prior to the start of construction and shall remain in place until substantial completion.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site prior to move.
   1. Review Temporary Offices, Temporary Furniture and moving schedule.

2. Review methods and procedures related to moving, covering and protecting office furniture, office materials and equipment remaining.

1.5 ACTION SUBMITTALS

A. Moving Schedule.

B. Temporary furniture product data.

C. Qualifications and Certification of moving contractor.

1.6 INFORMATION SUBMITALS

A. Maintenance and Moving Recommendations

B. Existing Conditions: Documentation of existing furniture and equipment indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include written documents and notations to indicate specific damage conditions of furniture and equipment designated to remain.

C. Quality-control program.

PART 2 – PRODUCTS

2.1 TEMPORARY FURNITURE

A. The Contractor shall provide office furniture of high quality for durability and promotion of employee health throughout construction.

PART 3 - EXECUTION

3.1 BUILDING PROTECTION:

A. It is required that the Contractor will at move-out and move-in:
   1. Prevent damage to all building structures involved in moving, positioning, and protecting office furniture to facilitate construction including, but not limited to, all walls, floors, and doorways.
   2. Protect all hallway corners as needed.
   3. Estimate and supply the correct amount and sizes of building protection materials. Those materials will be taken up and removed at the end of moving. If further building protection is needed, materials to do so will be provided and installed by the Contractor, kept in place while moving, and removed afterward.
   4. Not block access to emergency ingress/egress points of building infrastructure with staged and/or stored items. This includes, but is not limited to electrical closets and mechanical rooms.

B. Building Characteristics and Measurements.

1. See Project Drawings.

3.2 MOVING EQUIPMENT AND MATERIALS:

A. The moving contractor will provide all trucks, moving equipment, building protection materials, moving boxes, packing tape, other packing supplies, such as, but not limited, to safety glasses, protective face masks (as required by Contracting Officer), nitrile latex gloves, paper pads and sheet corrugated, for packing and moving.

B. Hours:
   1. Working hours are considered to be in accordance with Section 01 11 00 Summary of Work.

3.3 DAMAGED PROPERTY:

A. Contractor will be responsible for repairing or replacing any NPS property damaged or lost during the move.

3.4 CONTRACTOR RESPONSIBILITIES:

A. The Mover shall ensure that a safe environment is maintained around all move activities. As the Mover's personnel could be perceived as representing the NPS, the Mover's personnel shall maintain an appropriate decorum. In the event the Contracting Officer receives a complaint regarding the behavior of a Contractor's employee, the Contractor, upon receipt of such notification, shall promptly remove such employee or employees from the NPS premises and take immediate steps to ensure that its performance under this contract will not be reduced.

B. Restrooms: Contractors, construction personnel, are to use the temporary restrooms in the contractor staging area.

C. Meals shall be eaten in designated contractor staging areas at each move location.

D. Workforce: All Mover personnel must be fully trained and dressed in clean, standardized company uniforms with a standardized method of identifying personnel. Mover personnel who are not trained or not in uniform will be asked to leave the NPS premises. Training shall include the safe handling of items moving and on-the-job accident prevention.

E. Mover personnel shall follow all directions of the Contracting Officer's representatives, especially with regard to safety requirements and moving instructions.

F. The Mover will ensure adequate workforce and equipment commitments, so that a smooth move is accomplished.

END OF SECTION 02 50 10

SECTION 02 81 01 – OFFSITE TRANSPORTATION AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for the offsite transportation and disposal of wastes generated during the planned rehabilitation of the Kawuneeche Visitors Center (KVC) at Rocky Mountain National Park (ROMO), located at 16018 US-34, Grand Lake, Colorado 80447 (Project Site).

B. The Contractor will be responsible for sampling, analyzing, and characterizing waste materials to be shipped offsite for final disposal or recycling as required by the Disposal Facility.

C. If building materials coated with Lead-Containing Paint (LCP) and Lead-Based Paint (LBP) are demolished and will be disposed of, it will be the Contractor's sole responsibility to obtain temporary U.S. Environmental Protection Agency (EPA) ID number(s), as and if applicable, on behalf of the National Park Service (NPS) for any hazardous waste materials generated and removed from the Project Site during the execution of this Project. The Contracting Officer will identify appropriate NPS individuals to sign the required paperwork as the generator signatory for the Project.

D. Offsite recycling and disposal facilities will be approved by the Contracting Officer prior to the offsite transportation of materials.

E. Transportation of the materials will comply with the legal load restrictions of the U.S. Department of Transportation (DOT) and the Colorado Department of Transportation (CDOT).

1.2 RELATED SPECIFICATIONS

A. Section 01 74 19: Construction Waste Management and Disposal

B. Section 02 82 13: Asbestos Abatement

C. Section 02 83 13: Removal and Disposal of Material Containing Lead

D. Section 02 84 16: Handling of Lamps Containing Mercury

E. Section 10 81 19: Rodent and Bird Control

1.3 SUBMITTALS

A. The Contractor will include as a component of the Waste Management Plan (described in Section 01 74 19 "*Construction Waste Management and Disposal*") a description of planned means and

methods for transporting and disposing of all the waste materials removed or generated during the Project.

B. Permit for the selected Treatment Storage and/or Disposal Facility.

C. The Contractor will provide an original and/or copies of all Bills of Lading and Manifests for all transported waste material loads from the Project Site, including all required generator, transporter, and waste disposal facility receipt/transfer signatures. These documents will be provided to the Contracting Officer at least weekly and will be accompanied by a detailed electronic waste tracking sheet. The waste tracking sheet will be cumulative and updated weekly. This document will provide the following:
   1. Cumulative load numbers for each shipment.
   2. A description of the waste material being shipped for disposal.
   3. Company transporting the waste material.
   4. Estimated waste volumes for each shipment.
   5. Certified weight slips for each shipment.
   6. The disposal facility of record for each waste stream.
   7. The specific Manifest or Bill of Lading specific identifier number for the load being shipped for disposal.

D. At the conclusion of the Project, all waste disposal information collected will be submitted to the Contracting Officer as an electronic deliverable package as part of the required Project closeout record documentation. Payments to the Contractor for waste transportation disposal fees will not be approved until completed disposal tracking documents, as described above, are received by the Contracting Officer.

1.4 WASTE CONTAINERS

A. The Contractor will provide waste containers specific to the individual waste to be handled.

1.5 FIELD VERIFICATION

A. Field verification of all new and existing dimensions affecting the work of this contract by the Contractor is required before ordering products.

1.6 TRANSPORTATION OF WASTES

A. The Contractor will be responsible for transporting all wastes generated during the Project that cannot be salvaged, reused, or recycled. This includes materials generated by final Project Site cleanup activities and the dismantling of the temporary facilities and controls.

B. The Contractor will be responsible for coordinating the number and schedule of vehicles required for the offsite transportation of waste materials generated during the execution of the Project.

C. The Contractor will be responsible for inspecting transportation vehicles before and after loading to ensure compliance with all local, state, and federal regulations for the safe transport of wastes from the Project Site to the receiving facility. The Contractor will provide the necessary labor and materials to ensure all trucks and containers are covered prior to departure.

D. The Contractor will ensure that transporters arriving at the Project Site for loading do not cause undue congestion to local roadways and will stage trucks either within the perimeter of the Project Site or at an offsite staging area approved by the Contracting Officer.

E. The Contractor's transporters will proceed directly from the Project Site to a designated staging area or the designated offsite receiving facility. Temporary staging or storage of material will only be allowed at designated staging areas approved by the Contracting Officer.

F. The Contractor will originate, maintain, and provide the Contracting Officer with a copy of each executed Bill of Lading for all loads shipped offsite. In addition, the Contractor will provide the Contracting Officer with documentation and records verifying the receipt of each truckload by the receiving facility. Such documentation will indicate the actual weight of each load shipped.

G. Transporters will proceed from the Project Site along traffic routes established by the Contractor and approved by the Contracting Officer. Transporters will call back weights after each load and modify the loads accordingly. The Contractor will ensure that trucks leaving the Project Site are within appropriate weight limitations for the local roads along the designated route.

H. The weight measurements for the materials transported to recycling and disposal facilities will be determined by scales certified in accordance with local, state, and federal regulations and requirements.

1.7 DISPOSAL OF WASTES

A. The Contractor will be responsible for the proper disposal of all solid and liquid wastes generated during the execution of this Project in conformance with all local, state, and federal regulations and requirements. Proper disposal requires that the facility accepting the waste be a state-licensed disposal/recycling facility approved for acceptance of the waste based on the results of the characterization testing and analysis.

B. The disposal facilities will be approved by the Contracting Officer prior to transporting waste. The Contractor will not change facilities without prior written consent of the Contracting Officer.

C. If applicable, for wastes determined to have lead toxicity characteristics as a result of LCP or LBP, the Contractor shall obtain temporary EPA ID number(s) on behalf of the NPS, as directed by the Contracting Officer, for hazardous waste generated during the execution of this Project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 02 81 01

SECTION 02 82 13 – ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section consists of asbestos abatement tasks during the planned rehabilitation of the Kawuneeche Visitors Center (KVC) at Rocky Mountain National Park (ROMO), located at 16018 US-34, Grand Lake, Colorado 80447 (Project Site).

B. The Contractor will take all necessary reasonable measures to control air and water pollution by any material or equipment used during asbestos abatement.

C. The confirmed Asbestos-Containing Materials (ACM), presumed ACM, and trace-asbestos material (1% or less asbestos) present at the Project Site are described below. Estimated quantities of ACM and trace asbestos to be abated from the planned renovation and rehabilitation areas have also been provided below.

D. The abatement scope of work includes the removal of the following ACM:

ACMs:

1. Flooring Tile and Mastic Composite (FTC01): Nine-inch by nine-inch cream floor tile with tan mottling and black mastic is ACM. This material is located on floors throughout the 1963 construction era in the main building (approximately 3,000 sf).

2. Textured Surfacing (TS01): Light knock-down texture is ACM. This material is located on the walls in the 2005 office bathroom renovation area of the building (approximately 550 sf).

3. Textured Surfacing (TS02): Light knock-down texture is ACM. This material is located on the walls in the 2005 office bathroom renovation area of the building (approximately 120 sf).

Presumed ACMs:

4. Pipe Insulation Fittings (PI/PF): Site personnel confirmed that historical renovations had included the abatement of pipe insulation. Historical renovations have not included wall or ceiling cavities. It is presumed that there is remaining pipe insulation in wall and ceiling cavities, and if discovered that material contains asbestos.

5. Cementitious Transite Pipes (CB): Site personnel and building specification drawings indicated that the pipe and duct chases that were encased in the building slab were transite.

This material is known to contain asbestos. It is presumed that the transite in the building slab contains asbestos.

6. Roofing Material (RM)*:* Site personnel requested that the roof of the building not be impacted during this inspection. It is presumed that the roofing material contains asbestos.

Trace-ACMs:

7. Composite Drywall and Joint Compound (CDW01): This material is located throughout the main building, 1963 construction era (approximately 12,000 sf).

8. Composite Drywall and Joint Compound (CDW04): This material is located in the main building, 2005 office bathroom renovation area (approximately 670 sf).

E. Since the last asbestos inspection occurred in 2017, a re-inspection will be conducted by Colorado Certified Asbestos Building Inspector (CABI) to confirm current conditions of the Project Site and sample as-needed to address any new or potentially undiscovered suspect asbestos materials.

F. The Contractor will be responsible for the collection and analysis of personnel exposure samples for asbestos in accordance with the federal U.S. Occupational Safety and Health Administration (OSHA) regulations.

G. If any suspect ACM is encountered within the wall or ceiling interiors in unanticipated locations, the unforeseen condition shall be documented and described, including the location, extent, and quantity of suspect ACM and any immediate actions taken for safety or housekeeping purposes, and this information shall then be provided to the National Park Service (NPS).

H. Any ACM of the nature shown or described, but not specifically called out or shown in the plans but which are reasonably implied and necessary for a complete and satisfactory removal job, will be included without additional cost to the government.

I. Appropriate training will be provided by the Contractor prior to personnel performing abatement as required by applicable regulation 29 Code of Federal Regulations (CFR) 1926.1101 (asbestos). All persons conducting asbestos abatement work will receive compliant training per Title 40 of the CFR Protection of the Environment.

J. The Contractor will be responsible for all cleanup and testing of any area contaminated due to the Contractor's own negligence at no additional cost to the NPS.

1.2 REFERENCES AND RELATED SPECIFICATIONS

A. All work under this contract will be done in strict accordance with the applicable federal, state, and local regulations, standards, and codes governing ACM and trace-asbestos removal and other trade work done in conjunction with this type of asbestos removal work. The most recent edition of any relevant regulation, standard, document, or code will be in effect. Where a conflict among

the requirements or within these specifications may exist, the most stringent requirements will be utilized.

B. Section 02 81 01: Offsite Transportation and Disposal.

C. Section 02 83 13: Removal and Disposal of Material Containing Lead.

D. Section 02 84 16: Handling of Lamps Containing Mercury.

E. Section 10 81 19: Rodent and Bird Control.

F. Landmark Environmental, Inc., *Hazardous Materials Survey Report, Kawuneeche Visitors Center, Rocky Mountain National Park, Grand Lake, Colorado, 80447. Landmark Project No. 17075.001. October 16, 2017.*

G. American Society of Safety Engineers (ASSE), ASSE/SAFE Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems, 2012.

H. Underwriters Laboratories (UL), *UL Standard for Safety High-Efficiency Particulate, Air Filter Units, UL 586,* 2009; reprint 2017.

I. OSHA, 29 CFR 1910.1001, General Industry Standards for Asbestos.

J. OSHA, 29 CFR 1926.1101, Construction Industry Standards for Asbestos.

K. OSHA, 29 CFR 1926.62 Lead.

L. OSHA, 29 CFR 1910.134, Respiratory Protection.

M. OSHA, 29 CFR 1910.145, Accident Prevention.

N. OSHA, 29 CFR 1910.2, Medical Records.

O. OSHA, 29 CFR 1910.38, Emergency/Fire Prevention Programs.

P. OSHA, 29 CFR 1910.1200, Hazard Communication.

Q. U.S. Environmental Protection Agency (EPA), 40 CFR 61 Sub. A, General Provisions.

R. EPA, 40 CFR 61 Sub. B.

S. U.S. Department of Transportation (USDOT) 49 CFR 171 and 172.

T. National Institute for Occupational Safety and Health (NIOSH), *Certified Equipment List.*

U. NIOSH, *Occupational Exposure Sampling Strategy 77-173*.

V. NIOSH, *Guide to Industrial Respiratory Protection,* 87-116.

1.3 DEFINITIONS AND ACRONYMS

A. Colorado Department of Public Health and Environment (CDPHE).

B. Asbestos: Includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered. Asbestos also includes presumed ACM (PACM), as defined below.

C. Asbestos-Containing Material (ACM): Any material containing more than 1% asbestos.

D. Asbestos-Containing Waste Material (ACWM): Any material that is or is suspected of being contaminated with an ACM and which is to be removed from a work area for disposal.

E. Asbestos Debris: Pieces of ACM that can be identified by color, texture, or composition, or means of dust if the dust is determined by an accredited inspector to be ACM.

F. Authorized Person: Any person authorized by their employer and required by work duties to be present in regulated areas.

G. Class I Asbestos Work: Work activities involving the removal of ACM that is thermal system insulation or a surfacing material.

H. Class II Asbestos Work: Activities involving the removal of ACM, which is not thermal system insulation or a surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard systems with ACM drywall joint compound, floor tile and sheeting, roofing and siding shingles, and construction mastics.

I. Critical Barrier: One or more layers of plastic sealed over all openings into a work area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a work area from migrating into an adjacent area.

J. Competent Person: The Contractor's employee who is capable of identifying existing asbestos in the workplace, who has the authority to take prompt corrective measures to eliminate them, and who is trained and accredited as defined in 29 CFR 1926.1101 and 29 CFR 1926.62. The duties of the Competent Person include but are not limited to the following activities: controlling entry to and exit from the asbestos work area, supervising any employee exposure monitoring required by the standards, ensuring that all employees working in a work area wear the appropriate Personal Protective Equipment (PPE) and are trained in the use of appropriate methods of exposure control and decontamination, and ensuring that engineering controls in use are functioning properly.

K. Disposal Bag: A properly labeled 6-mil leak-tight polyethylene bag used for containerizing and/or transporting asbestos waste to the disposal site.

L. Friable Asbestos Material: Material that contains more than 1% asbestos by weight and can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

M. HEPA Filter: A High-Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97 percent of all mono-dispersed particles (e.g., asbestos fibers) of 0.3 microns in diameter.

N. Industrial Hygiene: An area of specialization in the field of industrial safety and health concerned with predicting, recognizing, assessing, controlling, and preventing environmental stressors in the workplace that can lead to sickness, disease, or other forms of impaired health.

O. Industrial Hygienist: A person having a college or university degree(s) in engineering, chemistry, physics, medicine, or related physical or biological sciences who, by virtue of special studies and training, has acquired competence in industrial hygiene.

P. Intact: ACM that has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Q. Negative Initial Exposure Assessment: Assessment by an Industrial Hygienist (IH) that demonstrates that employee exposure during an operation is expected to be consistently below the Permissible Exposure Limit (PEL) for the representative 8-hour Time-Weighted Average (TWA) samples as well as 30-minute Excursion Limit (EL) samples.

R. Non-Friable Asbestos Material: Material that contains more than 1% asbestos by weight and cannot be crumbled, pulverized, or reduced to a powder by hand pressure when dry.

S. Personal Monitoring: Sampling the asbestos fiber concentrations within the breathing zone of an employee.

T. PACM: Presumed Asbestos-Containing Material means materials that are not wood, masonry, metal, rubber, or fiberglass that should be presumed to contain asbestos until tested.

U. Regulated Area: An area established by the Contractor to demarcate areas where Class I, II, and III asbestos work is conducted; an adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the PEL.

V. Removal: All operations where ACM and/or PACM are taken out or stripped from the Project Site, including demolition operations.

W. Renovation: Modifying any existing structure or portion thereof.

X. Surfactant: A chemical wetting agent added to the water to improve wetting and penetration into a substrate.

Y. Time-Weighted Average (TWA): The average concentration of a contaminant in the air during a specific time period.

Z. Visible Emissions: Any emissions containing particulate asbestos material which are visually detectable without the aid of instruments.

AA. Work Area: The area where asbestos-related work or removal operations are performed that is defined and/or isolated to prevent the spread of asbestos dust, fibers, or debris and entry by any unauthorized personnel. A Work Area is a Regulated Area as defined by 29 CFR 1926.1101.

1.4 FIELD VERIFICATION

A. The Contractor shall field-verify all new and existing dimensions affecting work of this contract before ordering products.

1.5 CONSTRUCTION MATERIALS

A. The government will not furnish any materials for this project.

1.6 SALVAGED MATERIALS

A. Excess salvaged materials not reinstalled in the project remain the property of the government.

B. If materials will be reused or reinstalled, stockpile them within the rooms where the materials will be recovered for reuse. If more space is required, coordinate storage location with the NPS building or maintenance manager (whomever the appropriate site representative is).

1.7 PROJECT SUBMITTAL REQUIREMENTS

A. Pre-Project Submittals:
   1. Proof that required federal, state, and local permits have been obtained.
   2. Health and Safety Related Submittals: The Contractor will submit to the Contracting Officer for review an Asbestos-Specific Health and Safety Program including, but not limited to, a Respiratory Protection Program, Medical Surveillance Program, and Accident Prevention Program. Additional health and safety-related submittals required are:
      a. The Contractor must submit a resume and copies of professional registrations and certifications for the Contractor's employee who will be the Competent Person for the project. The Competent Person must meet qualifications and have training and certifications defined by OSHA.
      b. Proof that all employees have passed appropriate medical examinations required by OSHA.
      c. Certification that all employees were instructed on the hazards of asbestos exposure, use and fitting of respirators and protective dress, use of showers, work area entry and exit procedures, work methods, and protective measures.
      d. Certification that each employee was properly fit-tested for each type of respirator anticipated to be used on the project.
      e. If rental equipment is to be used in work areas or to transport asbestos-contaminated waste, provide notice to the rental agency stating the intended use of equipment.
      f. Copies of the certificates for each employee for all asbestos training as required by this Section.

g. Copies of the current physician's written approval to use respiratory protection for all employees subject to medical surveillance requirements defined within OSHA respiratory protection standards.
h. Copies of qualitative or quantitative fit-tests for each employee wearing a respirator on this project.

3. Asbestos Abatement Project Plan: Develop and submit a written Asbestos Abatement Project Plan to the Contracting Officer for review. This plan shall be prepared by a certified state-licensed Asbestos Project Designer. The plan will be job-specific and list work procedures to be used during the removal of asbestos. This work plan will include, but not be limited to:
   a. Construction schedule in sufficient detail for the Contracting Officer to determine the duration and level of effort required for the project.
   b. Description, accompanied by sketches to scale, of the decontamination enclosures and/or planned decontamination procedures.
   c. A description of the ACM and trace-asbestos waste handling procedures. Including the name and address of the waste disposal site; the name, address, and telephone number of the entity that will transport ACM waste; and a transport manifest to be used to identify the quantity of waste removed and accepted by the disposal site.

B. Asbestos-Related Project Submittals – Ongoing Requirements:
   1. Results of all worker exposure assessment air samples will be made available to applicable personnel per OSHA 29 CFR 1926.1101 within 24 hours of sample collection (if practical or as soon as reasonably possible due to the remote location of the Project Site). Submittals will include sample collection logs and laboratory analysis sheets.
   2. After every disposal operation, provide copies of transport manifests, disposal receipts, and Chain-Of-Custody (COC) forms for all asbestos waste materials removed from the site. COC forms will include the date, address of the pickup site, name and address of the Contractor, names of persons responsible for pickup, name and address of the disposal site, the quantity of ACM waste, and the type of containers used. The form will be signed by the Contractor, Contracting Officer, disposal site operator, and hauler if a private hauler is employed.

C. Close-Out Report: Prepare a close-out report with the following items:
   1. Description of ACM and trace-asbestos removal activities performed during the project.
   2. Pre- and post-work photographs.
   3. Description and results of all occupational and environmental sampling.
   4. Results of waste characterization sampling.
   5. Description and results of the third-party final clearance activities.
   6. Copies of all ACWM manifest documents will be completed and signed by the Contracting Officer, and the Contractor, the Transporter, and the Disposal facility.

1.8 QUALITY ASSURANCE

A. Qualifications: The workers will be fully qualified and experienced in the techniques of asbestos abatement, the handling and disposal of ACM and trace-asbestos-containing materials, and meet requirements as set forth by OSHA and the EPA.

B. Regulatory Requirements:

1. Comply with the OSHA Safety and Health Standard (29 CFR 1910.1001); OSHA Asbestos Regulation for the Construction Industry (29 CFR 1926.1101); National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR, Part 61, Subpart M); and the Asbestos Hazard Emergency Response Act (AHERA) (40 CFR, Part 763) regulations, and DOT regulations for transporting ACM waste materials.
2. Notify CDPHE in writing at least ten days before abatement work begins. Obtain all required permits before the work begins. The Contractor will be responsible for obtaining all necessary permits and certifications for personnel in conjunction with asbestos removal, hauling, and disposition and provide timely notification of such actions as may be required by federal, state, regional, and local authorities. The fees and/or charges for these permits will be included in the Contractor's bid price. Provide copies of all obtained permits to the Contracting Officer.
3. Dispose of asbestos waste at an authorized landfill site in accordance with requirements of NESHAP and applicable state and local guidelines and regulations.

1.9 RECORDKEEPING

A. Daily Project Log: The Contractor's Site Supervisor shall maintain a daily project log to document the following information:

1. Date.
2. Name of Supervisor.
3. Number of workers on site.
4. Name of third-party IH monitoring the Project Site.
5. Equipment utilized.
6. Manometer data (if applicable).
7. Brief description of the daily work activities.
8. List any non-compliance, emergencies, stop-work orders issued by any governmental authorities (with detailed explanation), and descriptions of any other significant events.

1.10 PROJECT CONDITIONS

A. Maintain existing emergency exits and building emergency equipment, such as fire alarms, fire hose equipment, and emergency lighting devices, in operating order.

B. Do not damage the existing building materials not associated with the work or work area. Any damage to building materials not protected within or outside the work area and not associated with the work will be repaired or replaced by the Contractor at no cost to the government.

C. Wall, ceiling, and flooring systems can include multiple layers. Due to the inconsistency of these systems and the potential for overlay materials, all systems will be assumed to be ACMs unless specifically sampled and confirmed to be non-ACM. If the work will impact the wall, ceiling, or flooring systems, any material uncovered that was not previously sampled must be assumed to be

asbestos. Samples of the uncovered material will be taken by a competent person, and work will be stopped until the Competent Person allows work to continue. If suspect ACM is encountered in wall or ceiling interiors in unanticipated locations, the unforeseen condition will be documented and described, including the location, extent and quantity of suspect ACM, and any immediate actions taken for safety or housekeeping purposes. The information will be provided to the IH and Contracting Officer.

PART 2 - PRODUCTS

2.1 PERSONAL PROTECTIVE EQUIPMENT

A. Respiratory Protection:

1. Workers who abate asbestos will be provided with personally issued, individually identified respirators that meet the required level of protection. During pre-cleaning, installation of critical barriers, and HEPA-vacuuming activities, the Contractor will utilize (at a minimum) half-face air-purifying respirators with approved HEPA filter cartridges. At a minimum, the Contractor will utilize Powered Air Purifying Respirators (PAPR) for removal and cleanup work unless the Contractor is able to provide an exposure assessment for removal of like materials that indicates the use of half-face negative pressure respirators are sufficient to protect abatement personnel.
2. The Contractor will provide workers with and require the use of respirators approved by NIOSH for asbestos in accordance with OSHA Standard 29 CFR 1926.1101. The minimum respiratory protection allowable will be an approved half-mask air-purifying respirator with HEPA cartridges. Disposable single-use respirators will not be permitted at the Project Site. Initial respiratory protection provided will be chosen prior to commencement of the removal operation based on the data from past exposure assessment monitoring or initial monitoring performed to accurately determine the airborne concentration of asbestos to which employees may be exposed.
3. Workers must perform positive and negative air pressure fit tests each time a respirator is donned, whenever the respirator design so permits. Prior to use, PAPRs will be tested for adequate flow as specified by the manufacturer.
4. Workers will be given a qualitative fit test in accordance with procedures detailed in OSHA 29 CFR 1926.1101 for all respirators to be used. An appropriately administered quantitative fit test may be substituted for the qualitative fit test. Documentation of adequate respirator fit must be provided by the Contractor. Fit tests must be administered annually.

B. Personal Protection Required for Asbestos Abatement:

1. Prior to the commencement of ACM and trace-asbestos removal activities, all personnel who will be required to enter the work areas for handling containerized ACM must have received the required training. Special onsite training on equipment and procedures unique to this job site will be performed as required. The Contractor is responsible for providing emergency response training, such as Cardiopulmonary Resuscitation (CPR) and evacuation procedures, to all abatement personnel prior to starting the work.

2. All respiratory protection must be provided to the workers through the written respiratory protection program. This program will be posted within the cleanroom area of the worker decontamination enclosure system.
3. Disposable clothing, including head, foot, and full-body protection, will be provided in sufficient quantities and adequate sizes for all workers and authorized visitors. All personnel engaged in asbestos removal work will wear the approved disposable protective clothing constructed of spun-bonded olefin, polypropylene fabrics, or any other material of equivalent resistance to penetration by asbestos. Contractor will provide disposable whole-body clothing, including head covers, gloves, and shoe coverings, for all personnel in the asbestos control areas.
4. Persons with facial hair that may interfere with the respirator's seal shall not enter the work areas.
5. Respirators will be worn at all times when ACM and trace-asbestos-containing material is impacted.
6. Protective eyewear, gloves, rubber boots and/or other necessary footwear will be provided by the Contractor as required for the workers and authorized visitors. Safety shoes may be required for some activities.
7. Eating, drinking, smoking, chewing gum, and tobacco will not be allowed in the work areas.

2.2 HEPA-EQUIPPED FILTRATION EQUIPMENT

1. Vacuum Equipment: HEPA-filtered vacuuming equipment with a filter system capable of collecting and retaining asbestos fibers. Filters are required to be 99.97 percent efficient for retaining fibers 0.3 microns or larger.
2. If full abatement containments are constructed for friable asbestos removal, a sufficient quantity of negative pressure ventilation units will be used, equipped with HEPA filters and operated in accordance with the ASSE/SAFE Z9.2 (local exhaust ventilation requirements), EPA guidance document EPA 560/5- 83-002 (Blue Book), and EPA 560/5-85/024 (Purple Book). The IH will inspect all Negative Air Machines (NAMs) after installation and prior to asbestos removal. This inspection will include visual inspections of HEPA filters for physical/water damage, and the NAM filter logbook will be checked. Filter use will not exceed manufacturers' recommended machine hours (typically 600 to 900 hours). The Contractor will use only those brands manufactured and tested for commercial purposes. No "homemade" units will be permitted. HEPA filters will be approved by UL 586.
3. For friable ACM abatement, provide fully operational negative pressure systems supplying a minimum of one air change every 15 minutes. Determine the volume in cubic feet of the work area by multiplying the floor area by the ceiling height. Determine a total ventilation requirement in cubic feet per minute (cfm) for the work area by dividing this volume by the air change rate.
4. Locate NAMs so that makeup air enters the work area primarily through decontamination facilities and transverses the work area to the negative pressure air machines placed at a maximum distance from the worker entry or the other makeup air sources. Place the end of the unit or its exhaust duct through an opening in the plastic barrier or wall covering. The

plastic around the unit or duct will then be sealed with tape. Vent NAM exhaust outside of the building unless authorized in writing by the IH or the Contracting Officer.

2.3 PLASTIC SHEETING

A. All abatement containments and decontamination stations will be constructed of a minimum of 6-mil poly sheeting sized to minimize the frequency of joints.

B. Polyethylene sheeting utilized for the worker decontamination enclosure will be opaque white or black.

2.4 TAPE

A. For use under dry and wet conditions, capable of being cleaned off surfaces without permanent marks or damage to the substratum.

2.5 CONTAINERS

A. Asbestos wastes will be stored in leak-tight, 55-gallon metal or fiberglass drums that have tightly fitting lids and are lined with 6-mil plastic bags. Label the containers in accordance with OSHA 1926.1101.

B. Disposal drums (if applicable) will be metal with locking ring tops and inner 6-mil polyethylene liners.

C. Stick-on warning labels, as per EPA or OSHA requirements, will be used on all disposal drums. All drums must additionally be labeled with a DOT code.

2.6 OTHER MATERIALS

A. Surfactant (wetting agent) will be a 50/50 mixture of polyoxyethylene ether and polyoxyethylene ester, or equivalent, mixed in a proportion as specified by the manufacturer.

B. Encapsulation materials will be either the penetrating or bridging type, pollution-free, non-toxic, with a Class A fire classification as specified herein. The encapsulant shall be flexible when cured and resistant to weathering, oxidation, aging, and abuse. The Contractor will submit product data, use instructions, and recommendations from the manufacturer for products intended for use.

C. Provide all other materials required for temporary construction.

PART 3 - EXECUTION

3.1 HOUSEKEEPING

A. Establish Regulated Areas per OSHA 29 CFR 1926.1101. Demarcate all of the Regulated Areas per OSHA.

B. Keep the project neat, orderly, and in a safe condition at all times. Use wet methods and HEPA-equipped vacuums only to collect all dust, waste, debris, etc., within areas where ACM and trace-asbestos-containing materials are impacted. Prohibit the use of dry sweeping or vacuuming without using HEPA-equipped vacuums.

C. All powered hand tools and equipment used to impact ACM and trace-asbestos-containing material must be equipped with point-of-contact HEPA-equipped vacuum attachments, and/or the materials must be thoroughly wetted with an effective wetting agent suitable for the material and operation.

D. Access to the work areas must be restricted to "authorized persons" only as defined in OSHA 29 CFR 1926.1101. This may be accomplished using properly demarcated critical barriers, securing adjacent access points, or installing barrier plastic sheeting and signs following the implementation of compliant Negative Exposure Assessment activities and at the direction of the Competent Person.

E. The Contractor will verify the locations of utilities prior to any environmental abatement and interior demolition work. Existing water, sewer, electrical, communications, and gas lines within the boundaries of the environmental abatement work will be located, and non-essential utilities will be properly locked and tagged out at the limits of the environmental abatement or selective demolition work. This work will require a qualified and licensed electrician to verify safety and proper lockout.

F. Unless and until a Negative Exposure Assessment is produced, establish an equipment room or area adjacent to the regulated area for the decontamination of employees and their equipment contaminated with asbestos.

G. Provide enough containers for collecting ACWM and construction debris.

H. Place drop cloths adjacent to areas where impacts to ACM and trace-asbestos-containing material will occur.

I. Use HEPA-equipped vacuum and wet methods to clean up dust, debris, or other waste materials that may contain or be contaminated with ACM and trace-asbestos-containing material.

J. No dry sweeping is permitted at any time during any activities conducted on or around any ACM or trace-asbestos material such that any waste dust, debris, or other items could be contaminated.

K. Thoroughly wet all dry or drying ACM and trace-asbestos-containing material to prevent creating dust.

L. Keep ACWM and trace-asbestos-containing materials adequately wet and in covered containers.

M. Smoking is not permitted.

3.2 FIRE SAFETY

A. The Contractor will take the following precautions against fire:

1. The Contractor will comply fully with requirements of the federal, state, and local government, Owner, and Owner's Representative, including stipulations as outlined below. The Contractor will maintain and enforce all of the regulations imposed and will be required to secure such protection as may be required. In the event of strikes, these precautions will not be relaxed. The Contractor is responsible for acquainting the local Fire Department with the existing conditions.
2. The Contractor will not impede or void the essential function of emergency fire exits while performing abatement work.
3. At least one qualified person thoroughly familiar with fire protection and prevention will be on duty at all hours while the Contractor's employees are working. This person will patrol the entire work area frequently and will have the authority to take immediate remedial action to eliminate unnecessary fire hazards.
4. Building material storage will be limited to secure areas within the building or, where stored outside, will be kept at least ten feet (10') away from the building. Storage areas will be approved by the Owner's Representative.
5. Fire extinguishers: Maintain and provide approved fire extinguishers throughout accessible areas. Placement, inspection, and maintenance of the fire extinguishers will comply with 29 CFR 1926.130. The Contractor will provide at least one 20 ABC fire extinguisher for every 3,000 sf of the work area, with a maximum distance of 100 feet between fire extinguishers. The Contractor will place (at a minimum) ABC fire extinguishers in the following locations:
   a. Cleanroom of personnel decontamination facility.
   b. Equipment room of personnel decontamination facility.
   c. Within the containment, at least one extinguisher for every 3,000 sf of the work area with a maximum distance of 100 feet between fire extinguishers.
6. Gasoline, oils, and other volatile liquids will be kept outside, to be brought into the building in quantities only as needed. Such storage will be in a well-ventilated location and removed from all open heating or lighting devices. Storage areas will be approved by the NPS.
7. The electrical wiring for construction light and power will be a properly fused Ground Fault Circuit Interrupter (GFCI) installed to conform to basic code requirements and maintained under the supervision of a competent electrician. This also applies to all temporary lines used by the Contractor.
8. During any torch-cutting activities, the Contractor will take necessary steps to comply with 29 CFR 1926 Subpart J (1926.350-1926.353), including provisions addressing transportation and storage of oxygen and acetylene cylinders, fire prevention, and project

ventilation. The Contractor will utilize persons trained and knowledgeable in all equipment used onsite.

3.3 FULL ABATEMENT CONTAINMENT PREPARATION

A. Full abatement containments will be constructed of a minimum of two layers of 6-mil poly sheeting on all walls and floors and/or other surfaces not being abated. A single layer of 6-mil poly sheeting will be used to cover all ceilings not being abated in full abatement containments.

B. Isolate the abatement containment area by installing barricade tape and posting caution signs in and around work areas to comply with OSHA 1910.1001(g)(1) and federal, state, and local regulations.

C. Shut down and lock out all heating, cooling, and air-conditioning system components that supply or pass through the work area.

D. Wet wipe or HEPA-vacuum surfaces where critical barriers are to be installed and seal off all openings, such as corridors, doorways, windows, vents, ducts, grilles, diffusers, switch and outlet boxes, and lighting fixtures, with a minimum of one layer of 6-mil poly sheeting sealed with duct tape.

E. Clean all items to be removed from the work area using HEPA vacuum equipment and/or wet cleaning methods. Remove cleaned items to a temporary location as directed by the NPS.

F. Clean items to remain within the work area using HEPA vacuum equipment and/or wet cleaning methods and completely cover with one layer of 6-mil poly sheeting sealed with duct tape. Protect items with temporary barricades, covers, or pads as necessary to prevent damage.

G. Construct a five-stage Personnel Decontamination Unit (PDU) with a functional shower unit and a two-stage Waste Load-Out (WLO) in a location contiguous with the full abatement containment.

H. Install NAMs and establish negative pressure within the work area with only critical barriers, PDU and WLO in place. Install a manometer equipped with a strip-chart recorder to confirm a minimum of -0.02 pressure differential between the interior and exterior of the containment.

I. Pre-clean the entire work area using HEPA-vacuum equipment and/or wet cleaning methods. All waste generated during this activity will be treated as ACWM.

J. Cover floors, then walls, with 6-mil poly sheeting sealed with duct tape.

1. Cover floors with a minimum of two layers of plastic sheeting. Extend plastic at least 24 inches up walls. Cover walls with a minimum of two layers of plastic sheeting to the floor level. Extend the plastic at least 12 inches onto the floor in an overlapping manner with the floor. (e.g., install floor, wall, floor, wall with the wall being the top layer of sheeting.)

2. Install a single layer of 6-mil poly on the ceiling if the ceiling is not being abated, overlapping the ceiling poly and innermost layer of wall poly a minimum of 12 inches.

3.4 SECONDARY ABATEMENT CONTAINMENT PREPARATION

A. Secondary abatement containments will be constructed of a one-layer critical barrier of 6-mil poly sheeting over all windows, doors, vents, and openings or penetrations into the works area and one layer on walls, floors, and ceilings and/or other surfaces not being abated.

B. Isolate the abatement containment area through the use of barricade tape and post caution signs in and around work areas to comply with OSHA 1910.1001(g) (1) and federal, state, and local regulations.

C. Shut down and lock out all heating, cooling, and air-conditioning system components that supply or pass through the work area.

D. Wet wipe or HEPA-vacuum all surfaces where critical barriers are to be installed and seal off all openings, such as corridors, doorways, windows, vents, ducts, grilles, diffusers, switch and outlet boxes, and lighting fixtures, with one layer of 6-mil poly sheeting sealed with duct tape.

E. Clean items to be removed from work areas using HEPA-vacuum equipment and/or wet cleaning methods. Remove cleaned items to a temporary location as directed by the NPS.

F. Clean the items to remain in work areas using HEPA-vacuum equipment and/or wet cleaning methods and completely cover with one layer of 6-mil poly sheeting sealed with duct tape. Protect items with temporary barricades, covers, or pads as necessary to prevent damage.

G. Install a decontamination chamber attached to the secondary containment for personnel decontamination. If a remote shower is used (not directly attached to the secondary containment), a single chamber can be erected for exiting personnel to remove their dirty protective suit and don a new clean suit prior to proceeding to the remote decontamination unit. Install a separate WLO chamber for waste transfer, also attached to the secondary containment.

H. Install NAMs and establish a minimum of 0.02 inches of a water column of negative pressure within the work area prior to erecting secondary containment barriers.

I. Pre-clean the entire work area using HEPA-vacuum equipment and/or wet cleaning methods.

J. Cover porous or non-cleanable surfaces and objects with a minimum of one layer of 6-mil poly sheeting sealed with tape.

K. Install a minimum of one layer of 6-mil poly sheeting on all walls, floors, ceilings, and/or surfaces not being abated. Overlap poly sheeting a minimum of 12 inches at all seams.

3.5 PERSONNEL DECONTAMINATION SYSTEMS – REQUIRED FOR ABATEMENT

A. During asbestos abatement, a worker decontamination system will be provided in at least one pre-designated location for each area where a regulated asbestos area is established. Pre-constructed decontamination trailers are permitted.

B. If decontamination units are constructed onsite, construction plans, including materials and layout, will be submitted as shop drawings, and approved in writing by the Contracting Officer prior to work initiation. Worker decontamination enclosure systems constructed at the worksite will utilize 10-mil opaque black or white polyethylene sheeting or other acceptable materials for privacy.

C. The worker decontamination system will consist of at least a clean room, with a shower room and an equipment room, each separated from the other and from the work area by airlocks.

D. Entry to and exit from all airlocks and the worker decontamination system chambers will be through curtained doorways consisting of three sheets of overlapping polyethylene sheeting. Each sheet will be secured at the top and staggered from left to right for subsequent sheets. The innermost sheets will have weights attached to the bottom to ensure that they hang straight and maintain a seal over the doorway when not in use. Doorway designs, providing equivalent protection and acceptable to the IH, may be utilized.

E. Access between any two rooms within the worker decontamination system will be through an airlock with at least 3 feet separating each curtained doorway, resulting in a five-stage decontamination unit. The pathways into (from clean to contaminated) and out from (contaminated to clean) the work area will be clearly designated.

F. The cleanroom will be sized to adequately accommodate the clothes, equipment, and supplies for the work crew. Clean disposable clothing, replacement filters for respirators, towels, and other necessary items will be provided in adequate supply at the cleanroom. A location for postings will also be provided in this area. Whenever possible, a lockable door will be used to permit access into the cleanroom from outside the work area. Lighting, heat, and electricity will be provided as necessary for comfort. No asbestos-contaminated items may enter this room. The workers will use this area to suit up, store street clothes, don respiratory protection on their way to the work area, and dress in street clothes after showering.

G. The shower room will contain one or more showers as necessary to adequately accommodate the workers. Each showerhead will be supplied with hot and cold water adjustable at the tap. The shower will be constructed with fully sealed walls and an overflow pan base to prohibit leakage of any kind. The Contractor will supply and keep available at all times an adequate supply of soap, shampoo, and towels. Shower water will be drained, collected, and filtered through a system with at least a 5-micron particle size collection capability. All filtered water will be stored for subsequent treatment by the Contractor. The shower should be constructed to ensure against leakage of any kind and will be kept clean of all debris and ACM at all times.

H. The equipment room will be used to store equipment and tools at the end of a shift after they have been decontaminated using a HEPA-filtered vacuum and/or wet cleaning techniques as appropriate. Replacement filters (in sealed containers until used) for HEPA vacuums and negative pressure ventilation equipment, extra tools, containers of surfactant, and any other materials and equipment that may be required during the abatement may also be stored here as needed. A pan filled with water will be located in the work area just outside the equipment room for workers to clean off foot coverings after leaving the work area and prevent excessive contamination of the worker decontamination system. A container lined with a labeled 6-mil polyethylene bag for the collection of disposable clothing will be located in this room. Contaminated footwear (e.g., rubber boots, other reusable footwear) will be stored in this area for reuse the following workday.

I. If full abatement containments are constructed for abatement of friable ACM, the container and equipment decontamination unit will be constructed of a minimum of three chambers, each separated by curtained doorways of three overlapping sheets of poly affixed at the top and staggered at left and right for subsequent sheets. All materials, equipment, and bagged ACM will be decontaminated in this unit. This area will be separate from the personal decontamination unit and will be used for decontamination and temporary storage of bagged waste and equipment. All WLO areas must have a minimum of two separate chambers separated by airlocks. The size of each container/equipment decontamination unit chamber depends on the type of materials to be passed out of the container/equipment decontamination unit. Each separate airlock must be of sufficient size to fully contain, within the individual airlock, any item passed out through the container/equipment decontamination unit. If the regulated area is not a full abatement containment, the waste transfer area will be designated, and all waste will be transferred through that location only.

J. A worker outside the regulated area will hand an unused bag to the worker in the regulated area. A worker in the containment chamber will deposit a sealed bag containing asbestos into this unused bag. The double-bagged material will then be sealed and passed into the waste transfer station, wiped down, and passed outside of the regulated area. If equipment is used to transfer wrapped components, the equipment will pass through the waste transfer, and any visible debris on the wrapped components or the equipment will be wet-wiped or washed with an airless sprayer.

K. The container/equipment decontamination system will be equipped with the necessary facilities to wash and wipe the outside of the bags, drums, or other items prior to loading them into the vehicle for transportation to a landfill. Provisions will be made by the Contractor to prevent any contaminated run-off from leaving the decontamination system. All wastewater from the area will be filtered through a multi-part filter system with a final pore size of 5.0 microns, nominal. The container/equipment decontamination system will be equipped with the necessary facilities to wash and wipe the equipment leaving the containment.

3.6 WORK AREA ENTRY AND EXIT PROCEDURES

A. If a containment is constructed, emergency exits will be established and clearly marked with duct tape arrows or other effective designations to permit easy location from anywhere within the work

area. Emergency exit indicator arrow or other effective designations will be placed at a maximum height of three feet to allow for visibility from a crawling position in the event of a fire that fills the work area with smoke. They will be secured to prevent access from uncontaminated areas and still permit emergency exiting. These exits will be properly sealed with polyethylene sheeting, which can be cut to permit egress if needed. These exits may be the worker decontamination system, the waste pass-out airlock, and/or other alternative exits satisfactory to fire officials. The Contractor shall place a razor knife at all emergency exit locations for quick cutting of poly sheeting to allow for quick egress. For uncontained regulated areas, the routes of egress will be clearly identified and communicated to all workers.

1. All workers and authorized personnel will enter the regulated areas through the worker decontamination system and must sign the entry log located in the cleanroom upon entry and exit.
2. All personnel entering any work area will read and be familiar with all posted regulations and personal protection requirements, including workplace entry and exit procedures and emergency procedures. A sign-off sheet will be used to acknowledge that these have been reviewed and understood by all personnel prior to entry.
3. All personnel will proceed first to the cleanroom, remove all street clothes, and put on required respiratory protection, disposable coveralls, head covering, and foot covering. Hard hats, eye protection, and gloves will also be utilized if required. Clean respirators and protective clothing will be provided and utilized by each person for each separate entry into the work area.
4. Personnel wearing designated PPE will proceed from the cleanroom through the shower room and equipment room to the main work area.
5. Before leaving the work area, all personnel will remove gross contamination from the outside of respirators and protective clothing through brushing and/or wet wiping procedures. Each person will clean the bottoms of protective footwear in the walk-off pan just prior to entering the equipment room. Upon entering the equipment room, they will then remove all personal protective equipment except for respirators. Deposit disposable clothing into appropriately labeled containers.
6. Reusable, contaminated footwear will be stored in the equipment room when not in use in work areas. Upon completion of abatement, it will be disposed of as asbestos-contaminated waste. Rubber boots may be decontaminated at the completion of the abatement for reuse.
7. Still wearing respirators, personnel will proceed to the shower area, shower and shampoo to remove residual asbestos contamination, and then clean the outside of the respirator and the exposed face under running water prior to removal of the respirator. Removal of the respirator and cleaning of the face underneath should be the last act prior to exiting the shower. Various types of respirators will require slight modification of these procedures. An airline respirator with HEPA-filtered disconnect protection may be disconnected in the shower. Care must be taken with a powered air-purifying respirator facepiece since the filter and power pack assembly are not waterproof. A dual-cartridge respirator may be worn into the shower area. Cartridges must be replaced for each new entry into the work area. After showering and drying off, proceed to the cleanroom to don clean disposable clothing if returning to the work area or street clothes if leaving the work area.

B. Cartridges used on half-face or full-face Air Purifying Respirators (APRs) will be disposed of each time a worker leaves the asbestos control area (after showering).

C. If used, PAPR cartridges may be capped after the worker leaves the asbestos control area and has completed initial showering (prior to removing the respirator). When PAPR cartridges become wet or filter loading decreases airflow below 4 cfm, the PAPR cartridges must be disposed of as ACWM.

D. The following provides clarification of decontamination procedures to workers once workers have removed and disposed of disposable clothing (Tyvek suit with hoods and boots and disposable gloves) and have removed and stored all protective footwear, headwear, and eyewear within the equipment room. Workers wearing half-face APRs will proceed to the shower and shower total body (soap and shampoo) with emphasis on running water over the exposed face and the outside of the respirator. Once residual contamination on the head, body, and respirator has been removed, the worker will open a re-sealable bag, remove saturated cartridges, and place cartridges into and seal the re-sealable bag. The worker will complete additional showering and exit to the cleanroom.

E. Replacement (new) respirator cartridges will be stored on shelving in the cleanroom in original packaging. Cartridges will not be stored on the floor or in any other locations where water and/or physical damage may occur.

3.7 ASBESTOS REMOVAL WORK

A. Upon completion of the asbestos removal work, the Contractor will submit a written statement to the NPS attesting that all items containing asbestos have been disposed of in accordance with EPA 40, CFR, Part 61, Subpart M in the approved sanitary landfill(s). Documentation will include proof of regulatory approval and copies of the completed Waste Shipment Records signed by the generator, transporter(s), and disposal site operator and listing the following information:

1. Name, address, and telephone number of the waste generator.

2. Name and address of local, state, or EPA regional agency responsible for administering the asbestos NESHAP program.

3. Quantity of ACWM in cubic meters or yards.

4. Name and telephone number of the disposal site operator.

5. Name and physical location of the disposal site.

6. Date transported.

7. Name, address, and telephone number of the transporter(s).

8. A certification that the contents of the shipment are fully and accurately described by the proper shipping name and classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to all applicable international and government regulations.

3.8 AIR MONITORING

A. Air samples for asbestos may be collected adjacent to the abatement work areas by the IH each day abatement occurs. Asbestos air samples will be analyzed by the IH at the end of each work shift. The purpose of abatement perimeter monitoring is to detect faults in the work area isolation, such as:
   1. Contamination of areas/buildings outside of the work area with airborne asbestos fibers.
   2. Failure of the filtration system or rupture in the differential pressure system (if used) causing contamination of air outside with airborne asbestos dust.
   3. Should any of the above conditions occur, immediately cease abatement activities until the fault is corrected. Do not recommence work until authorized by the IH.

B. If at any time in the abatement process that the outside work area monitoring results indicate that the asbestos concentration is at or above 0.01 fibers per cubic centimeter, CEASE ALL WORK except corrective action. After correcting the cause of unacceptable levels outside the work area, HEPA vacuum all surfaces that could potentially be contaminated; wet wipe, using amended water, all wettable surfaces, and HEPA vacuum a second time. Complete corrective work with no change in the contract sum if high airborne asbestos levels were caused by the Contractor's activities.

C. Aggressive final clearance air samples for asbestos will be collected in each asbestos removal area. The IH will collect clearance air samples for Phase Contrast Microscopy (PCM) analysis. If all of the air samples do not meet the post-abatement standard of 0.010 fibers per cubic centimeter (f/cc), the work area will be re-cleaned until acceptable air levels are achieved at no additional cost to the government. The asbestos abatement action will be considered complete when the clearance air samples result in acceptable air concentrations. Failed clearance costs will be the responsibility of the Contractor.

3.9 ABATEMENT WORK PRACTICES

A. The following sections describe protocols to be used for the various abatement tasks associated with this project. After all PPE and containment controls are implemented, the abatement task sequence will be as follows:
   1. Shut down and lock out all heating, ventilation, and air-conditioning (HVAC) units and mechanical or refrigeration equipment within the work area.
   2. Initiate pressure differential system using HEPA-filtered ventilation devices. Exhaust must be vented to the outside. Units are to be sized to achieve a minimum of one complete air change within the area every 15 minutes.

3. Construct the worker decontamination system at the entrance to the work area. Construct a waste pass-out decontamination system.
4. Pre-clean areas where critical barriers will be affixed and install critical barriers. Seal off any penetration or entrances into the work area using one layer of 6-mil polyethylene sheeting and tape. Polyurethane sealant foam may be used for small penetrations. Install a manometer equipped with a strip-chart recorder and verify a minimum of -0.020 inches of a water column pressure differential.
5. Pre-clean all mechanical equipment, floors, and walls.
6. Complete containment barrier installation (floors, walls, ceilings) per specification.
7. Approval of worker decontamination system(s) and containment system will be approved in writing prior to initiation of removal or repair activities.
8. Remove and properly dispose of existing friable and non-friable ACM.
9. Upon the completion of removal or repair activities, the Contractor will request a visual inspection of the work area by the IH. All surfaces are to be thoroughly cleaned prior to this request.
10. Upon confirmation from the IH that the scoped ACM has been completely removed and no visible dust or debris remains, the abatement contractor shall remove the wall, floor, and ceiling poly sheeting and package it as ACWM. The abatement contractor supervisor will then request a final visual inspection from the IH.
11. Upon successful completion of the final visual inspection, aggressive sampling of the work area will occur for air clearance with only the PDU, WLO, and critical barriers in place.
12. If air sampling indicates area clearance in accordance with specifications, the area will be declared clean, and all of the remaining polyethylene, tape, debris, etc., will be removed and bagged as asbestos-contaminated waste.
13. An encapsulating agent will be applied to surfaces from which ACM has been stripped if total decontamination or component removal cannot be accomplished. Approval from the IH must be obtained before applying the encapsulant.
14. All asbestos waste must be adequately wet as defined in the EPA/NESHAP Guidance dated December 1990. Per the EPA Guidance, "adequately wet" means to "sufficiently mix or penetrate with liquid to prevent the release of particles." If visible emissions are observed coming from ACM waste, the material is not adequately wet. The absence of visible emissions is not sufficient evidence of being adequately wet. All asbestos-abated materials, regardless of whether they are first stripped from their substrate, must be adequately wet prior to disposal.

3.10 PROJECT DECONTAMINATION AND FINAL CLEARANCE

A. At the conclusion of the active abatement process, all surfaces in the abatement area should be thoroughly, and completely HEPA vacuumed. The surfaces include but are not limited to ceilings, walls, floors, windows, doors, fixtures of any kind, and appliances. This includes not just abated surfaces but also un-abated surfaces exposed to asbestos dust generated by the abatement process. All areas should be included in this HEPA process, except for spaces that:
   1. Were found free of asbestos dust before the abatement process began;

2. Were properly sealed before the abatement process began; and
3. Were never entered during the abatement process.

B. Wet Wiping
1. Use Proper Wet Cleaning Procedures: At the conclusion of the active abatement process and after the first HEPA vacuuming, all surfaces identified as requiring HEPA vacuuming earlier should be thoroughly and completely washed with an amended water solution.
2. Change Cleaning Mixture Regularly: To avoid re-contaminating the area by using overly dirty water, users should carefully follow surface area limits and change cleaning mixtures accordingly. Users must ensure that dirty water does not re-contaminate the environment. This dirty water is potentially hazardous and should be treated accordingly.

C. Final Inspection
1. After the final cleanup is complete, the final inspection will take place. The IH will require 24-hour advanced notice of work areas prepared for the final inspection. The objective of the inspection is to verify abatement completeness and that no visible dust, dirt, or debris is present.
2. Post-abatement visual inspection will be performed to confirm the job completeness and determine whether all surfaces have been abated according to the approved abatement plan. The inspector will present the Contractor with a punch list of items to complete before the inspection process can continue.

3.11 RE-ESTABLISHMENT OF THE WORK AREA AND SYSTEMS

A. Re-establishment of the work area to general access will only occur following the completion of cleanup procedures and/or after clearance air monitoring has been performed and documented to the satisfaction of IH.

B. IH will visually inspect work areas for any remaining visible residues. Evidence of contamination will necessitate additional cleaning and air monitoring. Following satisfactory clearance of the work areas, the remaining polyethylene barriers may be removed and disposed of as asbestos-contaminated waste.

C. Upon successful completion of the final air monitoring, the Contractor will allow the NAMs to operate until all critical barriers are removed and sealed in disposal bags. The barriers will be disposed of as ACM waste. Removal of critical barriers and equipment will be conducted using appropriate PPE.

3.12 DISPOSAL

A. Asbestos waste will be thoroughly wetted and double-bagged in appropriately labeled asbestos disposal bags. Bags will be sealed airtight while the material is still wet. Bag tops will be twisted and sealed with duct tape, then bent over and sealed again with at least three wraps of duct tape.

Biological materials may be disposed of in standard construction garbage bags in enclosed roll-off containers.

B. Additional material will not be added to bags, and bags will not be reopened after they have been sealed. Asbestos wastes will be transported by a properly licensed transporter in a covered truck and disposed of at a landfill approved for asbestos. A manifest document will be completed and signed by the Contracting Officer, the Contractor, the Transporter, and the Disposal facility. The Contractor will submit all disposal records to the Contracting Officer.

C. Immediately remove hazardous rubbish from the Project Site. Place other construction debris in refuse containers at least daily. Dispose of refuse at least weekly, in a legal manner, at public or private dumping areas outside the park. Do not burn or bury refuse inside the park.

D. Labels must be affixed to all bags, drums, or other containers containing ACWMs. The following label will be prominently displayed on the waste containers. All warning label print will be readily visible in large bold letter-size print on a contrasting background. Labels will contain the following information:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
DO NOT DISTURB WITHOUT PROPER TRAINING AND EQUIPMENT
DO NOT BREATHE ASBESTOS FIBERS

3.13 AIR AND WATER POLLUTION CONTROL

A. Take all necessary reasonable measures to reduce air and water pollution by any material or equipment used during construction.

B. Contractor personnel, building occupants, and visitors to the structures must be protected from exposure to airborne asbestos fibers.

C. Initial exposure assessment sampling will be conducted by the Contractor's Competent Person during activities that impact ACM until a record of potential exposure during each type of activity is established.

D. Samples will be analyzed using PCM according to the NIOSH Counting Method 7400 for Phase Contrast Microscopy.

E. Laboratories performing analysis of the air samples will be rated proficient by the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) program.

F. Results of the air samples will be made available to applicable personnel and will be submitted to the IH within 24 hours of sample collection.

G. Do not allow ACWM or other waste materials to be washed into the lakes or other bodies of water.

3.14 REPORTS

A. Prepare and submit a close-out report at the completion of the work.

END OF SECTION 02 82 13

SECTION 02 83 33 – REMOVAL AND DISPOSAL OF MATERIAL CONTAINING LEAD

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section consists of tasks associated with the removal and disposal of material containing lead during the rehabilitation of the Kawuneeche Visitors Center (KVC) at Rocky Mountain National Park (ROMO), located at 16018 US-34, Grand Lake, Colorado 80447 (Project Site). This structure was found to have Lead-Containing Paint (LCP) on exterior surfaces. This specification establishes the required environmental controls to be used during impacts to Lead-Based Paint (LBP) or LCP during the planned rehabilitation work.

B. Testing and analysis at the Project Site identified LCP, including the following painted components:
   1. SVC-A-EXT-LBP07, Dark green/brown exterior wall paint collected at the southeast corner of room 121's exterior in the 1963 construction era section of the building is LCP.
   2. SVC-A-EXT-LBP08, Light green/grey exterior trim paint collected at the southeast corner of room 121's exterior in the 1963 construction era section of the building is LCP.
   3. SVC-C-EXT-LBP09, Dark green/brown exterior wall paint collected at the southwest corner of room B1's exterior in the 1963 construction era section of the building is LCP.
   4. SVC-C-EXT-LBP10, Light green/gray exterior trim paint collected at the southwest corner of room B1's exterior in the 1963 construction era section of the building is LCP.

C. The Contractor will be responsible for the collection and analysis of personnel exposure samples for lead in accordance with the U.S. Occupational Safety and Health Administration (OSHA) regulations.

D. Appropriate training will be provided by the Contractor prior to their personnel performing work impacting identified LCP and potentially discovered LBP as required by applicable regulation 29 Code of Federal Regulations (CFR) 1926.62 (lead).

E. Two hours of lead awareness training will be provided to applicable National Park Service (NPS) personnel and their subcontractors working within the areas that contain LBP/LCP who can reasonably be expected to be impacted as part of this work.

F. Work shall be conducted so that no visible emissions are generated by construction that impacts LBP/LCP building components. Manual removal methods that do not generate dust or debris must be utilized. The Contractor's Competent Person (CP) shall determine if the methods used present a risk of exposure above OSHA's Action Level (AL) of 30 micrograms per cubic meter over an 8-hour Time-Weighted Average (TWA) as required by the OSHA lead construction standard 29 CFR 1926.62.

G. Any employee that may be exposed to lead levels in excess of the OSHA AL will have a minimum of two hours of lead awareness training.

H. The Contractor is responsible for providing an independent Industrial Hygienist (IH). This IH will coordinate with the Contracting Officer to provide waste profile sampling.

I. The Contractor must carefully collect, containerize, characterize for waste disposal, transport, and dispose of any regulated or hazardous wastes generated during this project, including LCP dust and debris and other potentially lead-contaminated wastes. If LCP components or debris are disposed of offsite, a representative waste profile sample shall be collected and analyzed as required by the receiving landfill for waste profiling purposes. The Contractor shall provide temporary staging areas for waste and conduct waste profile sampling; analyses of the sample shall be by Toxicity Characteristic Leaching Procedure (TCLP).

J. The Contractor will be responsible for the cleanup and testing of any area(s) contaminated due to Contractor negligence at no additional cost to the NPS.

1.2 REFERENCES AND RELATED SPECIFICATIONS

A. All work under this contract will be conducted in strict accordance with all applicable federal, state, and local regulations, standards, and codes governing lead remediation and other concurrent trade work. The most recent edition of any relevant regulation, standard, document, or code will be in effect. Where conflict among the requirements or within these specifications exists, the most stringent requirements will be utilized.

B. Section 02 81 01: Offsite Transportation and Disposal.

C. Landmark Environmental, Inc., *Hazardous Materials Survey Report, Kawuneeche Visitors Center, Rocky Mountain National Park, Grand Lake, Colorado, 80447. Landmark Project No. 17075.001. October 16, 2017.*

D. American Society of Safety Engineers (ASSE), ASSE/SAFE Z9.2 *Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems*, 2012.

E. Underwriters Laboratories (UL), *UL Standard for Safety High-Efficiency Particulate, Air Filter Units, UL 586*, 2009; reprint 2017.

F. The U.S. Occupational Safety and Health Administration (OSHA), 29 CFR 1910.1025 - General Industry Standards for Lead.

G. OSHA, 29 CFR 1926.62 – Construction Industry Standards for Lead.

H. OSHA, 20 CFR 1910.120 – Hazardous Waste Operations and Emergency Response.

I. OSHA, 29 CFR 1910.134 – Respiratory Protection.

J. OSHA, 29 CFR 1910.145 – Accident Prevention.

K. OSHA, 29 CFR 1910.2 – Medical Records.

L. OSHA, 29 CFR 1910.38 – Emergency/Fire Prevention Programs.

M. OSHA, 29 CFR 1910.1200 – Hazard Communication.

N. The U.S. Environmental Protection Agency (EPA), 40 CFR 260 – Hazardous Waste Management System: General.

O. EPA, 40 CFR 261 – Identification and Listing of Hazardous Waste.

P. EPA, 40 CFR 262 – Standards Applicable to Generators of Hazardous Waste.

Q. EPA, 40 CFR 263 – Standards Applicable to Transporters of Hazardous Waste.

R. The U.S. Department of Transportation (US DOT), 49 CFR 171 and 172 – Hazardous Materials Regulations.

S. National Institute for Occupational Safety and Health (NIOSH), *Certified Equipment List.*

T. NIOSH, *Occupational Exposure Sampling Strategy, 77-173*.

U. NIOSH, *Guide to Industrial Respiratory Protection, 87-116*.

V. ASTM International, *Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination E1792*, 2003, reprinted in 2016.

1.3 DEFINITIONS

A. Atomic Absorption Spectrometry (AAS): The laboratory method used to determine lead in bulk and air samples.

B. Authorized Person: Any person(s) authorized by the employer and required by work duties to be present in regulated areas.

C. Critical Barrier: One or more layers of plastic sealed over all openings into a work area(s) or any other similarly placed physical barrier sufficient to prevent airborne dust in a work area(s) from migrating into an adjacent area.

D. Competent Person (CP): The Contractor's employee who identifies lead hazards in the workplace, has the authority to promptly implement corrective measures to eliminate them, and is trained and accredited as defined in 29 CFR 1926.62. The duties of the Competent Person include but are not limited to the following activities: 1) controlling entry to and exit from the lead work area; 2) supervising any employee exposure monitoring required by the standards; 3) ensuring that all employees working within a work area wear the appropriate Personal Protective Equipment (PPE) and are trained in the use of appropriate methods of exposure control and decontamination, and 4) ensuring that engineering controls in use are functioning properly.

E. Disposal Bag: A properly labeled 6- mil thick, leak-tight polyethylene bag used for containerizing and/or transporting lead waste to the disposal site.

F. Disturbance: Activities that disturb LCP or LBP within the facility.

G. Generator: Any person or site whose processes and actions create hazardous waste per 40 CFR 260.10.

H. HEPA Filter: A High-Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97% of all mono-dispersed particles (e.g., asbestos fibers) of 0.3 microns in diameter.

I. Industrial Hygiene: An area of specialization in the field of industrial safety and health concerned with predicting, recognizing, assessing, controlling, and preventing environmental stressors in the workplace that can lead to sickness, disease, or other forms of impaired health.

J. Industrial Hygienist: A person having a college or university degree(s) in engineering, chemistry, physics, medicine, or related physical or biological sciences who, by virtue of special studies and training, has acquired competence in industrial hygiene.

K. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.

L. Lead-Based Paint (LBP): Paint or other coatings containing at least 0.5% lead by weight or 1.0 milligrams (mg) per square centimeter.

M. Lead-Containing Paint (LCP): Paint or other coatings containing concentrations of lead that are quantifiable through laboratory analysis.

N. Negative Initial Exposure Assessment (IEA): A demonstration by the employer that demonstrates employee exposure during an operation is expected to be consistently below the Permissible Exposure Limit (PEL) for representative 8-hour TWA samples.

O. Personal Monitoring: Sampling of the dust/fiber concentrations within the breathing zone of an employee.

P. Regulated Area: An area established to demarcate the areas where lead-containing dust in the air exceeds, or there is a reasonable possibility it may exceed, the PEL or other applicable industry standards for occupational exposure limits.

Q. Removal: All work operations where lead is taken out of or stripped from structures or substrates, including demolition operations.

R. Renovation: Modifying any existing structure or portion thereof.

S. Time-Weighted Average (TWA): The employee's average airborne exposure in any 8-hour work shift of a 40-hour work week which shall not be exceeded. The 8-hour TWA PEL is the level of

exposure established as the highest level of exposure an employee may be exposed to without incurring the risk of adverse health effects.

T. Toxicity: The ability of a substance to cause harmful effects. Toxic waste is harmful or fatal when ingested or absorbed (e.g., containing mercury, lead, etc.). When toxic waste is land-disposed, contaminated liquid may leach from this waste and pollute groundwater.

U. Toxicity Characteristic Leaching Procedure (TCLP): Analytical test designed to determine the mobility of both organic and inorganic analytes present in liquid, solid, and multi-phase wastes. TCLP is used to determine if a waste will be a hazardous waste as defined by 40 CFR Part 261.

V. Transporter: Hazardous waste transporters are individuals or entities that move hazardous waste from one site to another by highway, railway, water, or air per 40 CFR 260.10. This includes transporting hazardous waste from a generator's site to a facility that can recycle, treat, store, or dispose of the waste. It can also include transporting treated hazardous waste to a site for further treatment or disposal.

W. Treatment: Treatment is defined as any method, technique, or process designed to change the physical, chemical, or biological character or composition of any hazardous waste to neutralize such waste, recover energy or material resources from the waste, or render such waste non-hazardous, or less hazardous; safer to transport, store or dispose of; or amenable for recovery, amenable for storage, or reduced in volume.

X. Visible Emissions: Any emissions potentially containing particulate and/or lead-containing dust material that is visually detectable without the aid of instruments.

Y. Work Area: The area(s) where lead-related work or removal operations are performed, which is defined and/or isolated to prevent the spread of lead-containing dust or debris and entry by unauthorized personnel. The work area includes the waste load-out area.

1.4 FIELD VERIFICATION

A. The Contractor shall field-verify all new and existing dimensions affecting the work of this contract before ordering products.

1.5 CONSTRUCTION MATERIALS

A. The Government will not furnish any materials for this project.

1.6 SALVAGED MATERIALS

A. Excess salvaged materials not reinstalled in the project remain the property of the Government.

B. Stockpile material within the rooms where the materials are recovered for reuse. If more space is required, the Contractor shall coordinate storage location with the Contracting Officer.

1.7 PROJECT SUBMITTAL REQUIREMENTS

A. Health and Safety-Related Submittals:

1. The Contractor's IH will prepare submittals on behalf of the Contractor for submission to the Contracting Officer for approval. These submittals will include a Health and Safety Plan that includes a Respiratory Protection Program, Medical Surveillance Program, Accident Prevention Program, and Lead Waste Management and Disposal Plan.
2. The Contractor will submit a resume and copies of professional registrations/certifications for the Contractor's employee, who will act as the CP for the project. The CP must meet qualifications and have the training and certifications defined by OSHA.
3. The Contractor will submit copies of attendance records and certificates for each employee for all lead hazard awareness training required by this Section.
4. The Contractor will submit proof that all employees have passed the appropriate medical examinations required by OSHA for respirator use and work around lead where the AL may be exceeded.
5. The Contractor will submit copies of current physicians' written medical opinions for all employees subject to the medical surveillance requirements defined in OSHA Respiratory Protection Standards.
6. If the CP determines that respiratory protection is required, the Contractor shall submit certification that each employee was properly fitted with a personally assigned respirator.
7. The Contractor will submit certification that HEPA vacuums, HEPA-equipped negative pressure air machines, and other equipment required to contain airborne lead dust or other particulates meets American National Standards Institute (ANSI) Z9.2 79.
8. For HEPA vacuums used for LBP and LCP debris cleanup or HEPA-equipped negative pressure air machines, the Contractor shall maintain and submit copies of HEPA-filter change logs for each piece of HEPA-equipped equipment at the project site to verify timely filter changes (filters should be changed every 750 hours of use).

B. Occupational Exposure Sampling:

1. After initial exposure monitoring, the Contractor shall submit sampling results to the NPS's Contracting Officer within three working days of sample collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.
2. The Contractor shall provide documentation that:
   a. The initial air monitoring is representative of each job classification or previously collected exposure data and represents the worker's job tasks for this project.

b. The worker exposure data, including a complete description of the job tasks (such as manual demolition and manual scraping, etc.) where lead-containing coatings are present, is submitted.

C. Lead Waste Management and Disposal Plan:

1. The Contractor shall submit a Lead Waste Management and Disposal Plan that complies with applicable requirements of federal, state, and local hazardous waste regulations and shall include:
   a. Identification and classification of wastes associated with the work.
   b. Estimated quantities of wastes to be generated and disposed of.
   c. Names and qualifications of each Contractor who will be transporting, storing, treating, and disposing of the wastes.
   d. Description of the waste containment, removal, and disposal procedures. Proper temporary containment of the waste includes using acceptable leak-tight waste containers such as 55-gallon drums or other secure and covered storage areas that prevent spillage and exposure to stormwater, as well as proper marking/labeling of the containers. Waste will be cleaned up and containerized daily.
   e. Description of any site construction process, such as the use of chemical strippers or caustic agents that may alter or treat waste, rendering hazardous waste non-hazardous.

D. The Contractor is responsible for the waste profile sampling and analysis for disposal of waste streams that include building components with LCP or LBP.

1.8 POST-PROJECT SUBMITTAL REQUIREMENTS

A. After every disposal operation, provide copies of transport manifests and disposal receipts for all lead waste materials removed from the site. The Chain-Of-Custody (COC) form will include the date, address of the pickup site, name and address of the Contractor, names of persons responsible for pickup, name, and address of the disposal site, quantity and type of hazardous waste, and the type of containers used. The form will be signed by the Contractor, Contracting Officer, disposal site operator, and hauler if a private hauler is employed.

B. Closeout Report: Prepare a closeout report with the following items:

1. Description of removal and stabilization activities performed during the project.
2. Description and results of occupational and environmental sampling.
3. Description of cleanup activities.
4. Description and results of confirmatory sampling.
5. Results of waste characterization sampling.
6. COC forms for confirmatory sampling and waste characterization sampling.
7. Description of completed work, including the onsite processing of waste (if any), handling and transportation procedures, and disposal site.
8. Certificates of disposal.
9. Transport manifests.

1.9 QUALITY ASSURANCE

A. Qualifications:

1. Competent Person: The Contractor shall submit the name, address, and telephone number of the CP selected to perform the responsibilities specified in Section 1.3 Definitions, Item D, "Competent Person." Provide documentation of construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62), which shows the ability to assess occupational and environmental exposure to lead, experience with the use of respirators, PPE, and other exposure reduction methods to protect employee health. Submit proper documentation that the CP is trained and certified in accordance with federal, state, and local laws.
2. Workers/Supervisors: The Contractor shall ensure that all workers will be fully qualified and experienced in handling and disposing of lead-painted materials. Submit training certifications and proper documentation for each worker, supervisor, and CP performing LBP/LCP removal activities in accordance with federal, state, and local laws.
3. Analytical Laboratory: The Contractor and IH shall use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) that is accredited by either the American Association for Laboratory Accreditation (AALA) or the American Industrial Hygiene Association (AIHA) and is also a successful participant in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis will be OSHA-approved.
4. The Contractor's Third-Party Industrial Hygiene Consultant: The Contractor shall submit the name, address, and telephone number of a third-party industrial hygiene consultant selected to assist the Contractor with any project submittals, etc. Submit the proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the EPA-authorized state (or local) certification and accreditation program.

B. Regulatory Requirements: Develop and implement a written Environmental Control Program covering the employees, visitors, and government personnel who can potentially be exposed to hazardous materials on the project. The program must include, but not be limited to, the following elements: a list of chemicals, labels, and other forms of warning, material Safety Data Sheets (SDS), all employee information and training, procedures, chemical safety and spill response information, and subcontractor notifications.

C. All work under this contract will be performed in strict accordance with all applicable federal, state, and local regulations, standards, and codes governing lead removal and other concurrently performed trade work. The most recent edition of any relevant regulation, standard, document, or code will be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirements will be utilized. Copies of applicable standards, regulations, and codes shall be maintained in the Contractor's project records and be available for access at the worksite during the work.

PART 2 - PRODUCTS

2.1 PERSONAL PROTECTIVE EQUIPMENT

A. Respiratory Protection:

1. If required by the CP, workers shall be provided with personally issued, individually identified respirators that meet the required level of protection. If construction activities generate any airborne dust emissions, then the Contractor will utilize appropriate respirators with HEPA filter cartridges until the initial air sampling exposure assessment demonstrates that the use of the respirators is not required to protect personnel from air concentrations of lead dust. The Contractor will provide workers with and require the use of respirators approved by NIOSH for lead, in accordance with the OSHA Standard 29 CFR 1926.62. Disposable single-use respirators or dust masks are not permitted.
2. Workers must perform positive and negative air pressure fit tests each time a respirator is worn.
3. If respiratory protection is required, workers will be given a qualitative fit test in accordance with procedures detailed in OSHA 29 CFR 1926.62 for all respirators to be used. An appropriately administered quantitative fit test may be substituted for a qualitative fit test. Documentation of adequate respirator fit must be provided to the workers. Fit tests will be administered at the start of the project.
4. Persons having facial hair that may interfere with the seal of a respirator will not be allowed to use respirators.

B. Personnel Protection for Lead-Containing and Lead-Based Paints:

1. If the work generates dust and debris from LBP/LCP, disposable clothing, including head, foot, and full-body protection, shall be provided in sufficient quantities and adequate sizes for all workers and any authorized visitors. All personnel engaged in LCP and LBP demolition work that may potentially exceed the OSHA AL will wear approved disposable protective clothing constructed of spun-bonded olefin or polypropylene fabrics or other material of equivalent resistance to penetration. Disposable whole-body clothing, including head covers, gloves, and shoe coverings, will be provided to and worn by all personnel in the removal work areas. If elastic sleeve closures are not provided, sleeves will be secured with duct tape to the gloves. Washable footwear having a non-skid tracking surface will be provided and used by all personnel within the lead work area.
2. Contaminated clothing will be treated as lead waste and undergo the same disposal procedures utilized for lead waste.
3. Protective eyewear, gloves, rubber boots and/or other footwear will be provided as required for workers and authorized visitors. Safety shoes may be required for some activities.
4. Eating, drinking, smoking, chewing gum, or tobacco will not be allowed in the LCP/LBP work areas.

2.2 EQUIPMENT

A. HEPA-equipped filtration equipment:

1. Vacuum Equipment: HEPA-filtered vacuuming equipment with a filter system capable of collecting and retaining lead particulates shall be used for housekeeping during work that creates dust and debris from LBP/LCP. The filters must be 99.97% efficient for retaining particles 0.3 microns or larger.
2. Use of HEPA filters will not exceed the manufacturers' recommended machine hours (typically 600 to 900 hours). Verification of proper/timely filter changes for each piece of equipment shall be submitted to NPS in the form of a filter change log. The Contractor will use only those brands manufactured and tested for commercial purposes. No "homemade" units will be permitted. The HEPA filters will be approved by UL Method 586.

B. If utilizing rental equipment that will be impacted by or used to dispose of LCP and LBP or other lead-containing materials, notify the rental agency in writing concerning the intended use of the equipment.

2.3 PLASTIC SHEETING

A. Six mil in thickness and sized to minimize the frequency of joints.

B. Polyethylene sheeting utilized for the worker decontamination enclosure, if required by the CP, will be opaque white or black.

2.4 TAPE

A. For use in dry and wet conditions, and capable of being cleaned off surfaces without permanent marks or damage to the substratum.

2.5 CONTAINERS

A. Air and watertight, 55-gallon metal or fiberglass drums with tightly fitting lids will be used to package the waste. The Contractor will line the drum(s) with 6-mil plastic bags and label containers in accordance with the OSHA requirements and the EPA Resource Conservation and Recovery Act (RCRA) requirements. All containers will carry appropriate labels as required by OSHA, EPA, and U.S. DOT, and the Arizona Department of Transportation (ADOT). No container on the Project Site will be unlabeled as to its contents (empty or otherwise).

PART 3 - EXECUTION

3.1 DECONTAMINATION ENCLOSURE SYSTEMS

A. Worker Decontamination
   1. A hygiene facility, as described in OSHA 1926.62, must be utilized during the lead removal activities.

3.2 AIR MONITORING

A. Air samples for lead exposure will be collected by the Contractor for a minimum of the first three days that LCP/LBP work occurs. Lead air samples will be analyzed by an independent accredited laboratory on a rush basis. The purpose of air monitoring is to confirm the protection of workers at the point of operation and to confirm the effectiveness of emission controls established by the Contractor. The Contractor will prevent the contamination of areas/outside of the regulated areas with airborne lead-containing dust. Should any of the above occur, the Contractor shall:
   1. Immediately cease removal activities within the regulated areas until the fault is corrected and any contamination outside the regulated area(s) is completely remediated. Do not commence work within the original regulated area until authorized by the Contracting Officer or the Contractor's Industrial Hygienist.
   2. Complete the corrective work at no additional cost to the Government if high airborne lead-containing dust levels are identified during the Contractor's activities.

3.3 WORK PRACTICES

The following sections describe protocols for the various LCP and LBP removal tasks associated with this project.

A. Manual or power sanding or grinding of lead-coated surfaces or materials is not permitted unless the tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead is prohibited.

B. Select lead removal processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead.

C. Cleanup
   1. Ensure surfaces in the lead control area are free of accumulations of dust and debris.
   2. Restrict the spread of dust and debris; keep the waste from being distributed over the work areas.
   3. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead operations have been completed, clean the controlled area of all visible

contamination by vacuuming with a HEPA-filtered vacuum cleaner and wet mopping and wet wiping the areas.

4. Re-clean areas that show dust or debris.
5. After removing visible dust and debris, wet wipe and HEPA vacuum all surfaces in the controlled area, as applicable.
6. If adjacent areas become contaminated at any time during the work, clean and visually inspect all contaminated areas.
7. The CP will certify in writing that the areas have been cleaned of lead contamination.

3.4 DISPOSAL

A. Additional material will not be added to bags, and bags will not be reopened after they have been sealed. The lead wastes will be transported by a properly licensed transporter and disposed of at a landfill approved for lead.

B. Labels must be affixed by the Contractor to all bags, drums, or other containers containing lead waste. The label will be prominently displayed on the waste containers. All warning label print will be readily visible in large bold letter-size printed on a contrasting background. This applies only to waste that is considered hazardous waste per the waste profile.

3.5 AIR AND WATER POLLUTION CONTROL

A. The Contractor must take all necessary reasonable measures to reduce air and water pollution by any material or equipment used during construction.

B. Contractor personnel and visitors must be protected from exposure to airborne lead-containing dust.

C. Lead air or dust samples will be analyzed by AAS using a laboratory accredited by the Environmental Lead Laboratory Accreditation Program and American Industrial Hygiene Association.

D. The Contractor will not dispose of lead, coating wastes, or oils in storm or sanitary drains.

E. The Contractor will not allow lead or other waste materials to be washed into streams or bodies of water.

3.6 REPORTS

A. Prepare and submit a final closeout report at the completion of the work.

END OF SECTION 02 83 33

SECTION 02 84 16 - HANDLING OF LAMPS CONTAINING MERCURY

PART 1 GENERAL

1.1 DESCRIPTION

A. The work included in this section consists of the abatement of fluorescent light bulbs that may contain mercury to be performed during the rehabilitation of the Kawuneeche Visitors Center (KVC) at Rocky Mountain National Park (ROMO), located at 16018 US-34, Grand Lake, Colorado 80447 (Project Site). The scope items and requirements for light bulbs are described in Sections B through D below.

B. Other-Regulated Materials (ORMs) are materials that will require special handling or disposal during a renovation project, which impacts these materials. An inventory of Regulated Building Materials (RBMs), including ORMs, is contained in Landmark's *Hazardous Materials Survey Report, Kawuneeche Visitors Center, Rocky Mountain National Park, Grand Lake, Colorado, 80447. Landmark Project No. 17075.001. October 16, 2017.*

C. Regulated lighting waste identified at the Project Site includes compact light bulbs. The regulated lights included compact fluorescent bulbs. The U.S. Environmental Protection Agency (EPA) classifies bulbs containing mercury concentrations greater than or equal to 0.2 milligrams per liter (mg/l) as potentially hazardous waste. Some of the compact light bulbs identified at the Project Site are suspected of containing concentrations of mercury greater than 0.2 mg/l. Unless otherwise labeled, compact fluorescent light bulbs at the Project Site are presumed to contain mercury in concentrations greater than 0.2 mg/l and should be removed and transported for recycling.

D. The Contractor will be responsible for the cleanup and testing of any area contaminated due to Contractor negligence at no additional cost to the National Park Service (NPS).

1.2 RELATED SPECIFICATIONS

A. Section 02 81 01: Offsite Transportation and Disposal

B. Section 02 82 13: Asbestos Abatement

C. Section 02 83 33: Removal and Disposal of Materials Containing Lead

D. Section 10 81 19: Rodent and Bird Control

1.3 FIELD VERIFICATION

A. Field-verify all new and existing dimensions affecting the work of this contract before ordering products.

1.4 CONSTRUCTION MATERIALS

A. The government will not furnish any materials for this project.

1.5 SALVAGED MATERIALS

A. Excess salvaged materials not reinstalled will remain the property of the government.

B. Stockpile materials within the rooms where materials are recovered for reuse. If more space is required, coordinate storage location with the Contracting Officer.

1.6 DEFINITIONS

A. Authorized Person: Any person authorized by the employer and required by work duties to be present in regulated areas.

B. Competent Person (CP): The Contractor's employee who is capable of identifying existing asbestos and lead hazards in the workplace, who has the authority to take prompt corrective measures to eliminate them, and who is trained/accredited as defined in 29 Code of Federal Regulations (CFR) 1926.1101 and 29 CFR 1926.62. The duties of the Competent Person include, but are not limited to, the following: 1) controlling entry to and exit from the abatement work area; 2) supervising any employee exposure monitoring required by standards; 3) ensuring that all employees working within a work area wear the appropriate personal protective equipment and are trained in the use of appropriate methods of exposure control and decontamination; and 4) ensuring that engineering controls in use are functioning properly.

C. Industrial Hygiene: An area of specialization in the field of industrial safety and health that is concerned with predicting, recognizing, assessing, controlling, and preventing environmental stressors in the workplace that can lead to sickness, disease, or other forms of impaired health.

D. Industrial Hygienist (IH): A person having a college or university degree(s) in engineering, chemistry, physics, medicine, or related physical or biological sciences who, by virtue of special studies and training, has acquired competence in industrial hygiene.

E. Personal Monitoring: Sampling of contaminate concentrations within the breathing zone of an employee.

1.7 SUBMITTALS

A. As specified in Sections 1.9, 1.10, and 1.11.

B. Proof that required federal, state, and local permits have been obtained.

C. Certification that all employees have been instructed on the hazards of asbestos and lead exposure since they will be working in and near areas with known asbestos-containing materials and lead-containing materials.

D. Certification that High-Efficiency Particulate Air (HEPA) vacuums, HEPA-equipped negative pressure air machines, and other equipment required to contain airborne fibers meet American National Standards Institute (ANSI) Z9.2-79.

E. Construction schedule in sufficient detail for the Contracting Officer to determine the duration and level of effort required for the project.

F. Description of waste handling procedures. Include the name and address of the waste disposal site; name, address, and telephone number of the entity that will transport the waste; and a sample of transport manifest to be used to identify the quantity of waste removed and accepted by the disposal site.

G. After every disposal operation, provide copies of transport manifests, disposal receipts, and Chain-Of-Custody (COC) forms for all ORM waste materials removed from the Site. The COC form will include the date, address of the pickup site, name and address of the Contractor, names of persons responsible for pickup, the name and address of the disposal site, quantity of waste, and type of containers used. The form will be signed by the Contractor, the Contracting Officer, the disposal site operator, and the hauler if a private hauler is employed.

If compact light bulbs are recycled, provide copies of the shipping record and receipt for recycled materials to the Contracting Officer for review.

1.8 APPLICABLE STANDARDS AND GUIDELINES

A. All work under this contract will be performed in strict accordance with all applicable federal, state, and local regulations, standards, and codes governing universal waste removal. The most recent edition of any relevant regulation, standard, document, or code will be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirements will be utilized.

B. Applicable Publications: The publications, codes, and safety regulations listed below are part of this specification and are included for reference only. It will be the responsibility of the Contractor to observe and follow all applicable guidelines:

29 CFR 1910.145	Accident Prevention
29 CFR 1910.2	Medical Records
29 CFR 1910.38	Emergency/Fire Prevention Programs
29 CFR 1910.1200	Hazard Communication
40 CFR 61 Sub. A	General Provisions
40 CFR 61 Sub. B	EPA
49 CFR 171 And 172	Department of Transportation (DOT)
77-173 NIOSH	Occupational Exposure Sampling Strategy
76-189 NIOSH	Guide to Ind. Respiratory Protection
91-105 NIOSH	Certified Equipment List

1.9 CODES AND REGULATIONS

A. The general applicability of codes, regulations, and standards: Except to the extent that more explicit or more stringent requirements are written directly into the Contract Documents, all applicable codes, regulations, and standards have the same force and effect (and are made a part of Contract Documents by reference) as if copied directly into the Contract Documents or as if published copies are bound herewith.

B. Contractor Responsibility: The Contractor will assume full responsibility and liability for the compliance with all applicable federal, state, and local regulations pertaining to the work practices, hauling, disposal, and protection of workers, visitors at the Project Site, and persons occupying areas adjacent to the Project Site. The Contractor is responsible for providing all medical examinations and maintaining the medical records of personnel as required by the applicable federal, state, and local regulations. Copies of these records will be kept available for the Contracting Officer's review.

C. OSHA: U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) including but not limited to:
   1. Access to Employee Exposure and Medical Records: Title 29, Part 1910, Section 20 of the Code of Federal Regulations;
   2. Hazard Communication: Title 29, Part 1910, Section 1200 of the Code of Federal Regulations; and
   3. Specifications for Accident Prevention Signs and Tags: Title 29, Part 1910, Section 145 of the Code of Federal Regulations.

D. DOT: U.S. Department of Transportation, including but not limited to:
   1. Hazardous Substance: Title 49, Part 171 and 172 of the Code of Federal Regulations.

E. EPA: U.S. Environmental Protection Agency (EPA), including but not limited to:
   1. Resource Conservation and Resource Recovery Act (RCRA): Title 40, Part 231-265 of the Code of Federal Regulations.

PART 2 -PRODUCTS

2.1 EQUIPMENT

A. HEPA-equipped filtration equipment.
   1. Vacuum Equipment: HEPA-filtered vacuuming equipment equipped with a filter system capable of collecting and retaining dust/fibers. Filters will be 99.97 percent efficient for retaining fibers 0.3 microns or larger.

2.2 CONTAINERS

A. The disposal drums (if applicable) will be of metal with locking ring tops and inner 6-mil polyethylene liners.

B. Stick-on warning labels, as per EPA or OSHA requirements, will be used on all disposal drums. All drums must additionally be labeled with federal and state DOT codes.

PART 3 -EXECUTION

3.1 HOUSEKEEPING

A. Keep the Project Site neat, orderly, and in a safe condition at all times. Use wet methods and HEPA-equipped vacuums only to collect all dust, waste, debris, etc., in areas where asbestos and/or lead dust are encountered. Prohibit the use of dry sweeping or vacuuming without using HEPA-equipped vacuums.

B. Access to the work area must be restricted to "authorized persons" only. This could be accomplished by using properly demarcated critical barriers, securing adjacent access points, or installing barrier plastic sheeting and signs.

C. The Contractor will verify the locations of utilities prior to any environmental abatement and interior demolition work. The existing water, sewer, electrical, communications, and gas lines located within the boundaries of the environmental abatement work will be located, and non-essential utilities will be properly locked and tagged out at the limits of the environmental abatement or the selective planned demolition work. This work will require a qualified and licensed electrician to verify safety and proper lockout.

3.2 FIRE SAFETY

The Contractor will take the following precautions against fire:

A. The Contractor will comply fully with the requirements of federal, state, and local governments, the Owner, and the Owner's Representative, including stipulations as outlined below. The Contractor will maintain and enforce all regulations imposed and will be required to secure such protection as may be required. The Contractor is responsible for acquainting the local fire department with existing conditions.

B. The Contractor will not impede or void the essential function of emergency fire exits while performing abatement work.

C. At least one qualified person thoroughly familiar with fire protection and prevention will be on duty at all hours that the Contractor's employees are working. This person will patrol the entire work area frequently and will have the authority to take immediate remedial action to eliminate unnecessary fire hazards.

D. Building materials storage will be limited to secure areas within the building or, where stored outside, will be kept at least ten feet away from the building. Storage areas will be approved by the Contracting Officer.

E. Fire extinguishers: Maintain and provide approved fire extinguishers throughout all accessible areas. Placement, inspection, and maintenance of fire extinguishers will comply with 29 CFR

1926.130. The Contractor will provide at least one 20 ABC fire extinguisher for every 3,000 square feet of the work area, with a maximum distance of 100 feet between fire extinguishers. The Contractor will place (at a minimum) ABC fire extinguishers in the following locations:

1. Cleanroom of personnel decontamination facility.
2. Equipment room of personnel decontamination facility.
3. Within the containment, at least one extinguisher for every 3,000 square feet of the work area with a maximum distance of 100 feet between fire extinguishers.

F. Gasoline, oils, and other volatile liquids will be kept outside to be brought into the building in quantities only as needed. Such storage will be in a well-ventilated location and removed from all open heating or lighting devices. Storage areas will be approved by the NPS.

G. Electrical wiring for construction light and power will be a properly fused Ground Fault Circuit Interrupter (GFCI) installed to conform to basic code requirements and maintained under the supervision of a competent electrician. This also applies to all temporary lines that are used by the Contractor.

3.3 AIR AND WATER POLLUTION CONTROL

A. Take all necessary reasonable measures to reduce air and water pollution by any material or equipment used during construction.

A. Contractor personnel, building occupants, and visitors to the structures must be protected from exposure during all work activities.

B. Do not allow waste materials to be washed into lakes or other bodies of water.

END OF SECTION 02 84 16

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
2. Reinforcing steel.
3. Welded-wire reinforcement.
4. Form-facing material for cast-in-place concrete.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement or blended hydraulic cement alone or in combination with one or more of the following:

1. Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cementitious Materials Ratio (w/cm): The ratio by weight of mixing water to cementitious materials.

C. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

D. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.

6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Ground calcium carbonate and aggregate mineral fillers.
10. Admixtures:

    a. Include limitations of use. Admixtures that do not comply with reference ASTM International requirements must be submitted with test data for approval.
11. Each type of steel reinforcement.
12. Bar supports.
13. Mechanical splice couplers.
14. Expose surface form-facing material.
15. Form ties.
16. Form-release agent.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Compressive strength at 28 days or other age as specified.
3. Durability exposure class for Exposure Categories F, S, W, and C.
4. Maximum w/cm.
5. Slump or slump flow limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
9. Intended placement method.
10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.

C. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, tie spacing, and supports for concrete reinforcement.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.

B. Welding certificates.

1. Reinforcement to be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agents.
5. Adhesives.

D. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Ground calcium carbonate and aggregate mineral filler.
10. Admixtures.
11. Steel Reinforcement.

    a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706.

12. Mechanical splice couplers.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D1.4M.

C. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products that complies with ASTM C94 requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94 and ACI 301.

B. Steel reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When air temperature has fallen to, or is expected to fall below 40 deg F during the protection period, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE STANDARDS

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents.

1. ACI 301, “Specifications for Structural Concrete.”
2. ACI 117, “Specifications for Tolerances for Concrete Construction and Materials.”
3. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice.”
4. ACI 318, “Building Code Requirements for Structural Concrete and Commentary.”

2.2 CONCRETE MATERIALS

A. Regional Materials: Concrete shall be manufactured within 500 miles of Project site from aggregates that have been extracted, harvested, or recovered as well as manufactured, within 500 miles of Project. Site.

B. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type of admixture from single source from single manufacturer.

C. Cementitious Materials:
1. Portland Cement: ASTM C595, Type I/II or ASTM C150 Type I/II/
2. Blended Hydraulic Cement: ASTM C595, Type IL, portland-limestone cement.
3. Performance-Based Hydraulic Cement: ASTM C1157: Type GU, general use.
4. Pozzolans such as fly Ash: ASTM C618, Class C, F, or N.
5. Slag Cement: ASTM C989, Grade 100 or 120.

D. Normal-Weight Aggregates: ASTM C33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567. Do not use this option with fly ash as an alkali content greater than 4.0 percent. Submit supporting data for each aggregate showing expansion in excess of 0.1 percent when tested in accordance with ASTM C1260.
c. Alkali Content in Concrete: Not to exceed 4 lb./cu. yd. for aggregate with expansion greater than or equal to 0.04 percent and less than 0.12 percent or 3 lb./cu. yd. for aggregate with expansion greater than or equal to 0.12 percent and less than 0.24 percent. Test aggregate reactivity in accordance with ASTM C1293. Calculate alkali content of concrete in accordance with ACI 301. Do not use this option with natural pozzolan or fly ash that has a calcium oxide content greater

than 18 percent or an alkali content greater than 4.0 percent; or for an aggregate with expansion at one year greater than or equal to 0.24 percent when tested in accordance with ASTM C1293.

2. Maximum Coarse-Aggregate Size: 3/4 inch nominal unless noted otherwise on Drawings.
3. Fine Aggregate: ASTM C33..

E. Air-Entraining Admixture: ASTM C260.

F. Chemical Admixtures: Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494, Type A.
2. Retarding Admixture: ASTM C494, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494, Type G.
6. Admixtures with special properties, with documentation of claimed performance enhancement, ASTM C494, Type S.

G. Mixing Water for Concrete Mixtures and Water Used to Make Ice: ASTM C1602. Include documentation of compliance with limits for alkalis, sulfates, chlorides, or solids content of mixing water from Table 2 in ASTM C1602.

2.3 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.
b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
c. Ambient Temperature Above 85 deg F: White.

D. Curing Paper: 8-feet-wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

E. Water: Potable water that does not cause staining of the surface.

F. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.4 RELATED MATERIALS

A. Bonding Agent: ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

B. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.5 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150 portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150 portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Design concrete mixtures to provide concrete with the properties indicated on the Drawings.

C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland or hydraulic cement in concrete assigned to Exposure Class F3 as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Total of Fly Ash or Other Pozzolans, and Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
4. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.

D. Limit water-soluble, chloride ion content in hardened concrete to 0.15 percent by weight of cement

E. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94, and furnish batch ticket information.

B. Project-Site Mixing: Site mixing is acceptable if the mix design meets or exceeds the requirements listed in the Structural General Notes.

2.8 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

B. Low-Alloy Steel Reinforcing Bars: ASTM A706, deformed.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A1064, plain, fabricated from as-drawn steel wire into flat sheets.

2.9 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete as follows:

a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

C. Mechanical Splice Couplers: ACI 318 Type 1, same material of reinforcing bar being spliced.

D. Steel Tie Wire: ASTM A1064, annealed steel, not less than 0.0508 inch in diameter. Finish: plain.

2.10 FABRICATING REINFORCEMENT

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

2.11 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.12 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in section 3.6, and as follows:

a. Plywood, metal, or other approved panel materials.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

2.13 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, and initial curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.3 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in section 3.6 for as-cast finishes.

C. Limit concrete surface irregularities as follows:

1. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
3. Install keyways, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips.
2. Use strike-off templates or compacting-type screeds.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

J. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that are attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

3.5 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater, unless otherwise indicated on Drawings.
2. Stagger splices in accordance with ACI 318.
3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI “Manual of Standard Practice.”
2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.6 TOLERANCES

A. Comply with ACI 117.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Notify Contracting Officer and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Water addition in transit or at the Project site must be in accordance with ASTM C94 and must not exceed the permitted amount indicated on the concrete delivery ticket.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

3.8 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
b. Remove projections larger than 1/4 inch.
c. Patch tie holes.
d. Surface Tolerance: ACI 117 Class B.
e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to match color and texture with in-place construction exposed to view.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305R, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

   a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
   b. Continuous Sprinkling: Maintain concrete surface continuously wet.
   c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
   d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
   e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

      1) Recoat areas subject to heavy rainfall within three hours after initial application.
      2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.

3.11 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete must be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.

1. Align and secure joints to avoid offsets.
2. Do not use patched forms for exposed concrete surfaces unless approved by Contracting Officer.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Contracting Officer.
2. Remove and replace concrete that cannot be repaired and patched to Contracting Officer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks in excess of 0.01 inch, spalls, air bubbles exceeding surface finish limits, honeycombs, rock pockets, fins and other projections on the surface exceeding surface finish limits, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

a. Limit cut depth to 3/4 inch.
b. Make edges of cuts perpendicular to concrete surface.
c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
d. Fill and compact with patching mortar before bonding agent has dried.
e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Contracting Officer.

D. Repairing Unformed Surfaces:

1. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    b. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
b. Dampen cleaned concrete surfaces and apply bonding agent.
c. Place patching mortar before bonding agent has dried.
d. Compact patching mortar and finish to match adjacent concrete.
e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Contracting Officer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Contracting Officer’s approval.

3.13 FIELD QUALITY CONTROL

A. Special Inspections: Contractor will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Contractor will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing facility for initial curing of strength test specimens on-site and verifying that test specimens are cured in accordance with standard curing requirements in ASTM C31.
2. Testing agency to immediately report to Contracting Officer, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Contracting Officer, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports to include reporting requirements of ASTM C31, ASTM C39, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.
2) Name of testing agency.
3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.
8) Date and time sample was obtained.
9) Truck and batch ticket numbers.
10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results of fresh concrete, including slump or slump flow, air content, temperature and density.
13) Information on storage and curing of samples at the Project site, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at seven days and 28 days.

4. Provide a space and source of power or other resources for curing and access to test specimens by the testing agency.

C. Delivery Tickets: comply with ASTM C94.

D. Special Inspections:

1. Formwork shape, location, and dimensions.
2. Steel reinforcement placement.
3. Steel reinforcement mechanical splice couplers.
4. Steel reinforcement welding.
5. Cast-in anchors.
6. Verification of use of required design mixture.
7. Concrete placement, including conveying and depositing.
8. Curing procedures and maintenance of curing temperature.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172 to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 150 cu. yd. or fraction thereof.

   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143:

   a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests as needed.

3. Slump Flow: ASTM C1611:

   a. One test at point of delivery for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests as needed.

4. Air Content: ASTM C231 pressure method, for normal-weight concrete:

   a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064:

   a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample when strength test specimens are cast.

6. Concrete Density: ASTM C138:

a. One test for each composite sample when strength test specimens are cast.

7. Compression Test Specimens: ASTM C31:

a. Cast and cure five 6-inch by 12-inch or 4-inch by 8-inch cylindrical specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39.

a. Test one set of two standard-cured specimens at seven days and one set of two standard-cured specimens at 28 days. Hold fifth specimen for 56-day break pending results of earlier tests.
b. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard-cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Contracting Officer but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:

a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Contracting Officer.
b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Contracting Officer.

1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.7.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.14 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.

6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION 03 30 00

SECTION 04 03 10 - HISTORIC MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment work consisting of cleaning historic stone masonry surfaces.

B. Related Requirements:

1. Section 01 35 91 "Historic Treatment Procedures" for general historic treatment requirements.
2. Section 04 03 42 “Historic Stone Masonry Repair” for select areas of repair.

1.2 DEFINITIONS

A. Very Low-Pressure Spray: Less than 100 psi.

B. Low-Pressure Spray:

1. Pressure: 100 to <300 psi.
2. Flow Rate: 4 to 6 gpm.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review minutes of Preliminary Historic Treatment Conference that pertain to masonry historic treatment and cleaning.
2. Review methods and procedures related to cleaning historic masonry, including, but not limited to, the following:

a. Historic treatment specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
b. Materials, material application, and sequencing.
c. Quality-control program.
d. Cleaning program.
e. Coordination with building occupants.

1.4 SEQUENCING AND SCHEDULING

A. Work Sequence: Perform historic masonry cleaning work in the following sequence:

1. Remove plant growth.

2. Inspect masonry for open mortar joints. Where repairs are required, delay further cleaning work until after repairs are completed, cured, and dried to prevent intrusion of water and other cleaning materials into the wall.
3. Clean masonry.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include material descriptions and application instructions.
2. Include test data substantiating that products comply with requirements.

B. Qualification Data: For historic treatment specialists including field supervisors and workers.

C. Quality-control program.

D. Preconstruction Test Reports: For cleaning materials and methods.

E. Cleaning program.

1.6 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic masonry cleaning specialist having not less than ten years successful experience in comparable masonry projects. Experience cleaning new masonry work is insufficient experience for historic treatment work.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

C. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, sequence, and equipment to be used; protection of surrounding materials; and control of runoff during operations.

1. If materials and methods other than those indicated are proposed for any phase of cleaning work, add to the quality-control program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.
2. Program shall follow the Secretary of Interior Standards for Rehabilitation, Preservation Brief 1: Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings.

D. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Cleaning: Clean an area approximately 25 sq. ft. for each type of masonry and surface condition.

a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified historic treatment specialist to perform preconstruction testing on masonry surfaces.

1. Use test areas as indicated and representative of proposed materials and existing construction.
2. Propose changes to materials and methods to suit Project.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry cleaning work to be performed according to product manufacturers' written instructions and specified requirements.

B. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least seven days after completion of cleaning.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.

D. Mold, Mildew Remover, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.

2.2 ACCESSORY MATERIALS

A. Other Products: Select materials and methods of use based on the following, subject to

approval of a mockup:

1. Previous effectiveness in performing the work involved.
2. Minimal possibility of damaging exposed surfaces.
3. Consistency of each application.
4. Uniformity of the resulting overall appearance.
5. Do not use products or tools that could do the following:

    a. Remove, alter, or harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
    b. Leave residue on surfaces.

PART 3 - EXECUTION

3.1 CLEANING MASONRY, GENERAL

A. Have cleaning work performed only by qualified historic treatment specialist.

B. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet away by Contracting Officer.

C. Proceed with cleaning in an orderly manner; work from top to bottom of each wall width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.

D. Use only those cleaning methods indicated for each masonry material and location.

1. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.

    a. Equip units with pressure gauges.
    b. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
    c. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
    d. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.

E. Perform each cleaning method in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.

1. Keep wall wet below area being cleaned to prevent streaking from runoff.

F. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.

G. Water-Spray Application Methods:

1. Water-Soak Application: Soak masonry surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches from masonry surface, and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

H. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.2 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Maintain and protect lichen growth. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open masonry joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances includes caulking.

1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.

3.3 CLEANING UNPOLISHED STONEWORK

A. Cold-Water Soak:

1. Apply cold water by intermittent spraying to keep surface moist.
2. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
3. Apply water in cycles of five minutes on and 20 minutes off.
4. Continue spraying until surface encrustation has softened enough to permit its removal by water wash, as indicated by cleaning tests.
5. Remove soil and softened surface encrustation from surface with cold water applied by low-pressure spray.

B. Cold-Water Wash: Use cold water applied by very low-pressure spray unless higher pressure is approved by Contracting Officer during mock-up review.

C. Hot-Water Wash: Use hot water applied by very low-pressure spray unless higher pressure is approved by Contracting Officer during mock-up review.

D. Detergent Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Scrub surface with detergent solution using medium-soft brushes until soil is

thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.

3. Rinse with cold water applied by low-pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.

E. Mold, Mildew Removal:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply mold, mildew remover by brush or low-pressure spray.
3. Scrub surface with medium-soft brushes until mold, mildew are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
4. Rinse with cold water applied by low-pressure spray to remove mold, mildew remover and soil.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.

3.4 FINAL CLEANING

A. Rework areas designated for “Additional Cleaning” until designed effect is approved by Contracting Officer. Note: It is the intent of this project that the cleaning work achieve an overall consistency, without the appearance of spot cleaning or residual staining

B. Clean adjacent nonstone surfaces. Use detergent and soft brushes or cloths.

C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

D. Remove masking materials, leaving no residues that could trap dirt.

E. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure-wash pavement surfaces to remove mortar, dust, dirt, and stains.

F. Clean adjacent non masonry surfaces of spillage and debris. Use detergent and soft brushes or cloths.

G. Remove masking materials, leaving no residues that could trap dirt.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections. Allow inspectors use of lift devices, as needed, to perform inspections.

B. Notify inspectors in advance of times when lift devices, if any, will be relocated. Do not relocate lift devices until inspectors have had reasonable opportunity to make inspections

and observations of work areas at lift device or scaffold location.

END OF SECTION 04 03 10

SECTION 04 03 42 - HISTORIC STONE MASONRY REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment work consisting of repairing historic stone as follows:

1. Select repointing.
2. Application of new parge coat topping to masonry walls.

B. Related Requirements:

1. Section 01 35 91 "Historic Preservation Treatment Procedures" for general historic treatment requirements.
2. Section 02 41 91 "Selective Historic Demolition" for historic removal and dismantling work.
3. Section 04 03 10 “Historic Masonry Cleaning” for surface preparation before parging or repointing.

1.2 DEFINITIONS

A. Low-to-Medium Pressure Spray:

1. Pressure: <100 to <300 allowable maximum psi.
2. Flow Rate: 4 to 6 gpm.

B. Arris: The sharp edge or exterior corner formed by the meeting of two surfaces, whether planed or curved.

C. Bedding, Bed, or Bed Joint: a horizontal joint, mortared or dry laid, between two adjacent stones.

D. Capstone: the uppermost stone course at stone walls.

E. Cavity Wall: a masonry wall with face wythes of CMU and/or stone masonry which are tied with metal ties that extend through a fully grouted cavity.

F. Depth: the dimension from the exposed face of a stone to the opposite, unexposed face, within a wall, veneered or otherwise.

G. Face: the exposed major surface of the stone piece with its specified finish.

H. Face-bedded: the practice of placing the bedding plane of the stone parallel to the surface plane of the wall.

I. Head: the exposed surface of the jointed end of any given piece whose gauged dimension is not more than the minimum thickness of the material specified.

J. Height: the vertical dimension of the exposed face of a stone within a wall, veneered or otherwise.

K. Honed: dull sheen, without reflections.

L. Joint: a vertical joint, mortared or dry laid, between two adjacent stones. The end or side surface of a piece which is covered when the piece is set in place. A filled or open space extending vertically between adjacent pieces set in place.

M. Jumper: a stone that extends up through horizontal bedding planes. These stones may be square or rectangular in shape.

N. Kerf: slot cut into edge of sandstone or granite piece with saw blade for insertion of anchor.

O. Quirk Mitre: the right-angle exposure from the face of the jointed edge whose dimension is a recommended minimum of 1/4 inch. Honed finish on the quirk miter when the face is honed.

P. Rebated Kerf: additional cut that counter sinks kerf from back edge of kerf to back edge of stone piece for the purpose of additional anchor clearance. This is not a gauged cut, and if used for a bearing surface, it must be shimmed to allow for tolerance in cut.

Q. Sawn: relatively plane surface with texture ranging from wire sawn, a close approximation of rubbed finish, to shot sawn, with scorings 3/32-inch in depth. Gang saws produce parallel scorings, rotary or circular saws make circular scorings. Shot-sawn surfaces should be cleaned to remove all rust stains.

R. Seam: a crack or fissure in a rough quarry block.

S. Start: the beginning of a crack, caused by quarrying, fabrication, or handling.

T. Stone Veneer: non-structural facing of stone secured to a concrete backing and supported by mechanical fasteners attached to the backing.

U. Width: the horizontal dimension of the exposed face of a stone within a wall, veneered or otherwise.

V. Stone Terminology: ASTM C119.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference on historic masonry repair and repointing at Project site.

1. Review minutes of Preliminary Historic Treatment Conference that pertain to stone historic treatment and repair.
2. Review methods and procedures related to repairing historic stone masonry, including, but not limited to, the following:

a. Verify historic treatment specialist's personnel, equipment, and facilities

needed to make progress and avoid delays.

b. Materials, material application, sequencing, tolerances, and required clearances.
c. Quality-control program.
d. Fire-protection plan.
e. Stone historic treatment program.

1.4 SEQUENCING AND SCHEDULING

A. Order sand and gray portland cement for colored mortar immediately after approval of mockups. Take delivery of and store at Project site a sufficient quantity to complete Project.

B. Work Sequence: Perform stone historic treatment work in the following sequence, which includes work specified in this and other Sections:

1. Remove plant growth.
2. Inspect stonework for open mortar joints and permanently or temporarily point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
3. Remove paint.
4. Clean stone.
5. Rake out mortar from joints to be repointed.
6. Perform stone cutting and associated dismantling where indicated on drawings.
7. Point mortar and sealant joints.
8. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.

1.5 ACTION SUBMITTALS

A. Product Data**:** Manufacturer's product data or custom mix design for parge coat and mortar, including:

1. Binder type and proportions.
2. Aggregate source, gradation, and color.
3. Pigment data (if used).
4. Manufacturer's instructions for mixing, application, curing.

B. Shop Drawings:

1. Contractor shall submit shop drawings for all existing stone features and new construction and as indicated on the Drawings for CO approval prior to deconstruction, repair, reconstruction and installation or new construction.
2. If alternative methods and materials to those indicated are proposed for any portion of the work, submit recommendations in the shop drawings, including evidence of successful use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this project.

C. Samples for Initial Selection: For the following:

1. Mortar: Submit samples for repointing.

    a. Demonstrate materials, methods and colorants to be used for repointing existing stone repair and pointing new stone construction; samples should reflect a minimum of 3 LF of repointing and should include both vertical and horizontal joint work.
    b. New mortar color, strength, composition and texture as determined by mortar testing shall match strength characteristics of new, existing or salvaged stone to be used construction, reconstruction or repair.

D. Manufacturer's Literature and Product Data: submit manufacturer's printed instructions and data for each product; including applicable temperature ranges, technical data for each product indicated including recommendations for their application and use; including test reports and certifications substantiating that products comply with requirements.

1. Certificates: Furnish an affidavit from supplier certifying materials and products delivered meet requirements specified.
2. Joint reinforcement, anchors, and ties: Submit manufacturer's data.
3. Admixtures: Describe content, properties and recommended dosage.
4. Setting and Grouting Materials: submit separate statement or notation on package labels indicating compliance with specified requirements and suitability for intended use. Submit setting and joint sand mortar color additive for approval by Contracting Officer.

E. Construction Procedures: proposed hot and cold weather construction procedures. Description of grouting methods for cavity wall grouting and stone veneer grouting.

F. Qualification Data: For historic treatment specialist, including field supervisors and workers.

G. Preconstruction Test Reports: For existing stone types and mortar.

H. Quality-control program.

I. Stone historic treatment program.

1.6 MOCK-UPS

A. Field-Constructed Mock-Ups:

1. Prior to start of general masonry construction, prepare following field mock-ups in locations noted or where directed by Contracting Officer:

    a. Mortar color
    b. Tooling of mortar

2. Obtain Contracting Officer's acceptance of field mock-ups for visual qualities and approval of construction for each mock-up before proceeding with work.

1.7 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: Work shall be performed by a specialist having not less than ten years successful experience in comparable masonry projects (random, rustic stone) and skilled in masonry restoration processes and operations indicated. Submit a list (minimum of five) of project references to substantiate experience. Include the project name, location, client contact, a brief description of the project scope and cost, project start and completion dates and before (if available) and after photos.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising worker performance and preventing damage.

C. Stone Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of the historic treatment work, including protection of surrounding materials and Project site.

1. Include methods for keeping exposed mortar damp during curing period.
2. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add to the quality-control program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.
3. Program shall follow the Secretary of Interior Standards for Rehabilitation Preservation Brief 2: Repointing Mortar Joints in Historic Masonry Buildings.

D. Mockups: Prepare mockups of historic treatment to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.

1. Stone Repair: Prepare sample areas for each type of stone indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches in least dimension. Construct sample areas in locations in existing walls where directed by Contracting Officer unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:

   a. Patch missing or failing mortar

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Sandblasting and/or use of non-proprietary acids, alkalis, powdered or liquid, will not be permitted.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on stone masonry as follows:

1. Provide test specimens as indicated and representative of proposed materials and existing construction.
2. Existing Mortar and Parge Coat: Test according to ASTM C1324, modified as agreed by testing service and Contracting Officer for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength. Use x-ray diffraction, infrared spectroscopy, and differential thermal analysis to supplement microscopical methods. Carefully remove existing mortar for testing from within joints at five locations designated by Contracting Officer.
3. Temporary Patch: As directed by Contracting Officer, provide temporary materials followed by permanent repairs at locations from which existing samples were taken.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.

D. Store lime putty covered with water in sealed containers.

E. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit repair work to be performed according to product manufacturers' written instructions and specified requirements.

B. Temperature Limits: Repair stonework only when air temperature is between 40 and 90 deg F and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.

C. Cold-Weather Requirements: Comply with the following procedures for stone repair unless otherwise indicated:

1. When air temperature is below 40 deg F, heat mortar ingredients, repair materials, and existing stone to produce temperatures between 40 and 120 deg F.
2. When mean daily air temperature is below 40 deg F, provide enclosure and heat to

maintain temperatures above 32 deg F within the enclosure for seven days after repair.

D. Hot-Weather Requirements: Protect stonework repairs when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.

E. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Source Limitations: Obtain each type of material for repairing historic masonry (cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

B. Cutting Stone: Cut back/hidden face of stone so that, when it is set in final position, the rift or natural bedding planes match the rift orientation of existing stones.

C. Date Identification: Stamp with permanent, nonbleeding ink on a concealed, interior surface of each modified stone in easily read 1/4-inch- high characters, "MODIFIED <Insert year>."

2.2 MORTAR MATERIALS

A. Basis of Design: Match existing historic mortar in binder chemistry, aggregate color and gradation, color, texture, and joint profile. Perform trial batches as needed to achieve match.

B. Mortar Type and Proportion:

1. Mortar shall conform to ASTM C270, Type N mortar, using the proportion specification of 1 part portland cement : 1 part hydrated lime : 5 parts sand by volume.
2. Use white or gray portland cement, or blend thereof, as required to match existing color.
3. Use volumetric proportioning for field batching; do not batch by weight.

C. Portland Cement: ASTM C150/C150M, Type I or Type II; alkali content ≤0.60% per ASTM C114.

D. Hydrated Lime: ASTM C207, Type S.

E. Aggregate (Sand):

1. Natural sand matching color, gradation, and texture of existing mortar as closely as possible, including the historic higher-fines content. Gradation need not meet ASTM C144 limits where such compliance would prevent matching the existing.
2. Sand shall be sub-angular with moderate sphericity, consistent with the original mortar.
3. Blend multiple sands if necessary to achieve match.

F. Pigments: Where needed to match hardened mortar color, use ASTM C979 mineral oxide pigments, maximum 5% by weight of cementitious materials.

G. Water: ASTM C270 potable, clean, and free from deleterious substances.

H. Admixtures:

1. No admixtures except air-entraining agents when required for freeze–thaw durability and consistent with color/match. Air content to comply with ASTM C270 limits.
2. No calcium chloride or other chloride-based accelerators permitted.

2.3 PARGE COAT MATERIALS

A. Binder:

1. Portland Cement: ASTM C150/C150M, Type I or II; alkali content ≤0.60% per ASTM C114; white or gray or blend to match existing.
2. Hydrated Lime: ASTM C207, Type S.
3. Mortar Proportion: Conform to ASTM C270 Type N, proportion 1 part portland cement : 1 part hydrated lime : 5.5 parts sand by volume (per report recommendation for plaster-like application).

B. Aggregate (Sand):

1. Natural sand matching existing mortar/plaster color, gradation, and texture.
2. Gradation may vary from ASTM C144 to match historic fines content.
3. Sub-angular with moderate sphericity.
4. Washed and free of deleterious materials.

C. Pigments: ASTM C979 mineral oxide pigments, ≤5% by weight of cementitious.

D. Water: Potable, clean, free from deleterious matter.

E. Admixtures:

1. No admixtures except air-entraining agents if required for freeze–thaw resistance.
2. No calcium chloride or chloride-based accelerators.

2.4 ACCESSORY MATERIALS

A. Setting Buttons and Shims: Resilient plastic, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units, less the required depth of pointing materials

unless removed before pointing.

B. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.

C. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:

1. Previous effectiveness in performing work involved.
2. Minimal possibility of damaging exposed surfaces.
3. Consistency of each application.
4. Uniformity of the resulting overall appearance.
5. Do not use products or tools that could do the following:

a. Remove, alter, or harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
b. Leave residue on surfaces.

2.5 MORTAR MIXES

A. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix in ASTM C5 and to manufacturer's written instructions.

B. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

C. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Contracting Officer’s approval.

1. Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black, which is limited to 2 percent, unless otherwise demonstrated by a satisfactory history of performance.

D. Do not use admixtures in mortar unless otherwise indicated.

E. Mixes: Mix mortar materials in the following proportions:

1. Colored Mortar: Add mortar pigments to produce exposed, setting (rebuilding) mortar of colors required.

PART 3 - EXECUTION

3.1 PROTECTION

A. Prevent mortar from staining face of surrounding stone and other surfaces.

1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
2. Keep wall area wet below rebuilding and repair work to discourage mortar from adhering.
3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.

3.2 PREPARATION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site and surrounding buildings and all landscape and lawn areas from injury resulting from restoration work.

B. Erect temporary protection barriers at points of entrance and exit for persons which must remain in operation during course of restoration work.

C. Protect unpainted metal and wood from contact with detergent cleaners by covering them with polyethylene film and water-proof masking tape.

D. Clean surfaces as indicated in Section 04 03 10 – Historic Masonry Cleaning.

3.3 STONE REPAIR, GENERAL

A. Have repair work performed only by qualified historic treatment specialist.

B. Repair Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 20 feet away by Contracting Officer.

3.4 JOINT POINTING

A. Re-pointing Existing Masonry:

1. Rake out deteriorated mortar from joints to depths equal to two-and-one-half times their widths, but not less than 1- 1/2 inch nor less than that required to expose sound, un-weathered mortar.
2. Re-point masonry only where mortar is deteriorated, not providing a weatherproof joint or where mortar is missing.
3. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar.
4. Brush, vacuum or flush joints to remove dirt and loose debris.
5. Do not spall edges of masonry or widen joints.
6. Do not cut or otherwise damage existing masonry.
7. Replace any masonry which become damaged.
8. Cut out old deteriorated mortar by hand with chisel and mallet.
9. Power operated rotary hand saws and grinders may be permitted, but only on horizontal joints (a pneumatic chisel may be allowed on vertical joints to facilitate efficiency) and only on specific written approval of Contracting Officer based on submission by Contractor of a satisfactory quality control program and demonstrated ability of operators to use tools without damage to masonry.
10. Quality control program shall include provisions for supervising performance and

preventing damage due to worker fatigue.

11. Deteriorated mortar joints are joints which are no longer providing weather protection and/or have lost bond to masonry or by cracks which are greater than hairline, or mortar has deteriorated greater than 1/4 inch or existing mortar crumbles to touch.

3.5 PARGE COAT APPLICATION

A. PREPARATION

1. Dampen wall surfaces to SSD (saturated surface-dry) before application.
2. Remove any incompatible coatings or failing parge layers without damaging substrate.

B. APPLICATION

1. Mixing:
   a. Measure materials by volume.
   b. Use clean mechanical mixer.
   c. Combine dry materials thoroughly before adding water.
   d. Mix to a workable consistency without excess water.
2. Base/Bond Coat:
   a. Apply tight-scrubbed first coat (~1/4 inch thick) pressed into substrate to fill surface irregularities.
   b. Score or roughen surface to receive finish coat.
3. Finish Coat:
   a. Apply second coat to bring total thickness to 3/8–1/2 inch unless otherwise indicated.
   b. Float, trowel, or brush to match approved mockup texture.
4. Curing:
   a. Keep surface damp for minimum 72 hours.
   b. Protect from freezing, rapid drying, or direct precipitation during curing.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage qualified testing agencies to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

B. Contracting Officer's Project Representatives: Contracting Officer will assign Project representatives to help carry out Contracting Officer's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Contracting Officer's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.

C. Notify Contracting Officer in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until Contracting Officer has had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

3.7 STONE-WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess stone materials are Contractor's property.

B. Stone Waste: Remove stone waste and legally dispose of off Government’s property.

END OF SECTION 04 03 42

SECTION 05 12 00 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. Anchor rods.
3. Shop primer.
4. Galvanized-steel primer.
5. Etching cleaner.
6. Galvanized repair paint.
7. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
5. Identify members not to be shop primed.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Welding certificates.

C. Mill test reports for structural-steel materials, including chemical and physical properties.

D. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172). Section 2, Source Quality Control, may be waived for AISC-Certified or IAS-Accredited Fabricators if approved by the Building Official.
1. Alternate Fabricator Qualifications: A fabricator with a minimum of five years of documented experience and a record of successful performance on projects with similar materials, design, and scope to this Project. If a non-AISC-Certified or non-IAS-Accredited Fabricator is chosen for this Project, no portion of Section 2, Source Quality Assurance, shall be waived.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Contractor’s testing and inspecting agency observes repackaging and seals containers.

2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL STANDARDS

A. Comply with applicable provisions of the following unless modified by requirements in the Contract Documents:

1. ANSI/AISC 303, “Code of Standard Practice for Steel Buildings and Bridges.”
2. ANSI/AISC 360, “Specification for Structural Steel Buildings.”

2.2 PERFORMANCE REQUIREMENTS

A. Connection Design Information:

1. Connection designs have been completed and connections indicated on the Drawings.

2.3 STRUCTURAL STEEL MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Angles: ASTM A572, Grade 50 or ASTM A36.

C. Plate and Bar: ASTM A572, Grade 50 or ASTM A36.

D. Rectangular and Square Hollow Structural Sections: ASTM A500, Grade C structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.4 BOLTS AND CONNECTORS

A. High-Strength Group 120 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.

1. Finish: Plain at interior applications and Mechanically deposited zinc coating at exterior applications.

2.5 RODS

A. Unheaded Anchor Rods: ASTM F1554 Grade 36, Grade 55 with weldability supplement S1, and/or Grade 105 as indicated.

1. Configuration: Straight.
2. Nuts: ASTM A563 heavy-hex carbon steel.
3. Plate Washers: ASTM A36 carbon steel.
4. Washers: ASTM F436, Type 1, hardened carbon steel.
5. Finish: Plain at interior applications and Mechanically deposited zinc coating, ASTM B695, Class 50 at exterior applications.

B. Threaded Rods: ASTM A36.

1. Nuts: ASTM A63 hex carbon steel.
2. Washers: ASTM A36 carbon steel.
3. Finish: Plain at interior applications and Mechanically deposited zinc coating at exterior applications.

2.6 PRIMER

A. Steel Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat, unless specified otherwise in Division 9.

B. Galvanized-Steel Primer: MPI#26, MPI#80 or MPI#134 unless specified otherwise in Division 9.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: MPI#18, MPI#19, SSPC-Paint 20 or ASTM A780 unless specified otherwise in Division 9.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
1. .

B. Base Plates:

1. Provide oversize holes for anchor rods in accordance with the AISC Steel Construction Manual, Table 14-1, unless otherwise noted.
2. Plate washers are to be 3/8″ minimum thick, unless noted otherwise. Plate washers shall as a minimum completely cover the hole in the base plate. Field weld plate washers to base plates where indicated.

C. Thermal Cutting: Perform thermal cutting by machine.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard, short-slotted and/or long-slotted bolt holes perpendicular to metal surfaces as indicated.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 2.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

2.8 SHOP CONNECTIONS

A. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize mechanical screen framing attached to structural-steel frame and located in exterior walls.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Galvanized surfaces.
4. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with SSPC-SP 2 unless specified otherwise in Division 9.

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness

of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.11 SOURCE QUALITY ASSURANCE

A. Special Inspections and Tests: Contractor will engage a qualified special inspection and testing agency to perform special inspections and tests and prepare special inspection and testing reports in accordance with the quality assurance requirements in ANSI/AISC 360.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform inspections and non-destructive tests.
2. Verify structural-steel materials and inspect steel frame joint details
3. Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E165.
    b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    c. Ultrasonic Inspection: ASTM E164.
    d. Radiographic Inspection: ASTM E94.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates and Bearing Plates: Clean concrete bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate where indicated.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Do not use thermal cutting during erection unless approved by the Contracting Officer.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780.

3.6 FIELD QUALITY ASSURANCE

A. Special Inspections and Tests: Contractor will engage a qualified special inspection and testing agency to perform special inspections and tests and prepare special inspection and testing reports in accordance with the quality assurance requirements in ANSI/AISC 360.

1. Verify structural-steel materials and inspect steel frame joint details.

2. Visually inspect field-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E165/E165M.
    b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    c. Ultrasonic Inspection: ASTM E164.
    d. Radiographic Inspection: ASTM E94/E94M.

END OF SECTION 051200

SECTION 05 52 13 – PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings Type A500.

1.2 COORDINATION

A. Coordinate installation of anchorages for railings. 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. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

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

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.

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

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Sample: steel railing post, rail, picket, handrail and handrail bracket.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

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

D. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

E. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, “Structural Welding Code - Aluminum.”
2. AWS D1.6/D1.6M, “Structural Welding Code - Stainless Steel.”

B. Accessibility Inspection: See Section 3.5.A.

C. Handrail shall meet safety and structural performance criteria in IBC 1014.1, 1015.1, and 1607.8.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

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

2.2 FASTENERS

A. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Epoxy Grout: Prepackaged epoxy grout shall be prepared from a ready-to-mix epoxy bonding agent supplied by a manufacturer in kit form. Epoxy grout shall be concrete-gray in color. Epoxy grout shall have a 7-day compressive strength of not less than 4,000 psi when tested in accordance with ASTM C579.

2.4 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for dimensions, member sizes and spacing, details, finish, and anchorage.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

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

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with either welded or non-welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Non-welded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer’s standard splicing method.

J. Form Changes in Direction as Follows:

1. By bending.

K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

N. Handrail gripping surfaces shall be free of sharp or abrasive elements and shall have rounded edges.

2.5 STEEL FINISHES

A. Steel parts shall be powder coat finish to match existing adjacent paint on the exterior of the building columns.
   1. Basis of Design: RAL #8028.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

   1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

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

   1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

F. Adhere to ASTM A780 for the repair of galvanized coatings in the field. This applies to damaged elements as well as treatment of site welds.

G. Handrails shall not rotate within their fittings.

H. Clearance between handrail gripping surfaces and adjacent surfaces shall be 1 ½ inches minimum.

I. Any surfaces adjacent to handrails shall be free of sharp or abrasive elements.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Provide simple sleeved expansion joints in longitudinal railing elements per plans to accommodate thermal movements.

3.3 ANCHORING POSTS

A. Anchor posts by anchoring directly to concrete surfaces.

3.4 INSPECTIONS

A. Accessibility Inspection: Accessibility inspection shall be performed by the Contractor. Inspections shall be scheduled at the conclusion of each work sequence and in conjunction with updated construction schedules. Contractor shall utilize the National Park Service CQC Accessibility Inspection Report as basis for recording findings. Any non-compliant conditions shall be documented. Supplement Report with digital images, notation, red-line drawings, sketches and dimensions, product literature, submittal, etc. to explain installed work. Submit completed Report to CO within 24 hours of commencing inspection.

3.5 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05 52 13

SECTION 06 03 12 - HISTORIC WOOD REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment of wood in the form of repairing wood features as follows:

1. Repairing exterior wood beam, soffits, fascia, siding, and trim.
2. Repairing interior wood trim and paneling.
3. Repairing interior wood ceiling.
4. Replacing interior wood trim in kind.

B. Related Requirements:

1. Section 01 35 91 "Historic Treatment Procedures" for general historic treatment requirements.
2. Section 02 41 91 “Selective Historic Demolition” for removal of historic and non-historic adjacent materials.
3. Section 08 03 14 “Historic Treatment of Wood Doors” for repairs to existing doors to remain.
4. Section 08 03 52 "Historic Treatment of Wood Windows" for historic wood window repairs, including related trim.
5. Section 09 03 91 “Historic Treatment of Plain Painting”.
6. Section 09 91 13 “Exterior Painting” for back-priming of exterior repaired wood.
7. Section 09 91 24 “Interior Painting”.
8. Section 09 93 01 “Staining and Transparent Finishes”.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review minutes of Preliminary Historic Treatment Conference that pertain to historic wood repair.
2. Review methods and procedures related to historic wood repair, including, but not limited to, the following:
   a. Historic treatment specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Materials, material application, sequencing, tolerances, and required clearances.
   c. Fire-protection plan.
   d. Wood historic treatment program.

1.3 SEQUENCING AND SCHEDULING

A. Perform historic wood repair in the following sequence, which includes work specified in this and other Sections:

1. For wood components to be removed and repaired on-site or off-site repair, tag each component with location-identification numbers before removal. Indicate on tags and building plans the locations of each component, such as "Baseboard on North Side of Room 101."
    a. Stack units in orderly fashion with inventory list.
    b. In the field during disassembly, label each repaired component and whole or partial replacement with permanent location-identification number in inconspicuous location and remove site-applied tags.
    c. Sort units by condition, separating those that need extensive repair.
2. Clean surfaces (removed components or components in-situ).
3. General Wood-Repair Sequence:
    a. Remove paint or stain to bare wood.
    b. Repair wood by consolidation, replacement, partial replacement, and patching.
    c. Sand, prime, fill, sand again, and prime surfaces again for refinishing.
4. Reinstall components.
5. Apply finish coats.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, and sections showing locations and extent of repair and replacement work, with enlarged details of replacement parts indicating materials, profiles, joinery, reinforcing, method of splicing or attaching wood members to other surfaces, accessory items, and finishes.
2. Include field-verified dimensions and the following:
    a. Full-size shapes and profiles with complete dimensions for replacement components and their jointing, showing relationship of existing components to new components.
    b. Templates and directions for installing anchorages.
    c. Identification of each new unit and its corresponding location in the building on annotated plans and elevations.
    d. Provisions for sealant joints, flashing as required for location.

C. Samples for Verification: Actual sample of finished products for the following products in manufacturer's standard sizes unless otherwise indicated for both interior and exterior applications:

1. Replacement Wood: 12-inch- long, full-size molding sections with applied finish.
2. Repaired Wood: Prepare Samples using existing wood removed from site, repaired, and prepared for refinishing.
3. Refinished Wood: Prepare Samples using existing wood removed from site, repaired, and refinished.

D. Qualification Statements: For historic treatment specialist and wood-repair-material manufacturer.

E. Wood Historic Treatment Program and Schedule: Submit before work begins.

F. Samples for Verification: For each type of wood species to match existing.

1.5 INFORMATIONAL SUBMITTALS

A. For all wood product designated in the specification as "FSC certified," provide evidence of compliance with FSC standards as follows:

1. Demonstrate that products are FSC certified by providing vendor invoices. Invoices will contain the vendor's Chain-of-Custody (COC) number and identify each FSC certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for the on-site installation.
2. Wood products without submittal of acceptable documentation will be rejected.

1.6 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic wood-repair specialist, with a thorough understanding of the Secretary of Interiors Standards, with a minimum of ten years' experience in repairing, refinishing, and replacing historic wood in whole and in part. Experience only in fabricating and installing new woodwork is insufficient experience for wood historic treatment work.

B. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood consolidant and wood-patching compound that have been used for similar historic wood-treatment applications with successful results, and with factory-authorized service representatives who are available for consultation, Project-site inspection, and on-site assistance.

C. Wood Historic Treatment Program and Schedule: Prepare a written, detailed description of materials, finishes, methods, equipment, and sequence of operations to be used for historic treatment work, including protection of surrounding materials and Project site.

1. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.

D. Preconstruction Testing Service: Engage a qualified historic treatment specialist with minimum ten years successful experience in comparable projects to perform preconstruction testing on historic wood materials as follows:

1. Provide test specimens representative of proposed materials and existing construction.
2. Test historic treatment products and methods for effectiveness and compliance with specified requirements.

1.7 MOCK-UPS

A. Prepare mockups of historic treatment repair processes to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation. Prepare mockups so they are inconspicuous. Drawings indicate potential locations but confirm with Contracting Officer.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Pack, deliver, and store products in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products will not be deformed, broken, or otherwise damaged.

B. Until installed, store products inside a well-ventilated area and protect from weather, moisture, soiling, abrasion, extreme temperatures, and humidity, and where environmental conditions comply with manufacturer's requirements.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with historic wood repair only when existing and forecasted weather conditions are within environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS

2.1 HISTORIC WOOD REPAIR QUALITY STANDARD

A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWMAC/WI's "North American Architectural Woodwork Standards" for construction, finishes, grade rules, and other requirements unless otherwise indicated.

1. Exception: Industry practices cited in Section 12, Paragraph 6, "Industry Practices," under Article 12.1, "Basic Considerations," of AWMAC/WI's "North American Architectural Woodwork Standards" do not apply to the Work of this Section.

B. Dimension Lumber shall be locally sourced and Forest Stewardship Council (FSC) certified.

2.2 WOOD-REPLACEMENT MATERIALS

A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.

1. Species: Match species of each existing type of wood component or assembly unless otherwise indicated.

B. Exterior beam, soffits, fascia, siding, and trim:

1. Species and grade to match historic.
2. Maximum Moisture Content: 15 percent.
3. Finger Jointing: Not allowed. Join and splice to match existing.
4. Face Surface: Saw textured.
5. Trim to match existing profile; groove or kerf backs of flat trim members to match historic. Install with minimum number of joints possible when replacing trim.

C. Interior trim and paneling: Match existing species.

1. Species and grade to match historic.
2. Maximum Moisture Content: 15 percent.
3. Finger Jointing: Not allowed. Join and splice to match existing.
4. Face Surface: Saw textured.
5. Trim to match existing profile; groove or kerf backs of flat trim members to match historic. Install with minimum number of joints possible when replacing trim.

2.3 WOOD-REPAIR MATERIALS

A. Source Limitations: Obtain wood consolidant and wood-patching compound from single source from single manufacturer.

B. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated due to weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.

C. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound must be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound must be capable of filling deep holes and spreading to featheredge.

D. Limit consolidant use to repairs less than 2 sq. inches. with painted finish only. Confirm locations of consolidant wood repair with Contracting Officer.

2.4 MISCELLANEOUS MATERIALS

A. Borate Preservative Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage caused by fungi and wood-boring insects; containing no boric acid.

B. Cleaning Materials:

1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
2. Mildewcide: Commercial, proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

C. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure condition.

D. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.

1. Match existing fasteners in material and type of fastener unless otherwise indicated.
2. Use concealed fasteners for interconnecting wood components.
3. Use concealed fasteners for attaching items to other work unless exposed fasteners are unavoidable or the existing fastening method.
4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
5. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
6. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

2.5 WOOD FINISHES

A. Unfinished Replacement Units: Provide exposed exterior and interior wood surfaces of replacement units unfinished; smooth, filled, and suitably prepared for on-site priming and finishing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect adjacent materials from damage by historic wood repair.

B. At exterior wood, clean of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.

C. At interior wood, clean of mildew, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or refinishing.

D. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

E. Existing Paint, Coatings, and Varnish

1. Remove damaged or deteriorated paint to next sound layer using gentlest method possible (scraping and sanding by hand preferred).
2. T-111 Board Cladding, sanding is not recommended as unsurfaced face of boards shall be protected. To retain existing rough texture, wood stripper shall be primary means of removing paint on this material only.
3. Use with care hot-air guns on decorative wood features and electric heat plates on flat wood surfaces when paint is so deteriorated that total removal is necessary to repainting.
4. Use chemical strippers primarily to supplement other methods such as hand scraping, hand sanding, and above-recommended thermal devices. Apply wood stripper per manufacturer's recommendations.
5. Work steel wool into creases and detail recesses to work aged, darkened varnish out.
6. Repeat as necessary to remove aged varnish.

3.2 HISTORIC WOOD REPAIR, GENERAL

A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Contracting Officer from 5 ft. away for interior work and from 20 ft. away for exterior work.

B. General: In treating historic items, disturb them as minimally as possible and as follows:

1. Stabilize and repair wood to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
2. Remove coatings and apply borate preservative treatment before repair.
3. Repair items in place where possible.
4. Limit use of consolidant repair methods.
5. Back prime elements that are removed for repair or accessible in place.
6. Install temporary protective measures to protect wood-treatment work that is indicated to be completed later.

C. Mechanical Abrasion: Where mechanical abrasion is needed for the Work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods, such as sanding, wire brushing, or power tools, except as indicated as part of the historic treatment program and as approved by Contracting Officer.

D. Rehabilitate Wood: Retain as much original material as possible.

1. Unless otherwise indicated, rehabilitate wood elements.
   a. Prepare wood as described above.
   b. Assess condition for needed repair or replacement.

c. Where no repair or replacement is required, clean surface and treat for mildew.
d. Sand (unless otherwise noted) and prepare for new finish as described below.

E. Repair Wood: Match existing materials and features, retaining as much original material as possible to perform repairs.

1. Unless otherwise indicated, repair wood by patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood. Limit use of consolidant repair methods.
2. Where indicated, repair wood by limited replacement matching existing material.

F. Replace Wood: Where too deteriorated to repair, duplicate and replace units with units made from salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.

1. Do not use substitute materials unless otherwise indicated.

G. Identify removed items with numbering system corresponding to item locations, to ensure reinstallation in same location. Key items to Drawings showing location of each removed unit. Permanently label units in a location that will be concealed after reinstallation.

3.3 WOOD PATCH-TYPE REPAIR

A. General: Patch wood that exhibits depressions, holes, or similar voids, and that has limited amounts of rotted or decayed wood.

1. Verify that surfaces are sufficiently clean and free of paint residue prior to patching.
2. Treat wood with wood consolidant prior to application of patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and refuses to absorb more. Allow treatment to harden before filling void with patching compound.
3. Remove rotted or decayed wood down to sound wood.

B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom. Allow treatment to dry.

C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.

1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
2. Mix only as much patching compound as can be applied according to manufacturer's written instructions.
3. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
4. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.
5. Clean spilled compound from adjacent materials immediately.

3.4 WOOD-REPLACEMENT REPAIR

A. General: Replace parts of or entire wood items at locations where damage is too extensive to patch .

1. Remove surface-attached items from wood surface before performing wood-replacement repairs unless otherwise indicated.
2. Verify that surfaces are sufficiently clean and free of paint residue prior to repair.
3. Remove broken, rotted, and decayed wood down to sound wood.
4. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.
5. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.

B. Apply borate preservative treatment to accessible surfaces after replacements are made. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.

C. Repair remaining depressions, holes, or similar voids with patch-type repairs.

D. Clean spilled materials from adjacent surfaces immediately.

E. Reinstall items removed for repair into original locations.

3.5 ADJUSTMENT

A. Adjust existing and replacement operating items and accessories for a tight fit at contact points and for smooth operation and tight closure. Lubricate moving parts.

3.6 FINISHING

A. Touch up work specified in the Section prior to finishing.

1. Fill fastener holes with matching filler where exposed.
2. Sand smooth using fine paper.

B. Field Finishing: See Division 09 Sections for final finishing of installed exterior and interior architectural woodwork.

3.7 CLEANING AND PROTECTION

A. Protect wood surfaces from contact with contaminating substances resulting from construction operations. Monitor wood surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact wood surfaces, remove contaminants immediately.

B. Clean exposed surfaces immediately after historic wood repair. Avoid damage to coatings and finishes. Remove excess sealants, patching materials, dirt, and other substances.

END OF SECTION 06 03 12

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products
3. Wood blocking and nailers.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Engineered wood products.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

B. For all wood product designated in the specification as "FSC certified," provide evidence of compliance with FSC standards as follows:

1. Demonstrate that products are FSC certified by providing vendor invoices. Invoices will contain the vendor's Chain-of-Custody (COC) number and identify each FSC certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for the on-site installation.
2. Wood products without submittal of acceptable documentation will be rejected.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber:

1. Dimension Lumber: 19 percent unless otherwise indicated.

C. Dimension Lumber shall be locally sourced and Forest Stewardship Council (FSC) certified.

D. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 PRESERVATIVE TREATMENT

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. After treatment, redry dimension lumber to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood blocking and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills and similar concealed members in contact with concrete.

2.3 DIMENSION LUMBER FRAMING

B. All Framing: grade as indicated on the Structural General Notes.

1. Application: All framing.
2. Species: As indicated on the Structural General Notes.

C. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: As indicated on the Structural General Notes.

2.4 ENGINEERED WOOD PRODUCTS

A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

1. Extreme Fiber Stress in Bending, Edgewise: As indicated on the Structural General Notes.
2. Modulus of Elasticity, Edgewise: As indicated on the Structural General Notes.

2.5 MISCELLANEOUS MATERIALS

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.7 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.8 METAL FRAMING ANCHORS

A. Manufacturer: Provide products by the basis-of-design manufacturer, Simpson Strong-Tie Co., Inc., or an equal alternate with code-approved testing reports. Alternate products shall have equal or greater salient characteristics. Characteristics include same or greater allowable stress design capacities for the same intended use(s), and similar basic geometric properties. The contractor shall compare specified basis-of-design products using the last edition of Simpson Strong-Tie's catalog to proposed substitution products and submit to Contracting Officer for approval. Salient characteristics of Simpson Strong-Tie products specified in the drawings, to be matched with alternate products:

1. Framing Angles:

   a. A35, 18ga x 1 7/16" wide legged nailed angle, 650 lbs allowable shear

2. Joist Hangers:

   a. L90, 16ga L-shaped clip with one 2 3/8" leg and one 1 3/8" leg and 9" long, 690 lbs allowable shear

   b. HU26, 14ga U-shaped nailed hanger with 2 ¼" long seat x 1" flanges, 595 lbs allowable shear

3. Post Bases:

   a. CPT44Z, 12ga base x 3 1/2" wide x 3 1/2" long base with 1" standoff and 10ga x 5 3/4" knife plate, 600 allowable shear

B. Allowable design loads, as published by manufacturer, are to meet or exceed those of basis-of-design products. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors are to be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

   1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

   1. Use for wood-preservative-treated lumber and where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.2, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 INSTALLATION OF WALL AND PARTITION FRAMING

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

1. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

3.4 PROTECTION

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

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof sheathing.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.2 ROOF SHEATHING

A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2 sheathing.

1. Span Rating: As indicated on the Structural General Notes.
2. Nominal Thickness: As indicated on the Structural General Notes.

B. Oriented-Strand-Board Sheathing: DOC PS 2, sheathing.

1. Span Rating: As indicated on the Structural General Notes.
2. Nominal Thickness: As indicated on the Structural General Notes.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screw for Fastening Sheathing to Wood Framing: ASTM C1002.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF WOOD STRUCTURAL PANEL

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Roof Sheathing:
   a. Nail to wood framing per structural drawings.
   b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 061600

SECTION 06 20 13 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior trim.
2. Lumber siding.
3. Plywood siding.
4. Plywood soffits.
5. Lumber soffits.

1.2 DEFINITIONS

A. MDO: Plywood with a medium-density overlay on the face.

B. PVC: Polyvinyl chloride.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.

B. Wood-Preservative Treatment:

1. Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Indicate type of preservative used and net amount of preservative retained.
3. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.

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

D. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

E. Samples for Verification:

1. For each species and cut of lumber and panel products, with half of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.

1.4 INFORMATIONAL SUBMITTALS

A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.

C. Sample Warranties: For manufacturer's warranties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

1.6 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

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

C. Field Measurements: Where exterior finish carpentry is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction and indicate measurements on Shop Drawings.

D. Established Dimensions: Where exterior finish carpentry is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance

for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

B. Softwood Plywood: DOC PS 1.

C. Hardboard: ANSI A135.4.

D. All materials to be Class I ignition resistant per 2024 Wildland Urban Interface Code.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.

    a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

    a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

7. Application: All exterior lumber and plywood.

2.3 EXTERIOR TRIM

A. Lumber Trim for Opaque Finish (Painted Finish):

1. Species, Texture, and Grade to match existing.
2. Maximum Moisture Content: 19 percent.
3. Finger Jointing: Not allowed.
4. Face Surface: Smooth textured.
5. Factory Priming: Factory coated on both faces and all edges, with exterior primer compatible with topcoats specified.

B. MDO Trim: Exterior Grade B-B MDO plywood.

C. Primed Hardboard Trim: ANSI A135.6, primed with manufacturer's standard exterior primer. Recommended by manufacturer for exterior use.

2.4 LUMBER SIDING (T1-111 PLYWOOD)

A. Used at new Comfort Station fascia.

B. Provide kiln-dried lumber siding complying with DOC PS 20, factory coated with exterior primer compatible with topcoats specified.

C. Species and Grade:

1. Species and Texture to match existing.
2. Exterior Grade

D. Pattern:

1. To match existing: 5/8” thick T-111
2. Size: 4’x8’
3. Ribbing dimension: Match existing.
4. Seams: 4” on center (match existing.)

2.5 LUMBER SOFFITS

A. Provide kiln-dried lumber siding complying with DOC PS 20, factory coated with exterior primer compatible with topcoats specified.

B. Species and Grade:

1. Species, Texture, and Grade to match existing.
2. Hem-fir; NLGA, WCLIB, or WWPA Prime or D finish.

2.6 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.

1. For face-fastening siding, provide ringed-shank siding nails or hot-dip galvanized-steel siding nails.
2. For pressure-preservative-treated wood, provide hot-dip galvanized-steel fasteners.
3. For applications not otherwise indicated, provide hot-dip galvanized-steel fasteners.

B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.

C. Flashing: Comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.

2.7 FABRICATION

A. Back out or kerf backs of standing and running trim wider than 5 inches, except members with ends exposed in finished work.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.

1. Cut to required lengths and prime ends.
2. Comply with requirements in Section 09 91 13 "Exterior Painting."

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut exterior finish carpentry to fit adjoining work.
3. Refinish and seal cuts as recommended by manufacturer.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 INSTALLATION OF STANDING AND RUNNING TRIM

A. Install flat-grain lumber with bark side exposed to weather.

B. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

C. Fit exterior joints to exclude water.

1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 INSTALLATION OF SIDING

A. Install siding to comply with manufacturer's written instructions.

B. Plywood Siding:

1. Install panels with edges over framing or blocking.
2. Nail at 6 inches o.c. at panel perimeter and 12 inches o.c. at intermediate supports unless manufacturer recommends closer spacing.
3. Leave 1/16-inch gap between adjacent panels and 1/8-inch gap at perimeter,

openings, and horizontal joints unless otherwise recommended by panel manufacturer.

4. Seal butt joints at inside and outside corners and at trim locations.
5. Install continuous metal flashing at horizontal panel joints.
6. Apply battens and corner trim as indicated. Countersink nail heads, fill flush, and sand filler.
7. Conceal fasteners to greatest practical extent by countersinking and filling**,** by placing in grooves of siding pattern or by concealing with applied trim or battens as detailed.

    a. Do not nail through overlapping pieces.

C. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.

D. Finish: Apply finish within two weeks of installation.

3.6 ADJUSTING

A. Replace exterior finish carpentry that is damaged or does not comply with requirements.

1. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

B. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean exterior finish carpentry on exposed and semi exposed surfaces.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

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

END OF SECTION 06 20 13

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. New interior standing and running trim for transparent and opaque finish to match existing adjacent.
2. Plywood shelving for utility use.
3. Wood shelving for finished casework to match existing adjacent wood trim.
4. New interior door frames and jambs for transparent finish to match existing adjacent.
5. Miscellaneous materials.
6. Shop priming.

B. Related Requirements:

1. Section 06 03 12 “Historic Wood Repair”
2. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.
3. Section 09 91 24 “Interior Painting”
4. Section 09 93 01 “Staining and Transparent Finishing”

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Anchors.
2. Adhesives.
3. Shop finishing materials.

B. Shop Drawings:

1. Include the following:

a. Dimensioned plans, elevations, and sections.
b. Attachment details.

2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
4. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For each exposed product and for each shop-applied color and finish specified.

1. Size:

a. Panel Products: 12 inches by 12 inches.
b. Lumber Products: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.

D. Samples for Initial Selection: For each type of shop-applied exposed finish.

1. Size:

a. Panel Products: 12 inches by 12 inches.
b. Lumber Products: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.

E. Samples for Verification: For the following:

1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For architectural woodwork manufacturer and installer.

B. Product Certificates: For the following:

1. Composite wood products.
2. Adhesives.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
2. Installer Qualifications: Manufacturer of products and Licensed participant in AWI's Quality Certification Program.

B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

C. Lumber: Grade stamp shall contain, where applicable, symbol of grading agency, mill number or name, grade of lumber, species, rules under which graded, and condition of seasoning at time of manufacturer.

D. All work in this section to be accomplished under direct on-site supervision of thoroughly trained and experienced personnel who are completely familiar with requirements of this work and recommendations contained in reference standards.

E. Manufacturer's recommendations shall be strictly adhered to concerning both methods and materials. Where surrounding conditions or base materials are not compatible with manufacturer's recommendations, notify Contracting Officer in writing prior to bidding.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified historic treatment specialist with minimum ten years successful experience in comparable projects to perform preconstruction testing on historic wood materials as follows:

1. Provide test specimens representative of proposed materials and existing construction.
2. Test historic treatment products and methods for effectiveness and compliance with specified requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Architectural Woodwork Standards, Section 2.

B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

1.10 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction and indicate measurements on Shop Drawings.

D. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 WOODWORK, GENERAL

A. Provide FSC-certified wood products where possible.

B. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.

a. This project has been registered with AWI as AWI Quality Certification Program Number 25.0168.

2.2 NEW INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Premium.

B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.

1. Maximum Moisture Content: 19 percent.

C. Wood Species: Match existing adjacent trim in species, grade, graining, and texture.

D. Wood Finish: Transparent to match existing adjacent trim.

E. Match profile to adjacent existing trim and as indicated on drawings.

2.3 CLOSET AND UTILITY SHELVING

A. Architectural Woodwork Standards Grade: Economy.

B. Shelf Material: 3/4-inch solid lumber with rounded edges.

C. Cleats: 3/4-inch solid lumber.

D. Wood Species: Any closed-grain hardwood.

E. Wood Finish: Opaque: white.

2.4 FINISHED SHELVING

A. Architectural Woodwork Standards Grade: Premium.

B. Shelf Material: 3/4-inch solid lumber with eased exposed edges.

C. Cleats: 3/4-inch solid lumber.

D. Wood Species: Match existing adjacent trim in species, grade, graining, and texture.

E. Wood Finish: Transparent to match existing adjacent trim.

2.5 NEW INTERIOR DOOR FRAMES AND JAMBS FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Premium.

B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.

1. Maximum Moisture Content: 19 percent.

C. Wood Species: Match existing adjacent trim in species, grade, graining, and texture.

D. Wood Finish: Transparent to match existing adjacent trim.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.7 FABRICATION

A. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Ease edges to radius indicated for the following:

a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
b. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
3. Notify Contracting Officer seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.

a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.8 SHOP PRIMING

A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar

preparations for finishing interior architectural woodwork, as applicable to each unit of work.

B. Interior Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish as specified in Section 09 93 01 "Staining and Transparent Finishing."

1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Clean substrates of projections and substances detrimental to application.

C. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims.
2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

F. Standing and Running Trim:

1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity is to prepare and submit report of inspection.

3.4 REPAIR

A. Repair damaged and defective interior architectural woodwork to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.

B. Where not possible to repair, replace defective woodwork per Section 06 03 12 "Historic Wood Repair".

C. Field Finish: See Section 09 91 24 "Interior Painting" and Section 09 93 01 "Staining and Transparent Finishing" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.5 CLEANING

A. Clean interior architectural woodwork on exposed and semi exposed surfaces.

B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.6 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

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

END OF SECTION 06 40 23

SECTION 06 64 00 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plastic sheet paneling where indicated on drawings.

B. Related Requirements:
1. Section 06 10 00 "Rough Carpentry" for wood furring for installing plastic paneling.
2. Section 09 29 00 “Gypsum Board” for wall board substrate for plastic paneling.
3. Section 09 67 00 “Resilient Flooring” for rubber base.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.
1. Linen Texture.
2. Color: Shelter Cove Gray 1281 or similar from manufacturer’s standard colors.
3. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.
4. Nominal Thickness: Not less than 0.09 inch.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, and caps as needed to conceal edges.
1. Color: Match panels.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer.

E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove any materials or wall coatings that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.
   1. Mark plumb lines on substrate at panel joint locations for accurate installation.
   2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
   1. Drill oversized fastener holes in panels and center fasteners in holes.
   2. Apply sealant to fastener holes before installing fasteners.

D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mineral-wool blanket (thermal and acoustic) insulation at wall cavities.
2. Non-halogenated rigid foam board insulation at exterior frame walls.
3. Accessories, including close cell spray foam insulation for voids and penetrations.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Insulation installation schedule including, but not limited to, location of installation and R value.

C. Installer qualifications for over 10 years on commercial installations.

D. Post installation inspection report and data.

E. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. Sign, date, and post the certification in a conspicuous location on Project site.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.5 QUALITY CONTROL

A. Contractor to submit inspection report as an action submittal to CO.

PART 2 - PRODUCTS

2.1 MINERAL-WOOL BOARD INSULATION

A. Mineral-Wool Board Insulation, Type IVB: ASTM C612, Type IVB; unfaced.

1. Product suitable cavity wall and rainscreen applications.
2. Thickness: As required to meet minimum R-values indicated on drawings.
3. Flame-Spread Index: 0 when tested in accordance with ASTM E84.
4. Nominal Density: 4.3 lb/cu. ft..
5. Moisture Sorption: 0.03% by volume when tested in accordance to ASTM C1104.
6. Linear Shrinkage: 0.7% @ 1200 degrees Fahrenheit when tested in accordance with ASTM C356.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

D. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

E. Thermal-Resistance Value (R-Value): R-value as indicated on Drawings in accordance with ASTM C518.

F. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

2.3 MINERAL-WOOL BLANKET INSULATION THERMAL AND ACOUSTIC

A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

1. Flame-Spread Index: 0 when tested in accordance with ASTM E84.
2. Smoke Developed Index: 0 when tested in accordance with ASTM E84.
3. Density: >2lbs/cu. ft. when tested in accordance to ASTM C167.
4. Thickness: As required to meet minimum R-values indicated on drawings and to fully fill cavities.

2.4 NON-HALOGENATED HIGH DENSITY POLYISO:

A. High-Density Polyisocyanurate Board: ASTM C1289 Type II, Class 2, Grade 2.

1. Flame-Spread Index: <75 when tested in accordance with ASTM E84.
2. Smoke Developed Index: <200 when tested in accordance with ASTM E84.
3. Thickness: As required to meet thickness indicated on drawings.

2.5 INSULATION FASTENERS

A. Insulation Fastener Accessories: Provide double-pointed weld pins, lagging pins, quilting pins, duct liner pins, insulation hangers, specialty washers, special caps, j-hooks, capacitor discharge annular weld pins, capacitor discharge acoustical lagging pins, and other accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.

2.6 ACCESSORIES

A. Insulation for Miscellaneous Voids and continuous sealing at Admin Walls:

1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Miscellaneous Application Accessories:

1. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing

projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Mineral-Wool Board Insulation: Install insulation fasteners 4 inches from each corner of board insulation, at center of board, and as recommended by manufacturer.

1. Fit courses of insulation between obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

B. Board Insulation: Install within existing cavities in accordance with the following requirements:

1. Use insulation widths, lengths, and depths that fill the cavities formed by existing framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit

between edges of insulation and adjoining framing members.

3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

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

1. Detailing Foam Insulation for Voids: Apply in accordance with manufacturer's written instructions.

D. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation in accordance with manufacturer's written instructions.

1. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.
2. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.5 INSPECTION

A. Contractor shall commence inspection to confirm insulation installation complies with manufacturer’s installation instructions and IECC requirements for continuous insulation. Observations, measurements, and other notes shall be recorded as digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with IECC. Submit report to CO within 24 hours of commencing inspection with plan of action to remedy any items not in compliance.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building paper at exterior walls at Comfort Station fascia.
   2. Flexible flashing accessories.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Building paper at exterior walls.
   2. Flexible flashing accessories.

B. Shop Drawings: Show details of building paper at terminations, openings, and penetrations. Show details of flexible flashing applications.

C. Post inspection data and photographs for documentation of installation as per manufacturer's instructions.

PART 2 - PRODUCTS

2.1 BUILDING PAPER

A. Weather Barrier installed as air barrier (at Comfort Station fascia assembly):
   1. Air penetration resistance: <.001 cfm/sf @75 Pa when tested in accordance with ASTM E2178
   2. Water penetration resistance: 280 cm when tested in accordance with AATCC 127
   3. Water vapor transmission: 28 perms when tested in accordance with ASTM E05.
   4. Up to 9 months of allowable UV exposure.
   5. Surface burning characteristics: Class A, ASTM E84

2.2 FLEXIBLE FLASHING

A. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.040 inch.
   1. Flame Propagation Test: Materials and construction to be as tested in accordance with NFPA 285.

B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

C. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F1667.

PART 3 - EXECUTION

3.1 INSTALLATION OF BUILDING PAPER

A. Cover exposed exterior surface of sheathing with building paper securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with building paper as follows:
   1. Cut back paper 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply paper to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
   3. Tape all seams per manufacturer’s approved recommendations.

C. Installation shall be per manufacturer's approved recommendations.

3.2 INSTALLATION OF FLEXIBLE FLASHING

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
   1. Prime substrates as recommended by flashing manufacturer.
   2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
   3. Lap flashing over water-resistive barrier at bottom and sides of openings.
   4. Lap water-resistive barrier over flashing at heads of openings.
   5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.3 INSPECTION REPORT

A. Contractor shall commence inspection to confirm weather barrier installation complies with manufacturer’s installation instructions and IECC requirements for continuous barrier for existing buildings. Observations, measurements, and other notes shall be recorded as digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with IECC. Submit report to CO within 24 hours of commencing inspection with plan of action to remedy any items not in compliance.

END OF SECTION 07 25 00

SECTION 07 53 23 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ethylene-propylene-diene-terpolymer (EPDM) roofing system.
2. Accessory roofing system materials.
3. Vapor retarder.
4. Roof insulation and accessories.
5. Cover board.
6. Patching of existing EPDM roofing at new mechanical penetrations.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry for wood nailers, curbs, and blocking.
2. Section 06 16 00 "Sheathing" for wood-based, structural-use roof deck panels.
3. Section 07 21 00 “Thermal Insulation” for rigid and tapered insulation.
4. Section 07 25 00 “Weather Barriers”
5. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
6. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
7. Division 23 “Heating, Ventilation, and Air Conditioning”

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Contracting Officer testing and inspecting agency representative, Roofing System Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness

and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Contracting Officer testing and inspecting agency representative, Roofing System Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation and patching, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Shop Drawings: Include roof plans, sections, and details including the following:

1. Layout and thickness of insulation.
2. Base and sheet flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation of roof deck and orientation of roofing membrane, fastening spacings, and pattern for corner, perimeter, and field-of-roof locations.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Crickets, saddles, and tapered edge strips, including slopes.
8. Tie-in with adjoining wall system air barrier.
9. Detail at interface of adjacent roof planes.

C. Samples for Verification: For the following products:

1. Roofing membrane and flashings of color required.

D. Wind-Uplift-Resistance Submittal: For roofing system, indicating compliance with wind-uplift performance requirements.

E. Qualification Data: For roofing system Installer manufacturer.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roofing membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

a. Submit evidence of complying with specified performance requirements.

2. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Product Test Reports: For roofing membrane and insulation, tests performed by an independent qualified testing agency, indicating compliance with specified requirements.

C. Research Reports: For components of roofing system, from an agency acceptable to authorities having jurisdiction showing compliance with specified performance requirements.

D. Field quality-control reports.

E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system.

B. Certified statement from existing roofing system manufacturer stating that existing roof warranty has not been affected by the Work performed under this Section.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, certified, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

1. Protect stored liquid material from direct sunlight.
2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.

1. Store in a dry location.
2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written installation instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty to include all components of roofing system, such as roof insulation, fasteners, adhesives, cover board, roofing membrane, base flashing sheet, and other components of roofing system.
2. Warranty Period: 30 years from Date of Substantial Completion.

B. Roofing System Installer's Warranty: Submit Roofing System Installer's warranty, on warranty form at end of this Section, signed by Roofing System Installer, covering the Work of this Section, including all components of roofing system, such as vapor retarder, roof insulation, fasteners, adhesives, cover board, roofing membrane, base flashing sheet, and other components of roofing system.

1. Warranty Period: Five years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and flashings to remain watertight.

1. Accelerated Weathering: Roofing membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roofing membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test in FM Approvals 4470.

B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1 (Roof Area Field): +16 PSF
2. Zone 2 (Roof Area Perimeter): +16 PSF

a. Location: From roof edge to four feet inside roof edge.

3. Zone 3 (Roof Area Corners): +16 PSF

a. Location: four feet in each direction from each building corner.

D. Exterior Fire-Test Exposure: Class A; for application and roof slopes indicated; when tested by a qualified testing agency in accordance with ASTM E108 or UL 790.

1. Identify products with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.

1. Identify products with appropriate markings of applicable testing agency.

F. Color: As selected by Contracting Officer from manufacturer's standard colors.

1. Basis of design: To match adjacent roof coloration.

2.2 ACCESSORY ROOFING SYSTEM MATERIALS

A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Base and Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as roofing membrane.

C. Protection Sheet: As recommended in writing by roofing membrane manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

D. Asphalt-Coated, Glass-Fiber-Mat, Venting Base Sheet: ASTM D4897/D4897M, Type II; nonperforated, asphalt impregnated, fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.

E. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.

F. Patching of existing roofing: As recommended in writing by roofing membrane manufacturer to be compatible with existing EPDM system and matching in color.

G. Roof Vents: As recommended in writing by roofing membrane manufacturer.

1. Size: Not less than 4-inch diameter.

H. Bonding Adhesive: Roofing membrane manufacturer's standard, water based.

I. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

J. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

K. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.

L. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film.

M. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

N. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

O. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

P. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

Q. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing system components to substrate; tested for required pullout strength, and acceptable to roofing membrane manufacturer.

R. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.

2.3 VAPOR RETARDER

A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

2.4 ROOF INSULATION AND ACCESSORIES

A. General: Preformed roof insulation boards manufactured or approved by roofing membrane manufacturer, approved for use in FM Approvals' RoofNav listed roof assemblies.

B. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope:

a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

C. General: Roof insulation accessories as recommended in writing by insulation manufacturer for intended use and compatibility with other roofing system components.

1. Insulation Adhesive: Insulation manufacturer's standard adhesive formulated to attach roof insulation to substrate and to another insulation layer as follows:

a. Modified asphaltic, asbestos-free, cold-applied adhesive.
b. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
c. Full-spread, spray-applied, low-rise, two-component urethane adhesive.

2. Insulation Fasteners: Insulation manufacturer's standard factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover board to substrate, and acceptable to roofing system manufacturer.

2.5 COVER BOARD

A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.

B. High-Density Polyisocyanurate Cover Board: ASTM C1289 Type II, Class 4, Grade 1,

1/2 inch thick, with a minimum compressive strength of 80 psi.

C. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV degradation; type and weight as recommended in writing by roofing system manufacturer for application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Roofing System Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests in accordance with roofing system manufacturer's written instructions.

1. Submit test result within 24 hours of performing tests.

a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

D. Install sound-absorbing insulation strips in ribs of acoustical steel roof deck in accordance with roof deck manufacturer's written instructions.

3.3 INSTALLATION OF ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING SYSTEM, GENERAL

A. Install roofing system materials and components in accordance with roofing system manufacturer's written installation instructions, FM Approvals' RoofNav assembly

requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with wall system air barrier specified under Section 07 25 00 “Weather Barriers”.

D. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 INSTALLATION OF VAPOR RETARDER

A. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
2. Continuously seal side and end laps with tape.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSTALLATION OF ROOF INSULATION AND ACCESSORIES

A. Coordinate installation of roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written installation instructions. Install minimum of two layers of insulation under area of roofing to achieve required thickness.

C. Install each layer of insulation with joints staggered not less than 24 inches in adjacent rows and offset not less than 12 inches from previous layer.

1. Make joints between adjacent insulation boards not more than 1/4 inch in width.
2. Trim insulation, so that water flow is unrestricted.
3. Fill gaps exceeding 1/4 inch with insulation.
4. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
5. Secure insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

3.6 INSTALLATION OF COVER BOARD

A. Install cover board over insulation with long joints in continuous straight lines with end

joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Cut and fit cover board tight to nailers, projections, and penetrations.

3.7 INSTALLATION OF EPDM ROOFING MEMBRANE

A. Install roofing membrane over roof area for adhered application method in accordance with roofing system manufacturer's written installation instructions.

B. Unroll roofing membrane and allow it to relax before installing.

C. Start installation in presence of roofing system manufacturer's technical personnel.

D. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

E. Adhered Application: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply to splice area of roofing membrane.

1. In addition to adhering, mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roof area.

F. Adhesive Seam Installation: Clean both faces of splice areas and apply splicing cement.

1. Firmly roll side and end laps of overlapping roofing membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.
3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.

G. Tape Seam Installation: Clean and prime both faces of splice areas and apply splice tape.

1. Firmly roll side and end laps of overlapping roofing membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

H. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

1. Firmly roll side and end laps of overlapping roofing membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

I. Repair tears, voids, and lapped seams in roofing membrane that do not comply with requirements.

J. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roofing membrane in place with clamping ring.

K. Adhere protection sheet over roofing membrane at locations indicated.

3.8 INSTALLATION OF BASE AND SHEET FLASHINGS

A. General: Install and adhere base and sheet flashings and preformed flashing accessories to substrates in accordance with roofing system manufacturer's written installation instructions.

B. Apply bonding adhesive to substrate and underside of flashings at required rate and allow to partially dry. Do not apply to seam area of flashings.

C. Flash penetrations and field-formed inside and outside corners.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping flashings to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of terminations.

E. Terminate and seal top of flashings and mechanically anchor to substrate through termination bars.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, and installation of roofing membrane, flashings, protection, and drainage components, and to furnish reports to Contracting Officer.

B. Perform the following tests:

1. ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roofing membrane using ELD in accordance with ASTM D7877 and ASTM D8231.

    a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.

        1) Cost of retesting is Contractor's responsibility.

    b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.

2. Flood Testing: Flood test each roof area for leaks, in accordance with recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

    a. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches of clearance from top of base flashing.
    b. Flood each area for 48 hours.
    c. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.

1) Cost of retesting is Contractor's responsibility.

d. Testing agency to prepare survey report indicating locations initial leaks, if any, and final survey report.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Contracting Officer, and to prepare inspection report.

1. Notify Contracting Officer 48 hours in advance of date and time of inspection.

D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Contracting Officer.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 53 23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom flashing and trim fabrications, made from the following:

1. Sheet metal materials including flashings and scuppers.
2. Miscellaneous materials.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 53 23 “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing”
3. Section 07 92 00 “Joint Sealants” for sealing non-lap joints between sheet metal fabrications and adjacent construction.

C. Reference Standards

1. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.
3. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2014.
4. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
5. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Plans, elevations, sections, and attachment details.
2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Identification of material, thickness, weight, and finish for each item and location in Project.
4. Details for forming, including profiles, shapes, seams, and dimensions.
5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Details of termination points and assemblies.
7. Details of roof-penetration flashing.
8. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, counterflashings, and scuppers.
9. Details of special conditions.
10. Details of connections to adjoining work.
11. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples: For each exposed product and for each color and texture specified, 6 inches long by actual width.

D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

E. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.

1. Sheet Metal Flashing and Trim: Manufacturers' standard size. Include finished seam with required profile. Include fasteners, cleats, clips, closures, and other attachments.

F. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

G. Qualification Statements: For fabricator.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates: For each type of and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.6 MOCK-UPS

A. Provide mock-up of Lightning Protection System downlead connection at Comfort Station roof parapet. Include full-size construction demonstrating waterproofing approach of penetration.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity with similar projects/commercial installations for 15+ years that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Entity that employs a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified Architectural Metal Flashings and Accessories Installers.

C. For roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop is to be listed as able to fabricate required details as tested and approved.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch thick base metal, shop pre-coated with PVDF coating.

1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
2. Color: To match adjacent material color. Assume up to four custom colors to match adjacent finish.

2.3 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed with soft neoprene, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

C. Primer: Zinc chromate type.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight; color to match adjacent material.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.4 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

H. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

A. Overhead-Piping Safety Pans:

1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
2. Pipe and install drain line to plumbing waste or drainage system.

3.4 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

3.6 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Contracting Officer.

END OF SECTION 07 62 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Silane-modified polymer joint sealants.
5. Mildew-resistant joint sealants.
6. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Silane-modified polymer joint sealants.
5. Mildew-resistant joint sealants.
6. Latex joint sealants.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application including materials to seal, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

B. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

D. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.7 MOCKUPS

A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1. Provide mock-up at exterior drinking fountain installation. Color of sealant to

match adjacent mortar.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with concrete substrates.
4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Contracting Officer.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Contracting Officer seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
5. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

6. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.9 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.10 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: One years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Contracting Officer from manufacturer's full range to generally match the adjacent materials to be sealed.

C. Comply with South Cost Air Quality Management District (SCAQMD) Rule #1168 VOC limits.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

2.5 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C1330, or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

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

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance

with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Unglazed surfaces of ceramic tile.
    c. Solid surface countertop.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic tile.
    d. Plumbing fixtures.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for

products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide recessed joint configuration of recess depth and at locations indicated on Drawings in accordance with Figure 8C in ASTM C1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

a. Extent of Testing: Test completed and cured sealant joints as follows:

1) Perform 3 tests for the first 100 ft. of joint length for each kind of sealant and joint substrate.

2) Perform one test for each 100 ft. of joint length thereafter or one test per each floor per elevation.

b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.

1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

c. Inspect tested joints and report on the following:

1) Whether sealants filled joint cavities and are free of voids.
2) Whether sealant dimensions and configurations comply with specified requirements.
3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

C. Prepare test and inspection reports.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair

damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

SECTION 08 03 14 - HISTORIC TREATMENT OF WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Historic treatment of wood doors in the form of the following:
   a. Repairing wood doors components
   b. Replacing wood door units and components with custom-fabricated replicated units.
   c. Repairing, refinishing, and replacing hardware.

B. Related Requirements:

1. Section 01 35 91 "Historic Treatment Procedures" for general historic treatment requirements.
2. Section 06 03 12 “Historic Wood Repair” for wood jamb and trim repair.
3. Section 08 14 16 "Flush Wood Doors" for replacement wood doors or new replacement leaves not included in this Section.
4. Section 08 71 00 “Door Hardware”
5. Section 09 93 00 “Staining and Transparent Finishing” for staining of historic wood doors and frames.

1.2 DEFINITIONS

A. Door: Generally, this term includes door frame, leaves, hardware, side panels or lights, fan light, transom, storm and screen doors, and storm vestibule unless otherwise indicated by context.

B. Wood Door Component Terminology: Wood door components for historic treatment work include the following classifications:

1. Frame Components: Head, jambs, stop, and threshold or sill.
2. Leaf Components: Stiles, rails, and muntins.
3. Exterior Trim: Exterior casing, brick mold, and cornice or drip cap.
4. Interior Trim: Casing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review minutes of Preliminary Historic Treatment Conference that pertain to historic treatment of wood doors.
2. Review methods and procedures related to historic treatment of wood doors including, but not limited to, the following:
   a. Historic treatment specialist's personnel, equipment, and facilities needed to make progress and avoid delays.

b. Materials, material application, sequencing, tolerances, and required clearances.
c. Fire-protection plan.
d. Wood door historic treatment program.

1.4 SEQUENCING AND SCHEDULING

A. Perform historic treatment of wood doors in the following sequence, which includes Work specified in this and other Sections:

1. Label each door frame with permanent opening-identification number in inconspicuous location.
2. Tag existing door leaves, storm doors, storm-vestibule panels, and screen doors with opening-identification numbers and remove for on-site or off-site repair. Indicate on tags the locations of each component, such as "left-hand door leaf," "right-hand reverse door leaf," "top dutch-door leaf," "bottom dutch-door leaf," "first left-side storm-vestibule panel," and "second left-side storm-vestibule panel."
3. Remove door, dismantle hardware, and tag hardware with door opening-identification numbers.
4. In the shop, label each leaf, storm door, storm-vestibule panel, and screen door with permanent opening-identification number in inconspicuous location and remove site-applied tags.
5. Install temporary protection and security at door openings.
6. Sort units by condition, separating those that need extensive repair.
7. Clean surfaces.
8. General Wood-Repair Sequence:
   a. Remove paint to bare wood.
   b. Rack frames slightly to inject adhesive into mortise and tenon joints; square frames to proper fit before adhesive sets.
   c. If glass thicker than original is required, rout existing muntins to required rebate size.
   d. Repair wood by consolidation, member replacement, partial member replacement, and patching.
   e. Sand, prime, fill, sand again, and prime surfaces again for refinishing.
9. Repair, refinish, and replace hardware if required. Reinstall operating hardware.
10. Install glazing.
11. Remove temporary protection and security at door openings.
12. Reinstall units.
13. Apply finish coats.
14. Install remaining hardware and weather stripping.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.

B. Door Schedule: For doors, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

C. Shop Drawings: For locations and extent of wood-door repair and replacement work.

1. Include plans, elevations, sections, and details of replacement parts indicating materials, profiles, joinery, reinforcing, method of splicing into or attaching to existing wood door, accessory items, and finishes.
2. Include field-verified dimensions and the following:
   a. Full-size shapes and profiles with complete dimensions for replacement components and their jointing, showing relation of existing to new components.
   b. Templates and directions for installing hardware and anchorages.
   c. Identification of each new unit and its corresponding door locations in the building on annotated plans and elevations.
   d. Provisions for sealant joints flashing as required for location.

D. Samples for Initial Selection: For each type of exposed wood and finish.

1. Identify wood species, cut, and other features.
2. Include Samples of hardware and accessories involving color selection.

E. Historic Treatment Specialist Qualifications.

F. Wood Door Historic Treatment Program: Submit before work begins.

1.6 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic wood door specialist, with a thorough understanding of the Secretary of Interiors Standards, with a minimum of ten years' experience in in repairing, refinishing, and replacing wood doors in whole and in part. Experience only in fabricating and installing new wood doors is insufficient experience for wood-door historic treatment work.

B. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood consolidant and wood-patching compound that have been used for similar historic wood-treatment applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.

C. Wood Door Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for historic treatment work, including protection of surrounding materials and Project site.

1. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Pack, deliver, and store products in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products will not be deformed, broken, or otherwise damaged.

B. Store products inside a well-ventilated area, protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity, and where environmental conditions comply with manufacturer's requirements.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with historic treatment of wood doors only when existing and forecasted weather conditions are within environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS

2.1 HISTORIC TREATMENT OF WOOD DOORS QUALITY STANDARD

A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWMAC/WI's "North American Architectural Woodwork Standards" for construction, finishes, grades of wood doors, and other requirements unless otherwise indicated.

1. Exception: Industry practices cited in Section 12, Paragraph 6, "Industry Practices," under Article 12.1, "Basic Considerations," of AWMAC/WI's "North American Architectural Woodwork Standards" do not apply to the Work of this Section.

2.2 REPLACEMENT WOOD DOOR UNITS

A. Replacement Wood Door Units: Custom-fabricated, replicated wood door units and trim with operating and latching hardware.

1. Wood Door Components: Replace frames leaves and trim.
2. Joint Construction: Joints matching historic as indicated on drawings.
3. Wood Species: Match wood species of historic door components as indicated on drawings.
4. Wood Cut: Match cut of historic wood door components as indicated on drawings.
5. Wood Member and Trim Profiles: Match profiles and detail of historic door members and trim as indicated on drawings.
6. Hardware: Section 08 71 00 “Door Hardware”.
7. Glazing Stops: Provide replacement glazing stops coordinated with glazing system indicated.
8. Weather Stripping: Full-perimeter weather stripping for each exterior door leaf.
9. Date Identification: Emboss on a concealed surface of each replaced door frame and leaf, in easily read characters, "DOOR FRAME MADE 2022 " or "DOOR LEAF MADE 2022 ." Manufacturer's name may also be embossed.

2.3 WOOD-REPLACEMENT MATERIALS

A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.

1. Species: Match species of each existing type of wood component or assembly unless otherwise indicated.

B. Frame Heads and Jambs and Exterior Trim: Match existing species.

C. Exterior Trim: Match existing species.

D. Leaf Components: Match existing species.

E. Interior Trim: Match existing species.

F. Thresholds: As indicated on drawings.

2.4 WOOD-REPAIR MATERIALS

A. Source Limitations: Obtain wood consolidant and wood-patching compound from single source from single manufacturer.

B. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated because of weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.

C. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound to be designed for filling voids in damaged wood materials that have deteriorated because of weathering and decay. Compound to be capable of filling deep holes and spreading to feather edge.

2.5 HARDWARE

A. Per Section 08 71 00 Door Hardware.

2.6 WEATHER STRIPPING

A. Compression-Type Weather Stripping: Compressible weather stripping designed for permanently resilient sealing under bumper or wiper action; completely concealed when door is closed.

1. Weather-Stripping Material: Match existing materials and profiles as much as possible unless otherwise indicated.
   a. Cellular Elastomeric Gaskets: Preformed; complying with ASTM C509.
   b. Dense Elastomeric Gaskets: Preformed; complying with ASTM C864.

2.7 MISCELLANEOUS MATERIALS

A. Cleaning Materials:

1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate, 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
2. Mildewcide: Commercial, proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

B. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure conditions.

C. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.

1. Match existing fasteners in material and type of fastener unless otherwise indicated.
2. Use concealed fasteners for interconnecting wood components.
3. Use concealed fasteners for attaching items to other work unless exposed fasteners are unavoidable or the existing fastening method.
4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
5. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
6. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

D. Anchors, Clips, and Accessories: Fabricate anchors, clips, and door accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel complying with requirements in ASTM B633 for SC 3 (Severe) service condition.

2.8 WOOD DOOR FINISHES

A. Unfinished Replacement Units: Provide exposed exterior and interior wood surfaces of replacement units unfinished; smooth, filled, and suitably prepared for on-site priming and finishing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect adjacent materials from damage by historic treatment of wood doors.

B. Clean wood doors and trim of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.

C. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.2 HISTORIC TREATMENT OF WOOD DOORS, GENERAL

A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Contracting Officer from the door interior at 5 ft. away and from the door exterior at 20 ft. away.

B. General: In treating historic items, disturb them as minimally as possible and as follows:

1. Stabilize and repair wood doors to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
2. Repair items in place where possible.
3. Install temporary protective measures to protect wood door work that is indicated to be completed later.

C. Mechanical Abrasion: Where mechanical abrasion is needed for the Work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods such as sanding, wire brushing, or power tools except as indicated as part of the historic treatment program and as approved by Contracting Officer.

D. Repair and Refinish Existing Hardware: Dismantle door hardware; strip paint, repair, and refinish it to match finish Samples; and lubricate moving parts just enough to function smoothly.

E. Repair Wood Doors: Match existing materials and features, retaining as much original material as possible to perform repairs.

1. Unless otherwise indicated, repair wood doors by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
2. Where indicated, repair wood doors by limited replacement matching existing material.

F. Replace Wood Units: Where indicated, duplicate and replace units with units made from salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.

1. Do not use substitute materials unless otherwise indicated.
2. Compatible substitute materials may be used.

G. Protection of Openings: Where doors are indicated for removal, cover resultant openings with temporary enclosures so that openings are weathertight during repair period.

H. Identify removed doors, frames, leaves, trim, and members with numbering system corresponding to door locations to ensure reinstallation in same location. Key doors, frames, leaves, trim, and members to Drawings showing location of each removed unit. Permanently label units in a location that will be concealed after reinstallation.

3.3 WOOD DOOR PATCH-TYPE REPAIR

A. General: Patch wood members that exhibit depressions, holes, or similar voids and that have limited amounts of rotted or decayed wood.

1. Remove leaves storm doors from door frames before performing patch-type repairs at meeting or sliding surfaces unless otherwise indicated.
2. Verify that surfaces are sufficiently clean and free of paint residue before patching.
3. Treat wood members with wood consolidant before applying patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and unable to absorb more. Allow treatment to harden before filling void with patching compound.
4. Remove rotted or decayed wood down to sound wood.

B. Apply borate preservative treatment to accessible surfaces either before applying wood consolidant or after removing rotted or decayed wood. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom. Allow treatment to dry.

C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.

1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
2. Mix only as much patching compound as can be applied in accordance with manufacturer's written instructions.
3. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
4. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.
5. Clean spilled compound from adjacent materials immediately.

3.4 WOOD DOOR MEMBER-REPLACEMENT REPAIR

A. General: Replace parts of or entire wood door members at locations where damage is too extensive to patch .

1. Remove leaves storm doors from door frames before performing member-replacement repairs unless otherwise indicated.
2. Verify that surfaces are sufficiently clean and free of paint residue before repair.
3. Remove broken, rotted, and decayed wood down to sound wood.
4. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.
5. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.

B. Apply borate preservative treatment to accessible surfaces after replacements are made. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.

C. Repair remaining depressions, holes, or similar voids with patch-type repairs.

D. Clean spilled materials from adjacent surfaces immediately.

E. Reinstall units removed for repair into original openings.

F. Weather Stripping: Replace nonfunctioning and install missing weather stripping to ensure full-perimeter weather stripping for each exterior leaf.

3.5 WOOD DOOR UNIT REPLACEMENT

A. General: Replace existing wood door-frame leaf trim units with new custom-fabricated replicated units at locations indicated in the Historic Wood Door Schedule and where damage is too extensive to repair .

B. Apply borate preservative treatment to accessible surfaces before finishing. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.

C. Install units, hardware, weather stripping, accessories, and other components as indicated on Drawings.

D. Install units level, plumb, square, true to line, without distortion or impeding movement, anchored securely in place to structural support, and in proper relation to wall flashing, trim, and other adjacent construction.

E. Set threshold or sill members in bed of sealant for weathertight construction unless otherwise indicated.

F. Install door units with new anchors into existing openings.

G. Install full-perimeter weather stripping for each operable exterior leaf.

H. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

I. Disposal of Removed Units: Remove from Park property and legally dispose of them.

3.6 INSTALLATION OF WEATHER STRIPPING

A. Install weather stripping for tight seal of joints.

3.7 ADJUSTING

A. Adjust existing and replacement operating leaves, screens, hardware, weather stripping, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.8 INSPECTION

A. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

3.9 CLEANING AND PROTECTION

A. Protect door surfaces from contact with contaminating substances resulting from construction operations. Monitor door surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact door surfaces, remove contaminants immediately.

B. Clean exposed surfaces immediately after historic treatment of wood doors. Avoid damage to coatings and finishes. Remove excess sealants, glazing and patching materials, dirt, and other substances.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 03 14

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior standard insulated steel doors and frames.

B. Related Requirements:

1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.
2. Section 09 91 14 “Exterior Painting” for door and frame finish.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Exterior standard steel doors and frames.

B. Product Data Submittals: For each product.

C. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Field quality-control reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvested plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.37 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.

2.2 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard-Duty Doors and Frames: ANSI/SDI A250.8, Level 1; ANSI/SDI A250.4, Level C. At locations indicated in the Door and Frame Schedule on Drawings.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule on Drawings.
   b. Thickness: 1-3/4 inches.
   c. Face: Uncoated steel sheet, minimum thickness of 0.032 inch.
   d. Edge Construction: Model 1, Full Flush.
   e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
   f. Core: Manufacturer's standard.

2. Frames:

   a. Materials: Uncoated steel sheet, minimum thickness of 0.042 inch.
   b. Construction: Knocked down.

3. Exposed Finish: Prime.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Post installed Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.4 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

2.5 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer

complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Solidly pack mineral-fiber insulation inside frames.
4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Contracting Officer.

B. Inspections:

1. Egress Door Inspections: Inspect each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
2. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.

C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish in accordance with manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core flush wood doors.
2. Solid-core wood doors with louver(s).
3. Solid-core wood doors with vision lite.

1.2 REFERENCE SECTIONS

A. Section 08 03 14 “Historic Treatment of Wood Doors”.

B. Section 08 80 00 “Glazing”.

C. Section 08 71 00 “Door Hardware”.

D. Section 08 71 13 “Power Door Operators”.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Solid-core five-ply flush wood veneer-faced doors for transparent finish.

B. Product Data Submittals: For each product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory- finishing specifications.

C. Sustainable Design Submittals:

1. Third-Party Certifications: For each product.

2. Third-Party Certified Life Cycle Assessment: For each product.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.

D. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Dimensions and locations of blocking for hardware attachment.
4. Dimensions and locations of mortises and holes for hardware.
5. Clearances and undercuts.
6. Doors to be factory finished and application requirements.
7. Apply AWI Quality Certification Program label to Shop Drawings.

E. Samples for Initial Selection: For factory-finished doors.

F. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Quality Standard Compliance Certificates: AWI Quality Certification certificates.

1.7 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies complies with qualifications set forth in NFPA 101, Section 7.2.1.15.4.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.
2. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

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

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.

2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Provide labels, and from AWI certification program indicating that doors with

requirements of grades specified.

a. Design intent for wood species is to match existing glulam beams and exposed roof deck.
b. Contractor registers the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 855-345-0991.

2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.3 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.4 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors to receive transparent finish.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Premium.

a. System-5, Varnish, Conversion.
b. System-9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
c. System-10, UV Curable, Water Based.

d. System-11, Polyurethane, Catalyzed.

2. ANSI/WDMA I.S. 1A Grade: Premium.

a. TR-4 Conversion Varnish.
b. TR-6 Catalyzed Polyurethane.
c. TR-8 UV Cured Acrylated Polyester/Urethane.

3. Staining: None required.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors, with Installer present, before hanging doors.

1. Verify swing characteristics have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Contracting Officer.

B. Inspections:

1. Provide inspection of installed Work through AWI's Quality Certification Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
2. Egress Door Inspections: Inspect each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
3. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24

hours of commencing inspection.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames at gypsum board ceilings.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry"
2. Section 09 29 00 “Gypsum Board”
3. Section 09 91 24 "Interior Painting"
4. Division 21 “Fire Suppression”
5. Division 23 “Heating, Ventilation, and Air Conditioning”
6. Division 26 “Electrical and Lighting”

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

C. Product Schedule: For access doors and frames.

D. Shop drawing: For Equipment Platform access door showing full coordination with adjacent structural elements (including but not limited to roof trusses and platform floor joists).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Flush Access Doors with Concealed Flanges:

1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
2. Latch and Lock: Cam latch, hex-head wrench operated with interior release
3. Frame Material: Same material and thickness as door
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed

a. Interior finish to match adjacent ceiling.

5. Door sizes: 12”x 24” unless otherwise indicated on drawings.
6. Locations: Interior Gypsum Board Ceiling
7. Optional Features: Piano hinges

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

E. Stainless Steel Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

F. Aluminum Extrusions: ASTM B221, Alloy 6063.

G. Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

H. Frame Anchors: Same material as door face.

I. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied

finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

E. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for 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. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum windows for base scope of work replacement at Admin Wing and select Exhibit windows.

B. Related Sections:

1. Section 07 92 00 “Joint Sealants”.
2. Section 08 80 00 “Glazing”.
3. Section 12 20 00 “Window Treatments”.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.

B. Shop Drawings:

1. Plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of

available colors to match existing finish.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish:

1. Exposed Aluminum Finishes: Manufacturers' standard size.
2. Exposed Hardware: Full-size units.

E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

F. Mock ups.

1.4 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each aluminum window, for tests performed by qualified testing agency.

B. Field Quality-Control Reports: For aluminum windows.

C. Qualification Statements: For manufacturer and Installer.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Warranty Documentation:

1. Manufacturers' special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: Authorized representative who is trained and approved by aluminum window manufacturer.

C. Testing Agency Qualifications: An FGIA-accredited testing agency for testing indicated.

D. Mock-up: As indicated on drawings to show quality of window installation, relationships to existing building elements, waterproofing, etc.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum windows to Project site in original, unopened packages and store them in accordance with manufacturer's written instructions. Protect aluminum windows against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle aluminum windows in a manner that prevents damage before, during, and after installation.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install aluminum windows outside of limits recommended in writing by manufacturer.

B. Field Measurements: Verify unit locations and existing measurements of steel windows being removed (including but not limited to sash, frame, head, sill, jamb dimensions, rough opening). Verify actual dimensions of openings and adjacent construction by field measurements before fabrication and indicate on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

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

   a. Failure to meet performance requirements.
   b. Structural failures, including excessive deflection, water leakage, condensation, and air infiltration.
   c. Faulty operation of movable sash and hardware.
   d. Deterioration of materials and finishes beyond normal weathering.
   e. Failure of insulating glass.

2. Warranty Period:

   a. Window: 10 years from date of Substantial Completion.
   b. Glazing Units: 10 years from date of Substantial Completion.
   c. Hardware: Three years from date of Substantial Completion.
   d. Aluminum Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain aluminum windows from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: FGIA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: CW.
2. Minimum Performance Grade: 30.

C. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:

a. Operable Windows: Not more than 0.36 Btu/sq. ft. x h x deg F.

2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200:

a. Operable Windows: Not more than .43 as determined in accordance with NFRC 200.

3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance in accordance with AAMA 1503, showing a CRF of 52.

D. Thermal Movements: Provide aluminum windows, including anchorage, which allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces

E. Outdoor-Indoor Transmission Class (OITC): Rated for not less than 22 OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

2.3 ACCESSORIES

A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

C. Panning Trim: Profiles in sizes and configurations indicated on Drawings.

D. Nail Fins: Manufacturer's standard mounting flanges with holes pre-punched for mechanical fasteners.

2.4 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Half, outside for sliding sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

C. Glass-Fiber Mesh Fabric: 20-by-20 or 20-by-30 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.

1. Mesh Color: As selected by Contracting Officer from manufacturer's standard colors.

2.5 FABRICATION

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

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Window Assemblies: Provide window units in configuration indicated on Drawings. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, accessible, and weathertight installation, including the following:

1. Combination and reinforcing mullions with interior and exterior trim.
2. Interior and exterior extension and trim.
3. Exterior head and sill casings and trim.
4. ABAAS compliant hardware.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500 "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2604 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Contracting Officer from manufacturer's full range to match existing windows to be removed. BOD: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, air and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows for smooth operation and forces allowable by ABAAS.

D. Install windows and components to drain water passing joints and condensation to the exterior.

E. Separate aluminum from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspection of installed windows as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance in accordance with AAMA 502.
2. Air-Infiltration Testing:

   a. Test Pressure: As required to determine compliance in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for performance class indicated.
   b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

   a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
   b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: One window(s) of each type as selected by Contracting Officer and a qualified independent testing and inspecting agency. Windows will be tested at 5, 50, and 90 percent completion.
5. Test Reports: Prepared in accordance with AAMA 502.

C. Tests and Inspections:

1. Windows will be considered defective if they do not pass tests and inspections.
2. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

3.5 CLEANING AND PROTECTION

A. Clean exposed surfaces immediately after installing windows using manufacturer's written instructions. Avoid damaging finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 08 51 13

SECTION 08 51 23.13 - HOT-ROLLED STEEL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Option 01: Hot-rolled steel windows at Admin Wing.

B. Related Requirements:

1. Section 01 27 00 “Contract Line Items”.
2. Section 07 92 00 “Joint Sealants”.
3. Section 08 80 00 “Glazing”.
4. Section 12 20 00 “Window Treatments”.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements for hot-rolled steel windows, including, but not limited to, the following:

a. Coordinating finishing of hot-rolled steel windows with other work where color and finish matching is indicated.
b. Coordinating hot-rolled steel windows with other exterior wall components, including anchorage, glazing, flashing, weeping, air barriers, sealants, and protection of finishes.
c. Sequencing work to construct a watertight and weathertight exterior building enclosure.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. Shop Drawings:

1. Plans, elevations, sections, and details.
2. Detail attachments to other work, and between units, if any.
3. Hardware and required clearances.
4. Mullion details, including reinforcement and stiffeners.
5. Flashing details.

6. Glazing details.
7. Accessories.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for units with factory-applied color finishes.

1. Include available color or finish selections for hardware and accessories.

D. Samples for Verification: Actual sample of finished products for each type of hot-rolled steel window including weather stripping, glazing bead, and hardware.

1. Size: Manufacturers' standard size.

E. Product Schedule: For hot-rolled steel windows. Use same designations indicated on Drawings.

F. Mock-ups: one window unit installed into the existing opening in order to observe the relationship of the window to the plane of the wall. Include all waterproofing and trim (interior and exterior).

1.4 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each hot-rolled steel window, for tests performed by a qualified testing agency.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

C. Qualification Statements: For Installer manufacturer.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For hot-rolled steel windows.

B. Warranty Documentation:

1. Manufacturers' special warranties.
2. Installer's special warranties.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: A manufacturer capable of fabricating hot-rolled steel windows

that meet performance requirements indicated and of documenting performance by labels, test reports, and calculations.

2. Installers: Fabricator of products Entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mock-up: As indicated on drawings to show quality of window installation, relationships to existing building elements, waterproofing, etc.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify unit locations and existing measurements of steel windows being removed (including but not limited to sash, frame, head, sill, jamb dimensions, rough opening). Verify actual dimensions of openings and adjacent construction by field measurements before fabrication and indicate on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of hot-rolled steel windows that fail in materials or workmanship within specified warranty period.

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

a. Structural failures.
b. Faulty operation of sash or hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period:

a. Window: 20 years from date of Substantial Completion.
b. Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. SWI Standards: Comply with applicable requirements in SWI's "Architect's Guide to Steel Windows and Doors" and "Specifications - Solid Hot Rolled Sections," except where more stringent requirements are indicated.

B. Structural Wind Loads: As indicated on Drawings.

C. Deflection Limits: Design glass framing system to limit deflection of glass edges in a direction perpendicular to glass plane to less than 1/175 of glass-edge length for each individual glazing light or 3/4 inch, whichever is less, at design pressures.

D. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, hot-rolled steel windows do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding .2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Air Leakage for Weather-Stripped Sash: Not more than 0.37 cfm/ft. of sash crack length at a differential pressure across the windows of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283/E283M.

F. Air Leakage for Non-Weather-Stripped Sash: Not more than 1.0 cfm/ft. of sash crack length at a differential pressure across the windows of 1.56 lbf/sq. ft. when tested in accordance with ASTM E283/E283M.

G. Water Penetration for Weather-Stripped Sash: No leakage for 15 minutes when window is subjected to a rate of flow of 5 gal./h/sq. ft. with a differential pressure across the window of 2.86 lbf/sq. ft. when tested in accordance with ASTM E331.

H. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.36 Btu/sq. ft. x h x deg F.

I. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.43.

J. Condensation Resistance: Provide hot-rolled steel windows with a CR of 52 minimum, determined in accordance with NFRC 500.

K. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

L. Crack Tolerances: Test each type and size of required window unit, with sash closed and locked, for compliance with tolerances indicated in SWI's "Architect's Guide to Steel Windows and Doors" and "Specifications - Solid Hot Rolled Sections."

M. Fire-Test-Response Characteristics: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

2.2 GLAZING

A. Glass and Glazing System: See Section 08 80 00 "Glazing" for glass units and glazing requirements for hot-rolled steel windows.

2.3 HARDWARE

A. General: Provide manufacturer's standard, solid-bronze hardware, with operating

components of stainless steel, carbon steel complying with AAMA 907, brass, bronze, or other corrosion-resistant material designed to smoothly operate, tightly close, and securely lock hot-rolled steel window sash; and sized to accommodate sash weight and dimensions. Hardware and operation shall meet requirements of ABAAS.

2.4 ACCESSORIES

A. Fasteners: Provide fasteners of bronze, brass, stainless steel, or other metal that are warranted by manufacturer to be noncorrosive and compatible with trim, hardware, anchors, and other components of hot-rolled steel windows.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

B. Anchors, Clips, and Window Accessories: Provide units of stainless steel, hot-dip zinc-coated steel, bronze, brass, or iron complying with ASTM A123/A123M. Provide units with sufficient strength to withstand design pressure indicated.

C. Sealant: For sealants required within fabricated windows, provide manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.5 FABRICATION

A. Fabricate hot-rolled steel windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.

B. Provide units that are reglazable without dismantling framing.

C. Prepare windows for site glazing.

D. Subframes and Operable Sash: Formed of hot-rolled steel of profile indicated. Miter or cope corners, and weld and dress joints smooth.

E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

F. Provide weep holes and internal water passages to conduct infiltrating water to the exterior.

2.6 STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and

thermosetting topcoat to a minimum dry film thickness of 2 mils.

1. Color: black

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough-opening dimensions, levelness of sill plate, and clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF HOT-ROLLED STEEL WINDOWS

A. SWI Publication: Comply with applicable requirements in SWI's "Guidelines on How to Install Steel Windows," except where more stringent requirements are indicated.

B. Comply with manufacturer's written instructions for installing windows, hardware, operators, accessories, and other components.

C. Install windows level, plumb, square, true to line, without distortion or impediment to thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

D. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

E. Install windows and components to drain condensation, water-penetrating joints, and moisture migrating within windows to the exterior.

F. Separate corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E2112.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Test windows for air leakage and water penetration in accordance with AAMA 502, Test Method A, by applying same test pressures required for performance.

2. Testing Extent: Three as selected by Contracting Officer and a qualified independent testing and inspecting agency. Test windows immediately after installation.
3. Window will be considered defective if it does not pass tests and inspections.
4. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

C. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts as recommended in writing by manufacturer.

B. Clean factory-finished steel surfaces immediately after installing windows. Comply with manufacturer's written instructions for final cleaning and maintenance. Avoid damaging protective coatings and finishes.

C. Protect window surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately in accordance with manufacturer's written instructions.

D. Refinish or replace windows with damaged finish.

END OF SECTION 08 51 23.13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
4. Repair and rehabilitation of existing hardware to remain.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
2. Division 08 Sections for historic wood doors, new wood doors, and new hollow metal doors, and power door operators.
3. Division 09 sections for touchup, finishing or refinishing of existing and new openings modified by this section.
4. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.

5. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 1784 - Air Leakage Tests of Door Assemblies
2. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 101 – Life Safety Code

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems

4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors

5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
   a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.
   b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.

3. Samples for Verification: Submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
   a. Samples will be returned to supplier. Units that are acceptable to Contracting Officer may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:
   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:
      1) Door Index: door number, heading number, and contract document hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.

3) Name and manufacturer of each item.
4) Fastenings and other pertinent information.
5) Location of each hardware set cross-referenced to indications on Drawings.
6) Explanation of all abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for hardware.
8) Door and frame sizes and materials.
9) Degree of door swing and handing.
10) Operational Description of openings with electrified hardware covering egress and ingress (access).

5. Key Schedule:
   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Contracting Officer, by means as directed by Contracting Officer.
   f. Prepare key schedule by or under supervision of supplier, detailing Contracting Officer's final keying instructions for locks.

6. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.

C. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Final approved hardware schedule edited to reflect conditions as installed.
   d. Final keying schedule
   e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
   f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

D. Inspection and Testing:

1. Submit written reports to the Contracting Officer of the results of functional testing and inspection for:
   a. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
   a. For door hardware: DHI certified AHC or DHC.
   b. Can provide installation and technical data to Contracting Officer and other related subcontractors.
   c. Can inspect and verify components are in working order upon completion of installation.
   d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Contracting Officer.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Electrified Door Hardware
   a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

2. Accessibility Requirements:
   a. Comply with governing accessibility regulations cited in "REFERENCES" article 08 71 00, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all U.S. Access Board, Architectural Barriers Act Accessibility Standards and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
   a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      2) Preliminary key system schematic diagram.
      3) Requirements for key control system.
      4) Requirements for access control.
      5) Address for delivery of keys.

2. Pre-installation Conference
   a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

b. Inspect and discuss preparatory work performed by other trades.
c. Inspect and discuss electrical roughing-in for electrified door hardware.
d. Review sequence of operation for each type of electrified door hardware.
e. Review required testing, inspecting, and certifying procedures.
f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:
   a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Contracting Officer.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

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

C. Security: Coordinate installation of door hardware, keying, and access control with Contracting Officer.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
   a. Mechanical Warranty
      1) Locks: 10 years
      2) Exit Devices: 10 years
      3) Closers: 30 years
      4) Automatic Operators: 2 years
   b. Electrical Warranty
      1) Locks: 3 years
      2) Exit Devices: 1 year

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Contracting Officer for maintenance purposes.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Advise the Contracting Officer where visible fasteners, such as thru bolts, are required.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

D. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.

2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.02 HINGES (unless existing to remain as indicated on drawings)

A. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
   a. Exterior: Standard weight, bronze, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, bronze, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
   a. Exterior: Heavy weight, bronze, 5 inches (127 mm) high
   b. Interior: Heavy weight, bronze, 5 inches (127 mm) high

5. 2 inches or thicker doors:
   a. Exterior: Heavy weight, bronze, 5 inches (127 mm) high
   b. Interior: Heavy weight, bronze, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Out-Swinging Interior Lockable Doors: Non-removable pins
   e. Interior Non-lockable Doors: Non-rising pins

9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.03 CONTINUOUS HINGES

A. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
6. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.04 ELECTRIC POWER TRANSFER

A. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.05 FLUSH BOLTS

A. Requirements:

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

2.06 CYLINDRICAL LOCKS – GRADE 1

A. Requirements:

1. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
    a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
    b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
    c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
    d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
    e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
    a. Lever Design: Rhodes.

2.07 CYLINDRICAL LOCKS – GRADE 1

A. Requirements:

1. Cylinders: Refer to "KEYING" article, herein.
2. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
3. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
4. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
6. Provide electrified options as scheduled in the hardware sets.
7. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
    a. Lever Design Basis of Design: Longitude.

2.08 DEADBOLTS

A. Requirements:

1. Provide grade 1 deadbolt series conforming to ANSI/BHMA A156.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide deadbolts with standard 2-3/4 inches (70 mm) backset. Provide 2-3/8 inches (60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1-inch (25 mm) throw, constructed of steel alloy.
4. Provide manufacturer's standard strike.

2.09 EXIT DEVICES

A. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide touchpad type exit devices, fabricated of bronze, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide flush end caps for exit devices.
7. Provide exit devices with manufacturer's approved strikes.
8. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Contracting Officer.
9. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Provide electrified options as scheduled.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.10 ELECTRONIC ACCESS CONTROL LOCKSETS AND EXIT DEVICE TRIM

A. Requirements:

1. Provide offline electronic access control products that comply with the following requirements:
   a. Listed, UL 294 - The Standard of Safety for Access Control System Units.
   b. Compliant with ANSI/BHMA A156.25 Grade 1 Operation and Security.
   c. Certified to UL10C, FCC Part15, Florida Building Code Standards TAS 201 large missile impact, TAS 202 and TAS 203.
   d. Compliant with ASTM E330 for door assemblies.
   e. Compliant with ICC / ANSI A117.1, NFPA 101, NFPA 80, and Industry Canada RSS-210.
2. Functions: Provide functions as scheduled that are field configurable without taking the offline electronic product off the door.
3. Emergency Override: Provide mechanical key override; cylinders: Refer to "KEYING" article, herein.
4. Levers:
   a. Vandal Resistance: Exterior (secure side) door remains locked, preventing damage to internal lock components from vandalism by excessive force.

b. Provide pressure cast zinc plated, non-handed lever trim that operates independently of non-locking levers.
c. Style: custom

5. Power Supply: 4 AA batteries
   a. Provide electronic access control locks and/or exit device trim with the ability to communicate battery status.

6. Features:
   a. Visual tri-colored LED indicators that indicate activation, operational systems status, system error conditions and low power conditions.
   b. Visual bi-colored LED indicator on interior that can indicate secured/unsecured status of device to occupants on interior.
   c. Audible feedback that can be enabled or disabled.
   d. Onboard processor with memory capacity of 2,000 event audit history, up to 16 time zones and up to 32 calendar events.
   e. Central verification time of less than 1 second
   f. Tamper-Resistant Screws: Tamper torx screws on inside escutcheon for increased security.

7. Access:
   a. Programmable Keypad
      1) 3-6-digit PIN code and 12 backlit buttons in a 3 x 4 matrix.

8. Operation:
   a. Provide electronic access control locks and/or exit device trim with the ability to be configured at door by handheld programming device the length of time device is unlocked upon access grant.
   b. Provide electronic access control locks and/or exit device trim with the ability to communicate identifying information such as firmware versions, hardware versions, serial numbers, and manufacturing dates by handheld programming device.

9. Programming Means:
   a. General: Provide manufacturer-supplied programming means that allow secure configuration, credential management, and audit retrieval without removal of the electronic access control device from the door.
   b. Authorized Access: Programming access shall be restricted to authorized personnel via one or more of the following, as provided by the manufacturer:
      1) Handheld programming device
      2) Secure mobile application
      3) Secure web-based or desktop software interface
      b. Programming access shall require authentication (PIN, credential, password, or equivalent).
   c. Configuration Capabilities:
      Programming means shall allow, at a minimum, the following functions to be performed at the door or via secure interface:
      1) Add, delete, and modify user credentials (PINs, cards, or combinations thereof).
      2) Set unlock time duration and re-lock behavior.
      3) Configure time zones, schedules, and calendar events.
      4) Enable or disable audible and visual indicators.
      5) Enable, disable, and configure tamper and forced-door alarms (where supported).
      6) Configure privacy, passage, or office functions where scheduled.

d. Audit and Diagnostics:
   1) Retrieve audit trail and event history from the device.
   2) View device diagnostics including battery status, firmware version, hardware version, serial number, and manufacturing date.
   3) Clear or archive audit history.
e. Firmware Management:
   1) Programming means shall support firmware updates without removal of device from the door.
   2) Firmware updates shall not compromise UL listings, fire-door compliance, or operational functionality.
f. Offline Operation: Programming means shall not require continuous network connectivity for normal configuration, credential changes, or audit retrieval.
g. Documentation and Training:
   1) Provide written programming instructions and quick-reference guides at project closeout.
   2) Provide on-site training for Owner's designated staff covering normal programming, credential management, and audit retrieval.
h. Programming means shall not require cloud-based services, third-party subscriptions, or continuous internet connectivity.
i. Programming software and devices shall not transmit data externally without Owner authorization.

2.11 CYLINDERS

A. Requirements:

1. Provide cylinders/cores to match Park's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.12 KEYING

A. Scheduled System:

1. Existing factory registered system:
   a. Provide cylinders/cores keyed into Park's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:
   a. Temporary Construction Cylinder Keying.
      1) Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
         a) Split Key or Lost Ball Construction Keying System.
         b) 3 construction control keys, and extractor tools or keys as required to void construction keying.
         c) 12 construction change (day) keys.
      2) Contracting Officer will void operation of temporary construction keys.

b. Replaceable Construction Cores.
   1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
      a) 3 construction control keys
      b) 12 construction change (day) keys.
   2) Contracting Officer will replace temporary construction cores with permanent cores.

2. Permanent Keying:
   a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
      1) Master Keying system as directed by the Contracting Officer.
   b. Forward bitting list and keys separately from cylinders, by means as directed by Contracting Officer. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Government.
   c. Provide keys with the following features:
      1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
      2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
      3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
   d. Identification:
      1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
      2) Identification stamping provisions must be approved by the Contracting Officer.
      3) Stamp cylinders/cores and keys with Park's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
      4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Government.
      5) Forward permanent cylinders/cores to Contracting Officer, separately from keys, by means as directed by Contracting Officer.
   e. Quantity: Furnish in the following quantities.
      1) Permanent Control Keys: 3.
      2) Master Keys: 6.
      3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
      4) Key Blanks: Quantity as determined in the keying meeting.

2.13 KEY CONTROL SYSTEM

A. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
   a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
   b. Provide hinged-panel type cabinet for wall mounting.

2.14 DOOR CLOSERS

A. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
11. Closers shall be capable of being upgraded by adding modular mechanical or electronic components in the field.

2.15 DOOR CLOSERS

A. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.

6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.16 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide drop plates, brackets, and adapters for arms as required for details.
6. Provide actuator switches and receivers for operation as specified.
7. Provide weather-resistant actuators at exterior applications.
8. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Contracting Officer. Locate actuators, key switches, and other controls as directed by Contracting Officer.
10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.17 DOOR TRIM

A. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.18 PROTECTION PLATES

A. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.

2.19 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.20 DOOR STOPS AND HOLDERS

A. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.21 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.22 SILENCERS

A. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.

2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.23 ACTUATOR PUSH PLATE

A. Requirements:

1. Faceplate
   a. 4.5” round bronze actuator
   b. 16 gauge, 304 2B bronze

2. Backplate
   a. 1/8” thick aluminum

3. Compatible with wireless transmitter.
4. Vandal resistant
5. Include surface mounting box

2.24 FINISHES

A. FINISH: BHMA 606/633 (US4); EXCEPT:

1. Latch Protectors: BHMA 600 with field paint to match
2. Weatherstripping: Gold Anodized Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing doors and frames for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
   a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
   b. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
3. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Contracting Officer for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Contracting Officer.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Park's opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors and inside of exterior doors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Contracting Officer.

M. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

N. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors and inside of exterior doors.

O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

R. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

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

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 INSPECTION

A. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

3.07 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the Contracting Officer with corrections made prior to the solicitation process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

Legend:
Link to catalog cut sheet
Electrified Opening

Hardware Group No. 01
For use on Door #(s):

103A 103B
Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
		HINGES	EXISTING TO REMAIN			
		PANIC HARDWARE	EXISTING TO REMAIN			
1	EA	EXTERIOR TRIM	512NL		606	FAL
2	EA	MORTISE CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	SURFACE CLOSER	EXISTING TO REMAIN			
1	EA	KICK PLATE	EXISTING TO REMAIN			
1	EA	RAIN DRIP	142G (AS REQ'D)		G	ZER
1	EA	GASKETING	429G @ HEAD & JAMBS		G	ZER
1	EA	DOOR SWEEP	39G		G	ZER
1	EA	THRESHOLD	Per sill detail, otherwise 655G		G	ZER

Existing hardware to remain shall be tested and adjusted for full operability.

Hardware Group No. 02
For use on Door #(s):

108C

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	HINGE	EXISTING TO REMAIN			
1	EA	ELEC OFFICE LOCK	CO-100-CY-50-KP-RHO-L 4B BATTERY OPERATED		606	LON
1	EA	KIL CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	LOCK GUARD	LG12		600	IVE
1	EA	SURFACE CLOSER	EXISTING TO REMAIN			
1	EA	KICK PLATE	EXISTING TO REMAIN			
1	EA	GASKETING	429G @ HEAD & JAMBS		G	ZER
1	EA	DOOR SWEEP	39G		G	ZER
1	EA	THRESHOLD	Per sill detail, otherwise 655G		G	ZER

Existing hardware to remain shall be tested and adjusted for full operability.

FIELD PAINT LOCK GUARD TO MATCH HARDWARE

Hardware Group No. 03
For use on Door #(s):

115A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	114XY		313AN	IVE
1	EA	STOREROOM LOCK	T581L6 DAN		606	LON
1	EA	KIL CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	LOCK GUARD	LG12		600	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH MC WMS		633	LCN
1	EA	KICK PLATE	8400 10" X 34" LDW B-CS		606	IVE
1	EA	GASKETING	429G @ HEAD & JAMBS		G	ZER
1	EA	DOOR SWEEP	39G		G	ZER
1	EA	THRESHOLD	Per sill detail, otherwise 655G		G	ZER

FIELD PAINT LOCK GUARD TO MATCH HARDWARE

Hardware Group No. 04
For use on Door #(s):

108B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	EXISTING TO REMAIN			
1	EA	ELEC OFFICE LOCK	CO-100-CY-50-KP-RHO-L 4B BATTERY OPERATED		606	LON
1	EA	MORTISE CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	SURFACE CLOSER	EXISTING TO REMAIN			
1	EA	LOCK GUARD	LG12		600	IVE
1	EA	GASKETING	429G @ HEAD & JAMBS		G	ZER
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS		BK	ZER
1	EA	MEETING STILE	EXISTING TO REMAIN			
2	EA	DOOR SWEEP	39G		G	ZER
1	EA	THRESHOLD	Per sill detail, otherwise 655G		G	ZER

Existing hardware to remain shall be tested and adjusted for full operability.

FIELD PAINT LOCK GUARD TO MATCH HARDWARE

Hardware Group No. 05
For use on Door #(s):

152 153

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	HINGE	EXISTING TO REMAIN			
1	EA	STOREROOM LOCK	T581L6 DAN		606	LON
1	EA	KIL CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	LOCK GUARD	LG12		600	IVE
1	EA	SURFACE CLOSER	4040XP SHCUSH MC WMS		US4	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		606	IVE
1	EA	WALL STOP	WS406/407CCV		606	IVE
1	EA	GASKETING	139G @ HEAD & JAMBS		G	ZER
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS		BK	ZER
1	EA	THRESHOLD	Per sill detail, otherwise 655G		G	ZER

Existing hardware to remain shall be tested and adjusted for full operability.

DOOR MAY BE HELD OPEN WITH CLOSER ARM
FIELD PAINT LOCK GUARD TO MATCH HARDWARE

Hardware Group No. 06
For use on Door #(s):

150 151

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	114XY		710	IVE
1	EA	CLASSRM DEADBOLT	D121L		606	FAL
1	EA	RIM CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	STOREROOM LOCK	T581L6 DAN		606	LON
1	EA	LOCK GUARD	LG12		600	IVE
1	EA	SURFACE CLOSER	4040XP SHCUSH MC WMS		US4	LCN
1	EA	KICK PLATE	8400 10" X 34" LDW B-CS		606	IVE
1	EA	OH STOP	90S		SP4	GLY
1	EA	GASKETING	429G @ HEAD & JAMBS		G	ZER
1	EA	DOOR SWEEP	39G		G	ZER
1	EA	THRESHOLD	Per sill detail, otherwise 655G		G	ZER

EXISTING DOOR TO BE REUSED, SWING FLIPPED FROM EXISTING OPERATION.

DOOR MAY BE HELD OPEN WITH CLOSER ARM

Hardware Group No. 07
For use on Door #(s):

108A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	EXISTING TO REMAIN			
1	EA	ELEC OFFICE LOCK	CO-100-CY-50-KP-RHO-L 4B BATTERY OPERATED		606	LON
1	EA	KIL CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	SURFACE CLOSER	4010-3049 72MC WMS		US4	LCN
1	EA	OH STOP	90S		SP4	GLY
3	EA	SILENCER	SR66		GRY	IVE

Existing hardware to remain shall be tested and adjusted for full operability.

Hardware Group No. 08
For use on Door #(s):

109	110A	120	121A, 121B	122	122A
124	125				

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	EXISTING TO REMAIN			
1	EA	ENTRY / OFFICE LOCK	T511L6 DAN		606	LON
1	EA	KIL CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	WALL STOP	WS406/407CCV		606	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS		BK	ZER

Existing hardware to remain shall be tested and adjusted for full operability. Doors 122 and 122A are existing to be relocated to new opening.

Hardware Group No. 09
For use on Door #(s):

116

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		633	IVE
1	EA	STOREROOM LOCK	T581L6 DAN		606	LON
1	EA	KIL CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	SURFACE CLOSER	4011 MC WMS		US4	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		606	IVE
1	EA	WALL STOP	WS406/407CCV		606	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS		BK	ZER

Hardware Group No. 10
For use on Door #(s):

111

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	EXISTING TO REMAIN			
1	EA	KEYED PRIVACY LOCK	ND52LD RHO OS-OCC		606	LON
1	EA	KIL CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	WALL STOP	WS406/407CCV		606	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS		BK	ZER

Existing hardware to remain shall be tested and adjusted for full operability.

Hardware Group No. 11
For use on Door #(s):

112 113

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		606	IVE
1	EA	STOREROOM LOCK	T581L6 DAN		606	LON
1	EA	KIL CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	SURF. AUTO OPERATOR	4630 SERIES		US4	LCN
1	EA	ACTUATOR KIT	8310-2420		630	LCN
1	EA	KICK PLATE	8400 10" X 30" LDW B-CS		606	IVE
1	EA	KICK PLATE	8400 6" X 30" LDW B-CS		606	IVE
1	EA	WALL STOP	WS406/407CVX		606	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS		BK	ZER

RESTROOM KIT #8310-2420 INCLUDES ELECTRIC STRIKE, POWER SUPPLY, LOGIC CONTROLLER, BUTTONS AND SIGNAGE

OPERATION:

DOOR NORMALLY CLOSED, STRIKE IS UNLOCKED ALL ILLUMINATION IS GREEN TO INDICATE VACANT

USER PUSHES DOOR TO ENTER OR PRESSES "PUSH TO OPEN" ACTUATOR TO ENGAGE OPERATOR TO OPEN THE DOOR

WHEN DOOR CLOSES, USER PRESSES “PUSH TO LOCK" SWITCH. ALL ILLUMINATION CHANGES TO RED TO INDICATE OCCUPIED, OUTSIDE ACTUATOR IS INACTIVE, STRIKE IS LOCKED AND DOOR IS SECURE.

TO EXIT USER ROTATES INSIDE LEVER TO OPEN THE DOOR OR PUSHES THE "PUSH TO OPEN" SWITCH UNLOCKING THE STRIKE AND ENGAGING THE OPERATOR TO OPEN THE DOOR.

EITHER ACTION RE-SETS THE SYSTEM, ALL ILLUMINATION CHANGES BACK TO GREEN.

Hardware Group No. 12
For use on Door #(s):

104, 105, 114 119

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	EXISTING TO REMAIN			
1	EA	STOREROOM LOCK	T581L6 DAN		606	LON
1	EA	KIL CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		606	IVE
1	EA	OH STOP	90S		SP4	GLY
3	EA	SILENCER	SR66		GRY	IVE

Existing hardware to remain shall be tested and adjusted for full operability.

EXISTING DOOR 121A TO BE REUSED, SWING FLIPPED FROM EXISTING OPERATION.

Hardware Group No. 13
For use on Door #(s):

106

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	EXISTING TO REMAIN			
1	EA	PASSAGE SET	T101 DAN		606	LON
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		606	IVE
1	EA	OH STOP	90S		SP4	GLY
3	EA	SILENCER	SR66		GRY	IVE

Existing hardware to remain shall be tested and adjusted for full operability.

Hardware Group No. 14
For use on Door #(s):

102

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	EXISTING TO REMAIN			
1	EA	CLASSRM DEADBOLT	EXISTING TO REMAIN			
1	EA	PUSH/PULL PLATES	EXISTING TO REMAIN			
1	EA	MORTISE CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	SURFACE CLOSER	EXISTING TO REMAIN			
1	EA	KICK PLATE	EXISTING TO REMAIN			
1	EA	WALL STOP	WS406/407CVX		606	IVE
1	EA	GASKETING	488SBK PSA @ HEAD & JAMBS		BK	ZER

Existing hardware to remain shall be tested and adjusted for full operability.

EXISTING DOOR TO BE REUSED IN NEW LOCATION.

Hardware Group No. 15
For use on Door #(s):

107D

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		606	IVE
1	EA	ENTRY / OFFICE LOCK	T511L6 LON		606	LON
1	EA	KIL CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	FLOOR STOP	FS410		605	IVE

Hardware Group No. A01
For use on Door #(s):

100A, 100B,
107B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112HD EPT		710	IVE
1	EA	POWER TRANSFER	EPT10		695	VON
1	EA	ELEC PANIC HARDWARE	CD-24-R-NL		606	FAL
1	EA	MORTISE CYLINDER/CORE	MATCH EXISTING TYPE AND SYSTEM		606	
1	EA	PULL	CUSTOM WOOD PER DETAILS			
1	EA	OH STOP	100S ADJ		695	GLY
1	EA	SURFACE CLOSER	4021 MC		695	LCN
1	EA	DROP PLATE	PROVIDE AS NECESSARY		695	
1	EA	SURF. AUTO OPERATOR	4642 WMS 120 VAC		695	LCN
1	EA	ACTUATOR, TOUCH	8310-853T		630	LCN
1	EA	BOLLARD	866FLA			
1	EA	GASKETING	429G @ HEAD & JAMBS		G	ZER
1	EA	DOOR SWEEP	39G		G	ZER
1	EA	THRESHOLD	655G		G	ZER
1	EA	WIRE HARNESS	CON-XX AS REQUIRED			SCH

OPERATION:
EXIT DEVICE IS DOGGED WITH MECHANICAL KEY DURING BUSINESS HOURS AND UNDOGGED AFTER HOURS
OPERATOR IS ACTIVATED WHEN EXIT DEVICE IS DOGGED

Hardware Group No. A02
For use on Door #(s):

101A, 101B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112HD EPT		710	IVE
1	EA	POWER TRANSFER	EPT10		695	VON
1	EA	ELEC PANIC HARDWARE	CD-AX-LM-24-C-C-LBR-718		606	FAL
1	EA	PULL	CUSTOM WOOD PER DETAILS			
1	EA	OH STOP	100S ADJ		695	GLY
1	EA	SURFACE CLOSER	4021 MC		695	LCN
1	EA	DROP PLATE	PROVIDE AS NECESSARY		695	
1	EA	SURF. AUTO OPERATOR	4642 WMS 120 VAC		695	LCN
1	EA	ACTUATOR JAMB MOUNTED, TOUCH	8310-818T		630	LCN
1	EA	GASKETING	429G @ HEAD & JAMBS		G	ZER
1	EA	DOOR SWEEP	39G		G	ZER
1	EA	THRESHOLD	655G		G	ZER
1	EA	WIRE HARNESS	CON-XX AS REQUIRED			SCH

REFERENCE HW SET FOR EXTERIOR DOOR FOR DIRECTIONAL ACTUATOR AT VESTIBULE SIDE

OPERATION:
EXIT DEVICE IS DOGGED WITH MECHANICAL KEY DURING BUSINESS HOURS AND UNDOGGED AFTER HOURS
OPERATOR IS ACTIVATED WHEN EXIT DEVICE IS DOGGED

Door#	HwSet#
100	A01
101	A02
102	14
103A	01
103B	01
104	12
105	12
106	13
107B	A01
107D	15
108A	07
108B	04
108C	02
109	08
110A	08
111	10
112	11
113	11
114	12
115A	03
116	09
117	N/A
118	N/A
119	12
120	08
121A	08
121B	08
122	08
122A	08
124	08
125	08
150	06
151	06
152	05
153	05

END OF SECTION 08 71 00

SECTION 08 71 13 - POWER DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Power door operators for swinging doors.

B. Related Requirements:
   1. Section 08 71 00 "Door Hardware"
   2. Section 08 14 16 “Flush Wood Doors”
   3. Division 26 “Electrical”

1.2 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.

D. For automatic door terminology, see BHMA A156.10 for definitions of terms.

1.3 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats that control power door operators. Concrete, reinforcement, and formwork requirements are specified elsewhere.

B. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing power door operators.

C. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.

D. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to the following:
   1. Power supplies.
   2. Access-control system.
   3. Remote activation devices.
   4. Remote monitoring systems.

E. Pneumatic System Roughing-in: Coordinate layout and installation of power door operators and power units with compressed-air piping.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for power door operators.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For power door operators.
1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.
5. Include plans, elevations, sections, and attachment details for guide rails.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For power door operators, safety devices, and control systems, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of power door operators that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Faulty or sporadic operation of power door operator, including controls.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain power door operators, including activation and safety devices, from single source from single manufacturer.

2.2 POWER DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under

normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

1. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load of 30 PSF .

B. Electrohydraulic Operating System: Self-contained, low-pressure unit; with separate cylinders for power and checking, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.

C. Housing for Overhead Concealed Operators: Fabricated from minimum 0.125-inch- thick, extruded or formed aluminum and extending full width of door opening, including door jambs, to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

D. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 POWER DOOR OPERATORS FOR SWINGING DOORS

A. Standard: BHMA A156.10.

B. Performance Requirements:
1. Opening Force:
   a. Power-Operated Doors: Not more than 50 lbf required to manually set door in motion if power fails; not more than 15 lbf required to open door to minimum required width.
   b. Power-Operated Swinging Doors: Not more than 30 lbf required to manually open door if power fails.
   c. Breakaway Device for Power-Operated Doors: Not more than 50 lbf required for breakaway door or panel to open.
2. Entrapment-Prevention Force: Not more than 40 lbf required to prevent stopped door in the last 10 degrees of opening from moving in the direction of opening; not more than 30 lbf required to prevent stopped door from moving in direction of closing.

C. Configuration: Operator to control pair of swinging doors.
1. Traffic Pattern: Two way .
2. Operator Mounting: Overhead concealed.

D. Operation: Power opening and spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.10.

E. Operating System: Electrohydraulic.

F. Features:
1. Adjustable opening and closing speed.
2. Adjustable hold-open time from zero to 30 seconds.
3. Power door re-open if stopped while closing.

G. Controls: Activation and safety devices in accordance with BHMA standards.
   1. Activation Device, Switch: Push-plate switch on each side of door to activate door operator.
   2. Safety Device, Presence Sensor: Mounted on door header to detect pedestrians in presence zone and to prevent door from closing.

H. Exposed Finish: Finish matching door and frame.
   1. Color: As selected by Contracting Officer from full range of industry colors and color densities.

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Extrusions: ASTM B221.
   2. Sheet: ASTM B209.

2.5 CONTROLS

A. General: Provide controls, including activation and safety devices, in accordance with BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.

C. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.

D. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message.
   1. Configuration:
      a. Square push plate with 4-by-4-inch junction box.
         1) Mounting: As indicated on Drawings.
   2. Push-Plate Material: Stainless steel as selected by Contracting Officer from manufacturer's full range.
   3. Message: International symbol of accessibility and "Push to Open."

2.6 ACCESSORIES

A. Signage: As required by cited BHMA standard for type of door and its operation.
   1. Application Process: Operator manufacturer's standard process.
   2. Provide sign materials with instructions for field application when operators are installed.

2.7 FABRICATION

A. Factory fabricate power door operators to comply with indicated standards.

B. Form aluminum shapes before finishing.

C. Fabricate exterior components to drain condensation and water-passing joints within operator enclosure to the exterior.

D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

E. Provide metal cladding, completely covering visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.8 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary, protective covering before shipping.

B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

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

B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of power door operators.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before power door operator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install power door operators in accordance with manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.
   1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.

2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.

B. Controls: Install activation and safety devices in accordance with manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel. Connect control wiring in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 ADJUSTING

A. Adjust power door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
   1. Adjust operators on exterior doors for tight closure.

B. After completing installation of power door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.

C. Readjust power door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.4 INSPECTION

A. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain power door operators.

END OF SECTION 08 71 13

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Laminated glass.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Window film: UV and privacy.
6. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 08 51 13 "Aluminum Windows".
2. Section 08 21 23.13 "Hot-rolled Steel Windows".
3. Section 08 14 16 "Flush Wood Doors".

1.2 DEFINITIONS

A. Authorized Dealer/Applicator (ADA): Authorized by the Manufacturer to install window film as per the Manufacturer's specifications and in accordance with specific requests.

B. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

C. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

D. IBC: International Building Code.

E. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products; 12 inches square.

1. Laminated glass.
2. Insulating glass.

C. Glazing Accessory Samples: For sealants, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Window Film Samples: For each type, 12 inches square.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For glass.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than four Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of

deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.
3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.

4. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For laminated-glass lites, properties are based on products of construction indicated.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

E. Window Film

1. Film Material: The film shall be an optically clear polyester film containing at least 220 layers and incorporating an acrylic pressure sensitive adhesive on one side and an acrylic abrasion resistant coating on the other. The film shall also incorporate Infrared absorbing carbon and/or metal oxide particles. The film shall be uniform without noticeable pin holes, streak s, thin spots, scratches, banding or other optical defects. The variation in total transmission across the width, at any portion along the length, shall not exceed 2 % over the average. The film shall have a nominal thickness of 2.0 mils (0.002 inches). There shall be no evidence of coating voids. The film shall be identified as to Manufacturer of Origin.
2. Emissivity: The emissivity of the non-adhesive surface of the film shall be 0.78 nominal when measured using a Devices & Services Emissometer Model AE at or near room temperature. The Manufacturer shall provide laboratory data of emissivity and calculated window "U" Values for various outdoor temperatures based upon established calculation procedure defined by the 1997 ASHRAE Handbook of Fundamentals, ch. 29, or Lawrence Berkeley Laboratory Window 5.2 Computer Program.
3. U Value: The U Value of the film applied to 1/4 " (6 mm) clear glass shall be 1.0 nominal when measured in accordance with test procedures described for Emissivity.
4. Transmission – Visible, Exterior: When applied to 1/4 " (6 mm) clear glass, the luminous transmittance shall be 78% nominal when measured with an integrating sphere spectrophotometer as referenced by NFRC 100/200/304 (Formerly ASTM E-903) and calculated per ASTM E -308 using Standard Source "C " for average daylight.
5. Reflection – Visible, Exterior: When applied to 1/4 " (6 mm) clear glass, the total luminous reflection from the glass surface shall be 15% nominal when measured

with an integrating sphere spectrophotometer as referenced by N F R C 100/2 00/304 (Formerly ASTM E-903) and calculated per ASTM E -308 using Standard CIE Source "C " for average daylight.
Reflection – Visible, Interior: When applied to 1/4 " (6 mm) clear glass, the total luminous reflection from the glass surface shall be 16% nominal when measured with an integrating sphere spectrophotometer as referenced by NFRC 100/200/304 (Formerly ASTM E-903) and calculated per ASTM E-308 using Standard CIE Source "C " for average daylight.

6. Rejected – Ultraviolet Light: When applied to 1/4 " 6 mm) clear glass, the total rejection of solar ultraviolet radiation of air mass = 2 over the spectral range of 3000 to 3800 angstroms shall be 99 .9 % minimum when measured with an integrating sphere spectrophotometer as referenced by NFRC 100/200/304 (Formerly ASTM E-903).
7. Rejected – Infrared Light: Film shall have an IR transmission of not more than 3% when measured between 900-1000 nanometers.
8. Luminous Efficacy: When applied to (6 mm) clear glass, the luminous efficacy (Defined as the ratio of visible light transmission to Solar Heat Gain Coefficient) shall be 1.4 Nominal.
9. Adhesive System: The film shall be supplied with an optically clear pressure sensitive weather able acrylic adhesive applied uniformly over the surface opposite the abrasion resistant coating.
10. Flammability: The Manufacturer shall provide independent test data showing that equivalent window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoke Development Values per AS TM E -8 4.
11. Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5 % increase of transmitted light haze will result in accordance with ASTM D-104 4 using 50 cycles, 500 grams weight, and the CS10F Calbrase Wheel.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

   1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Contracting Officer from manufacturer's full range of industry colors.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary

sealant.

2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 WINDOW FILM

A. UV FILM

1. Pressure-sensitive acrylic film with transparent siliconized PET liner.

   a. Texture: clear
   b. Visible Light Transmittance: 78%
   c. Solar Heat Reflectance (exterior): 15%
   d. UV Light Rejected: 99%
   e. Location: All glazing in Exhibit Room 102 and 103 and Wilderness Desk 107.

B. PRIVACY FILM

1. Pressure-sensitive vinyl film with transparent synthetic liner.

   a. Thickness: 4.7mil.
   b. Texture: frosted
   c. Visible Light Transmittance: 72%
   d. Solar Heat Reflectance: 10%
   e. Solar Heat Transmittance: 64%
   f. Location: Interior of restrooms 112 and 113.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.
5. Free from defects and imperfections which will affect the final appearance of applied window film.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

C. For window film preparation, the window and window framing will be cleaned

thoroughly with a neutral cleaning solution. The exterior surface of the window glazing shall be bladed with industrial razors to ensure the removal of any foreign contaminants.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 WINDOW FILM

A. The film shall be applied as to the specifications of the Manufacturer by an ADA.

B. Materials will be delivered to the job site with the manufacturer's labels intact and legible.

C. Film edges shall be cut neatly and square at a uniform distance of 1/8 " (3mm) to 1/16 " (1,5 mm) of the window sealing device.

D. Edge Seal – N one required. Except near edges where water could pool for ex tended time periods, such as the bottom surface of a non-vertical glass that does not have adequate draining mechanisms. Edge sealing is not required around the entirety of the window, solely where the water can pool.

E. Water and film slip solution only will be used on the window glass and adhesive to facilitate the proper positioning of the film.

F. To insure efficient removal of excess water from the underside of the film and to maximize bonding of the pressure sensitive adhesive, polyplastic bladed squeegees will be utilized.

G. Upon completion, the film may have a dimpled appearance from residual moisture. Said moisture shall, under reasonable weather conditions, dry flat with no moisture dimples within a period of 30 calendar days when viewed under normal viewing conditions.

H. After installation, any leftover material and/or debris will be removed and the work area will be returned to original condition. ADA will protect the film before, during and after the installation

3.8 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

E. The film may be washed using common window cleaning solutions, including ammonia solutions, 30 days after application. Abrasive type cleaning agents and bristle brushes

which could scratch the film must not be used. Synthetic sponges or soft cloths are recommended.

3.9 LAMINATED GLASS SCHEDULE

A. Clear Laminated Glass Type G1 (Wilderness Desk Storefront): Two plies of fully tempered float glass.

1. Privacy film where indicated on drawings.

3.10 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type G3 (new Admin windows, new Exhibit windows):

1. Overall Unit Thickness: 1 inch
2. Minimum Thickness of Each Glass Lite: ¼" (6mm).
3. Outdoor Lite: Low-iron annealed float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Low-iron annealed float glass.
6. Low-E Coating: Sputtered on second surface.
7. Visible Light Transmittance: 70 percent minimum.
8. U-Factor: U-0.36 maximum.
9. SGHC: U-0.58 maximum.
10. Privacy film at Type A2 windows.
11. UV film at window types E1 and A3.

3.11 INSULATING-LAMINATED-GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Laminated Glass Type G2 (exterior doors):

1. Overall Unit Thickness: 1 inch
2. Minimum Thickness of Outdoor Lite: ¼" (6mm).
3. Outdoor Lite: Clear fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.

    a. Minimum Thickness of Each Glass Ply: ¼" (6mm).
    b. Interlayer Thickness: 0.060 inch (1.52mm).

6. Low-E Coating: Sputtered on second surface.
7. Visible Light Transmittance: 70 percent minimum.
8. U-Factor: U-0.63 maximum.
9. SGHC: U-0.58 maximum.
10. Safety glazing required.

END OF SECTION 08 80 00

SECTION 09 03 91 - HISTORIC TREATMENT OF PLAIN PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment of plain painting as follows:

1. Removing existing paint.
2. Repairing substrates.

B. Related Requirements:

1. Section 01 35 91 "Historic Treatment Procedures" for general historic treatment requirements.
2. Section 06 03 12 “Historic Wood Repair” for elements to be painted.
3. Section 09 91 14 “Exterior Painting” for exterior paint schedule.
4. Section 09 91 24 “Interior Painting” for interior paint schedule.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

H. Historic Paint Materials: Paint materials manufactured to match historic paint formulations; either custom-formulated products or standard products of manufacturers of historic paint materials.

I. Modern Paint Materials: Paint materials not designed to match historic paint formulations but that may be required to match historic paint colors.

J. Plain Painting: For historic treatment, this means painting that requires attention to historic treatment requirements, but no special, decorative or artistic painting skill.

K. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.

L. Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review minutes of Preliminary Historic Treatment Conference that pertain to historic treatment of painting.
2. Review methods and procedures related to historic treatment of painting including, but not limited to, the following:

    a. Verify historic treatment specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Materials, material application, colors, patterns, and sequencing.
    c. Fire-protection plan.
    d. Plain painting historic treatment program.

1.4 SEQUENCING AND SCHEDULING

A. Perform historic treatment of painting in the following sequence, which includes work specified in this and other Sections:

1. Dismantle existing surface-mounted objects and hardware except items indicated to remain in place. Tag items with location identification and protect.
2. Verify that temporary protections have been installed.
3. Examine condition of surfaces to be painted.
4. Remove existing paint to the degree required for each substrate and surface condition of existing paint.
5. Apply paint system.
6. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.

B. Samples: For each type of paint system and each pattern, color, and gloss; minimum 6 inches long in least dimension, but not less than whole pattern.

1. Include stepped Samples defining each separate coat, including fillers and primers. Resubmit until each required sheen, color, and texture is achieved.
2. For each painted color being matched to a standardized color-coding system, include the color chips from the color-coding-system company with Samples.
3. Include a list of materials for each coat of each Sample.

4. Label each Sample for location and application.
5. Sample Size:

    a. Plain Painted Surfaces: 4-by-8-inch Samples for each color and material, on hardboard.
    b. Stained or Natural Wood: 12-by-12-inch Samples of natural- or stained-wood finish, on representative surfaces.

C. Product List: For each paint product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current MPI's "MPI Approved Products List" for each MPI-product category specified in paint systems, with the proposed product highlighted.
3. VOC content.

D. Qualification Data: For historic treatment specialist(s) and paint-remover manufacturer per 1.8A below.

E. Plain Painting Historic Treatment Program: Submit before work begins.

F. Color Matching Certificate: For computer color matching of historic colors.

1.6 INFORMATIONAL SUBMITTALS

A. Preconstruction Test Reports: For cleaning materials, paint removers, and, paint coatings and systems.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra paint materials, from the same production run, that match products applied and that are packaged with protective covering for storage and identified with labels describing contents, including material, finish, source, and location on building.

1. Quantity: Furnish Government with an additional 5 percent, but not less than 1 gal. or one case, as appropriate, of each material and color applied.

1.8 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic painting specialist with 10 years' experience and expertise in matching and touching up existing painting. Experience only in new painting work is insufficient experience for historic treatment work.

B. Paint-Remover Manufacturer Qualifications: A firm regularly engaged in producing paint removers that have been used for similar historic painting applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.

C. Plain Painting Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for historic treatment work, including protection of surrounding materials and Project site and control of runoff during cleaning, paint removal, repainting, and other processes.

1. If materials and methods other than those indicated are proposed for any phase of historic treatment work, add a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project.

D. Mockups: Prepare mockups of historic treatment processes for each type of coating system and substrate indicated and each color and finish required to demonstrate aesthetic effects and to set quality standards for materials and execution. Duplicate appearance of approved Sample submittals.

1. Locate mockups in locations that enable viewing under same conditions as the completed Work.
2. Surface-Preparation Mockups: On existing surfaces using applicable specified methods of cleaning and other surface preparation, provide mockup sample of at least 100 sq. ft..
3. Coating Mockups: Two wall surfaces of at least 100 sq. ft. to represent surfaces and conditions for application of each type of coating system under same conditions as the completed Work.

a. Plain painted surfaces.
b. Stained or natural wood.

4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste daily.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with historic treatment of painting only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

B. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer for surface preparation and during paint application and drying periods.

D. Concealed and undocumented historic items, murals, and similar objects encountered during historic treatment remain Government's property. Carefully protect each item or object.

1. Coordinate with Section 01 35 91 “Historic Preservation Treatment Procedures” to establish special procedures for protection.

PART 2 - PRODUCTS

2.1 PREPARATORY CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for every 5 gal. of solution required.

D. Mildewcide: Commercial proprietary mildewcide or a job-mixed solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

E. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.

F. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation, also called "naval jelly," for removing corrosion from iron and steel.

2.2 PAINT, GENERAL

A. Material Compatibility:

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

B. Colors: Refer to Sections 09 91 13 “Exterior Painting” and 09 91 24 “Interior Painting”

2.3 HISTORIC PAINT MATERIALS

a. Flat Coatings: 50 g/L.
b. Nonflat Coatings: 100 g/L.
c. Nonflat - High-Gloss Coatings: 150 g/L.
d. Concrete/Masonry Sealers: 100 g/L.
e. Floor Coatings: 100 g/L.
f. Primers, Sealers, and Undercoaters: 100 g/L.
g. Shellacs, Clear: 730 g/L.
h. Clear Wood Finishes (Varnishes, Sanding Sealers, and Lacquers): 275 g/L.

2.4 MODERN PAINT MATERIALS, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Low VOC: Comply with the following VOC limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings.

1. Flats: 50 g/L
2. Non-Flats: 150 g/L

C. Low-Emitting Materials:

a. Flat Coatings: 50 g/L.
b. Nonflat Coatings: 100 g/L.
c. Nonflat - High-Gloss Coatings: 150 g/L.
d. Floor Coatings: 100 g/L.
e. Industrial Maintenance Coatings: 250 g/L.
f. Primers, Sealers, and Undercoaters: 100 g/L.
g. Flat Coatings: 50 g/L.
h. Clear Wood Finishes (Varnishes, Sanding Sealers, and Lacquers): 275 g/L.

D. Transition Coat: Paint manufacturer's recommended coating for use where a residual existing coating is incompatible with the paint system.

PART 3 - EXECUTION

3.1 PROTECTION

A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

1. Cover adjacent surfaces with materials that are proven to resist chemical solutions being used unless the solutions will not damage adjacent surfaces. Use protective materials that are UV resistant and waterproof. 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.

2. Do not apply chemical solutions during winds of sufficient force to spread them to unprotected surfaces.
3. Neutralize and collect alkaline and acid wastes before disposal.
4. Dispose of runoff from 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.

3.2 HISTORIC TREATMENT OF PAINTING, GENERAL

A. Historic Treatment Appearance Standard: Completed work is to have a uniform appearance as viewed by Contracting Officer from building interior at 5 feet away from painted surface and from building exterior at 20 feet away from painted surface.

B. Execution of the Work: In treating historic items, disturb them as minimally as possible and as follows:

1. Remove failed coatings and corrosion and repaint.
2. Verify that substrate surface conditions are suitable for painting.
3. Allow other trades to repair items in place and retain as much original material as possible before repainting.
4. Reproduce original, historic paint systems where indicated or scheduled.
5. Install temporary protective measures to protect historic painted surfaces that shall be treated later.

C. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail. Do not use abrasive methods such as rotary sanding, rotary wire brushing, or power tools except as indicated as part of the historic treatment program and as approved by Contracting Officer.

D. Heat Processes: Do not use torches, heat guns, or heat plates.

3.3 EXAMINATION

A. Examine substrates and conditions, with historic treatment specialist present, for compliance with requirements for maximum moisture content and other conditions affecting performance of painting work. Comply with paint manufacturer's written instructions for inspection.

B. Maximum Moisture Content of Substrates: Do not begin application of coatings unless moisture content of exposed surface is below the maximum value recommended in writing by paint manufacturer and not greater than the following maximum values when measured with an electronic moisture meter appropriate to the substrate material:

1. Wood: 15 percent.

C. Alkalinity: Do not begin application of coatings unless surface alkalinity is within range recommended in writing by paint manufacturer.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

1. If existing surfaces cannot be prepared to an acceptable condition for proper finishing by using specified surface-preparation methods, notify Contracting Officer in writing.

E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.4 PREPARATORY CLEANING

A. General: Use only the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.

B. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.

C. Solvent Cleaning: Use solvent cleaning to remove oil, grease, smoke, tar, and asphalt from painted or unpainted surfaces before other preparation work. Wipe surfaces with solvent using clean rags and sponges. If necessary, spot-solvent cleaning may be employed just prior to commencement of paint application, provided enough time is allowed for complete evaporation. Use clean solvent and clean rags for the final wash to ensure that all foreign materials have been removed. Do not use solvents, including primer thinner and turpentine, that leave residue.

D. Mildew: Clean off existing mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. Rinse with water applied by clean rags or sponges.

E. Chemical Rust Removal:

1. Remove loose rust scale with approved abrasives for ferrous-metal cleaning.
2. Apply rust remover with brushes or as recommended in writing by manufacturer.
3. Allow rust remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing. Do not allow extended dwell time.
4. Wipe off residue with mineral spirits and either steel wool or soft rags, or clean with method recommended in writing by manufacturer to remove residue.
5. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
6. Prime immediately to prevent rust. Do not touch cleaned metal surface until

primed.

F. Mechanical Rust Removal:

1. Remove rust with approved abrasives for ferrous-metal cleaning. Clean to bright metal.
2. Wipe off residue with mineral spirits and either steel wool or soft rags.
3. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
4. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

3.5 PAINT REMOVAL

A. General: Remove paint where indicated. Where cleaning methods have been attempted and further removal of the paint is required because of incompatible or unsatisfactory surfaces for repainting, remove paint to extent required by conditions.

1. Application: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

a. Apply materials to all surfaces, corners, contours, and interstices, to provide a uniform final appearance without streaks.
b. After work is complete, remove protection no longer required. Remove tape and adhesive marks.

2. Brushes: Use brushes that are resistant to chemicals being used.

a. Metal Substrates: If using wire brushes on metal, use brushes of same metal composition as metal being treated.
b. Wood Substrates: Do not use wire brushes.

3. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that spray methods do not damage surfaces.

a. Equip units with pressure gages.
b. Unless otherwise indicated, hold spray nozzle at least 6 inches from surface and apply material in horizontal, back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
c. For chemical spray application, use low-pressure tank or chemical pump suitable for chemical indicated, equipped with nozzle having a cone-shaped spray.
d. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
e. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.

B. Paint Removal with Hand Tools: Remove paint manually using hand-held scrapers, wire brushes, sandpaper, and metallic wool as appropriate for the substrate material. Do not

use other methods except as indicated as part of the historic treatment program and as approved by Contracting Officer.

C. Paint Removal with Alkaline Paste Paint Remover:

1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted surface with brushes.
3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.
5. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
6. Repeat process if necessary to remove all paint.

D. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:

1. Remove loose and peeling paint using water**,** scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted surface with brushes or as recommended in writing by manufacturer.
3. Apply cover according to manufacturer's written instructions.
4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
5. Scrape off paint and remover.
6. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.
7. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
8. For spots of remaining paint, apply alkaline paste paint remover according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph.

E. Paint Removal with Solvent-Type Paste Paint Remover:

1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply thick coating of paint remover to dry, painted surface with natural-fiber cleaning brush, deep-nap roller, or large paintbrush. Apply in one or two coats according to manufacturer's written instructions.
3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.
5. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
6. Repeat process if necessary to remove all paint.

F. Paint Removal with Covered, Solvent-Type Paste Paint Remover:

1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a

combination of these. Let surface dry thoroughly.

2. Apply paint remover to dry, painted surface with natural-fiber cleaning brush, deep-nap roller, or large paint brush or as recommended in writing by manufacturer.
3. Apply cover according to manufacturer's written instructions.
4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
5. Scrape off paint and remover.
6. Rinse with cold water applied by low-pressure spray to remove chemicals and paint residue.
7. Use mechanical methods recommended in writing by manufacturer to remove remaining chemicals and paint residue.

3.6 SUBSTRATE REPAIR

A. General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.

B. Wood Substrate:

1. Repair wood defects including dents and gouges more than 1/4 inch in size and all holes and cracks by filling with wood-patching compound and sanding smooth. Reset or remove protruding fasteners.
2. Where existing paint is allowed to remain, sand irregular buildup of paint, runs, and sags to achieve a uniformly smooth surface.

C. Metal Substrate:

1. Preparation: Treat repair locations by wire-brushing and solvent cleaning. Use chemical, or rust removal method to clean off rust.
2. Defects in Metal Surfaces: Repair non-load-bearing defects in existing metal surfaces, including dents and gouges more than 1/8 inch deep or 1/2 inch across and all holes and cracks by filling with metal patching compound and sanding smooth. Remove burrs and protruding fasteners.
3. Priming: Prime iron and steel surfaces immediately after repair to prevent flash rusting. Stripe paint corners, crevices, bolts, welds, and sharp edges. Apply two coats to surfaces that are inaccessible after completion of the Work.

3.7 PAINT APPLICATION, GENERAL

A. Comply with manufacturers' written instructions for application methods unless otherwise indicated in this Section.

B. Prepare surfaces to be painted according to the Surface-Preparation Schedule and with manufacturer's written instructions for each substrate condition.

C. Apply a transition coat over incompatible existing coatings.

D. Metal Substrate: Stripe paint corners, crevices, bolts, welds, and sharp edges before

applying full coat. Apply two coats to surfaces that are inaccessible after completion of the Work. Tint stripe coat different than the main coating and apply with brush.

E. Blending Plain Painted Surfaces: When painting new substrates patched into existing surfaces or touching up missing or damaged finishes, apply coating system specified for the specific substrate. Apply final finish coat over entire surface from edge to edge and corner to corner.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a testing agency to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

B. Notify testing agency in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until testing agency has had reasonable opportunity to inspect work areas at lift device or scaffold location.

C. Manufacturer's Field Service: Engage paint-remover manufacturer's factory-authorized service representative for consultation and Project-site inspection, and provide on-site assistance when requested by Contracting Officer.

D. Paint Material Testing: Government may engage the services of a qualified testing and inspecting agency to inspect and test paint for composition and dry film thickness.

1. Paint Composition: The following procedure may be performed at any time and as often as Government deems necessary during the period when paints are being applied:

   a. Testing agency will sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   b. Testing agency will perform tests for compliance of paint materials with product requirements.
   c. If test results show materials being used do not comply with product requirements, Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

2. Dry Film Thickness:

   a. Contractor shall touch up and restore painted surfaces damaged by testing.
   b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.9 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Contracting Officer, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.10 SURFACE-PREPARATION SCHEDULE

A. General: Before painting, prepare surfaces for painting according to applicable requirements specified in this schedule.

1. Examine surfaces to evaluate each surface condition according to paragraphs below.
2. Where existing degree of soiling prevents examination, preclean surface and allow it to dry before making an evaluation.
3. Repair substrate defects according to "Substrate Repair" Article.

B. Surface Preparation for MPI DSD 0 Degree of Surface Degradation:

1. Surface Condition: Existing paint film in good condition and tightly adhered.
2. Paint Removal: Not required.
3. Preparation for Painting: Wash surface by detergent cleaning; use solvent cleaning where needed. Roughen or degloss cleaned surfaces to ensure paint adhesion according to paint manufacturer's written instructions.

C. Surface Preparation for MPI DSD 1 Degree of Surface Degradation:

1. Surface Condition: Paint film cracked or broken but adhered.
2. Paint Removal: Scrape by hand-tool cleaning methods to remove loose paint until only tightly adhered paint remains.
3. Preparation for Painting: Wash surface by detergent cleaning; use other cleaning methods for small areas of bare substrate if required. Roughen, degloss, and sand the cleaned surfaces to ensure paint adhesion and a smooth finish according to paint manufacturer's written instructions.

D. Surface Preparation for MPI DSD 2 Degree of Surface Degradation:

1. Surface Condition: Paint film loose, flaking, or peeling.
2. Paint Removal: Remove loose, flaking, or peeling paint film by hand-tool or chemical paint-removal methods.

3. Preparation for Painting: Wash surface by detergent cleaning; use solvent cleaning where needed. Use other cleaning methods for small areas of bare substrate if required. Sand surfaces to smooth remaining paint film edges. Prepare bare cleaned surface to be painted according to paint manufacturer's written instructions for substrate construction materials.

E. Surface Preparation for MPI DSD 3 Degree of Surface Degradation:

1. Surface Condition: Paint film severely deteriorated
2. Paint Removal: Completely remove paint film by hand-tool or chemical paint-removal methods. Remove rust.
3. Preparation for Painting: Prepare bare cleaned surface according to paint manufacturer's written instructions for substrate construction materials.

F. Surface Preparation for MPI DSD 4 Degree of Surface Degradation:

1. Surface Condition: Missing material, small holes and openings, and deteriorated or corroded substrate.
2. Substrate Preparation: Repair, replace, and treat substrate according to "Substrate Repair" Article.
3. Preparation for Painting: Sand substrate surfaces to smooth remaining paint film edges and prepare according to paint manufacturer's written instructions for substrate construction materials. Remove rust.
4. Painting: Paint as required for MPI DSD 2 degree of surface degradation.

END OF SECTION 09 03 91

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gypsum wallboard.
2. Cementitious backer units.
3. Acoustical sealant.
4. Smart Vapor retarder.

B. Related Requirements:

1. Section 07 21 00 "Thermal Insulation" for acoustic insulation.
2. Section 09 30 13 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.
3. Section 09 91 24 “Interior Painting”

1.2 REFERENCE STANDARDS

A. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2019b.

B. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.

C. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

F. ASTM E413 - Classification for Rating Sound Insulation; 2016.

G. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Cementitious backer units.
3. Acoustical sealant.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For the following products:

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

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

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 GYPSUM BOARD, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. General gypsum Wallboard: Paper-faced, gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for ceilings and vertical surfaces, unless otherwise indicated.
2. Thickness: 1/2"

2.4 MOLD, MILDEW AND MOISTURE RESISTANT PAPER FACED GYPSUM BOARD

A. Gypsum Board, Regular Core, Mold, Mildew, Moisture Resistant: ASTM C1396/C1396M

1. Thickness: 1/2 inch (12.7 mm).
2. Core: Regular.
3. Edges: Square.
4. Mold/Mildew Resistance: ASTM D3273; Score of 10.
5. Mold/Mildew Resistance: ASTM G21, Score of 0.

2.5 CEMENTITIOUS BACKER BOARD

A. ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

B. Thickness as indicated on drawings.

C. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is

compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

E. Smart Vapor Retarder:

1. Material: Vapor-variable polyethylene copolymer protected by Polypropylene microfiber fleece
2. Permeability: vapor variable from 0.13 to over 13 perm – best in class (factor 100)
3. Class A material per ASTM E84 test (0 FS, 35 SDI)
4. Air permeance per ASTM E2178 0.00005cfm/ft^2 (0.0025 L/s*m^2)
5. Red List Free

2.9 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Ceiling Type: As indicated on Drawings.
3. Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At high walls, install panels horizontally unless otherwise indicated.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.3 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at showers and locations indicated to receive tile.

B. Water-Resistant Backing Board: Install where indicated with 1/4-inch gap where panels abut other construction or penetrations.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.4 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Not used.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 09 91 24 "Interior Painting."

5. Level 5: Not used.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.5 APPLICATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.6 INSPECTION

A. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing

inspection.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

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

END OF SECTION 09 29 00

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic tile and grout for walls and floor.
2. Tile Accessories.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 09 29 00 "Gypsum Board" for cementitious backer units.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Module Size: Actual tile size plus joint width indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces using stacked pattern as indicated on drawings.

1. Shop drawings shall show layout pattern and detailing around the floor register locations.

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Manufacturer has minimum five years' experience producing ceramic tile.
2. Installer had minimum five years' experience installing tile on projects of similar scale and complexity.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Ceramic Tile:

1. Basis of Design: Daltile and FireClay Tile
   a. Ceramic Wall Tile:
      1) Daltile: Color Wheel Classic 4”x4”.
         a) Color and pattern: Matte Arctic White Stacked
   b. Accent Wall Tile
      1) FireClay Tile; 4” x 4” bullnose for top of wall; 6” x 12” cove base
         a) Color and pattern: Satin, Natural Press, Green Apatite
   c. Ceramic Floor Tile Comfort Station:
      1) Daltile, Volume 1.0, 12” x 24”
         a) Color and pattern: Accent Brown VL78, Running Bond
         b) Slip Resistant
   d. Ceramic Floor Tile Administration Wing Staff Restrooms:
      1) Daltile, Volume 1.0, 12” x 24”
         a) Color and pattern: Reverb Ash VL74, Running Bond
         b) Slip Resistant

2. Face Size Variation: Rectified.

2.4 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.
2. Grout Color: As selected by Contracting Officer from manufacturer's full range.
   a. Grout colors to be selected for each tile color and pattern, maximum four colors.
   b. Wall and floor grout design intent is “Charcoal”.

2.5 MISCELLANEOUS MATERIALS

A. Metal Edge Strips: height to match tile and setting-bed thickness, anodized aluminum, 300 Series exposed-edge material.

1. Basis of Design: Schluter
   a. Exposed Edges: Schluter – Jolly, Polished Chrome

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.6 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Contracting Officer.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not, factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in pattern shown on drawings. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Tile: 1/8"

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.4 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 13

SECTION 09 51 23 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical tiles.
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Related Requirements:

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For components with factory-applied finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Tiles: Set of full-size Samples of each type, color, pattern, and texture.
2. Concealed Suspension-System Members: 6-inch- long Sample of each type.
3. Exposed Moldings and Trim: Set of 6-inch- long Samples of each type and color.
4. Seismic Clips: Full size.

E. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

   a. Lighting fixtures.
   b. Diffusers.
   c. Grilles.
   d. Speakers.
   e. Sprinklers.
   f. Access panels.
   g. Perimeter moldings.

7. Show operation of hinged and sliding components adjacent to acoustical tiles.
8. Minimum Drawing Scale: 1/8 inch = 1 foot.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical ceiling area as indicated on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A in accordance with ASTM E1264.
2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.2 PHYSICAL CHARACTERISTICS

A. Acoustical Tile

1. Material: Wet-formed mineral fiber
2. Finish: Factory-applied latex paint, BOD color: white
3. Size: 24” x 24” x ¾”
4. Profile: 9/16” beveled tegular
5. Light reflection: 0.85

B. Hanger system

1. Size: 9/16” Exposed Tee
2. Color: White

2.3 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

2.4 MISCELLANEOUS MATERIALS

A. Staples: 5/16-inch- long, divergent-point staples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with

requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches

from ends of each member.

9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.

1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches o.c.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Periodic inspection during the installation of suspended ceiling grids in accordance with ASCE/SEI 7.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and will test them for 200 lbf of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical tile ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient wall base and accessories.
2. Substrate Preparation.

B. Related Requirements:

1. Section 09 65 43 “Linoleum Flooring”

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, submit manufacturer's technical data sheet, care & maintenance document, submittal and/or warranty.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

E. Product Schedule: For resilient base and accessory products.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide resilient flooring materials manufactured in the United States of America by a firm with a minimum of 10 years’ experience with resilient flooring materials of type equivalent to those specified.

1. Manufacturer’s quality management system must have ISO 9001:2000 approval.
2. Provide resilient flooring products, including wall base, accessories and subfloor preparation products from one manufacturer to ensure color matching and compatibility.
3. Manufacturer shall be capable of providing technical training and technical field service representation.

B. Installer Qualifications: Installer must be professional, licensed, insured and acceptable to manufacturer of resilient flooring materials. Project Managers or Field Supervisors must be INSTALL (International Standards & Training Alliance) certified, CFI

(Certified Floorcovering Installers) Certified and/or an FCICA (The Flooring Contractors Association) CIM (Certified Installation Manager) for the requirements of the project.

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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.

B. Deliver materials sufficiently in advance of installation to condition materials to the required temperature for 48-hours prior to installation.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 WARRANTY

A. Provide manufacturer’s standard limited commercial warranty to cover manufacturing defects.

PART 2 - PRODUCTS

2.1 RESILIENT WALL BASE

A. Rubber Wall Base:

1. Material Specification: ASTM F1861, Type TS – rubber, vulcanized thermoset, Group 1 – solid, (homogenous), Style A – Straight, Style B – Cove, Style C – Butt-to
2. Material Height: 4”
3. Material Thickness: ASTM F386, 1/8”
4. Material Length: 120 foot sections
5. Color: as selected from manufacturer’s full range.

    a. Basis of Design: Roppe Pinnacle Type TS, Black

6. Limited Warranty: 1 year, manufacturing only
7. Material & Composition: 100% vulcanized homogenous rubber compound comprised of a premium blend & SBR rubber materials
8. Surface Burning: ASTM E84, Class B
9. Substrate Preparation: Per ASTM F710

2.2 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Do not install any pieces of resilient base that are less than 2 feet in length where a longer piece could be used.

E. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

F. Do not stretch resilient base during installation.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 43 - LINOLEUM FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Linoleum sheet flooring

B. Related Requirements:

1. Section 09 65 13 “Resilient Base and Accessories” for resilient wall base and accessories installed with linoleum flooring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Shop Drawings: For each type of linoleum flooring.

1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.
3. Show layout pattern and detailing around the floor register locations.

C. Samples for Initial Selection: For each exposed product and for each color and pattern specified in manufacturer's standard size, but not less than 6-by-9-inch sections.

1. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Samples for Verification: For each type of linoleum flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern required.

1. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

E. Heat-Welded Seam Samples: For each linoleum flooring product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6-by-9-

inch Sample applied to rigid backing and prepared by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer qualifications.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of linoleum flooring to include in maintenance manuals.

B. Product Test Reports: For tests performed by a qualified testing agency.

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. Sheet Flooring: Furnish not less than 10 square feet for every 500 square feet or fraction thereof for each type, color, and pattern of sheet flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for flooring installation and seaming methods indicated with minimum 10 years experience on commercial installations.

1.8 WARRANTY

A. Project Warranty: Comply with requirements according to the "Conditions of the Contract" in Division 1 Closeout Submittals Warranty Section for project warranty provisions.

B. Manufacturer's Warranty: Submit the manufacturer's standard warranty document executed by authorized company official for Contracting Officer’s acceptance. Manufacturer's warranty is in addition to, and not a limitation of, other rights Government may have under Contract Documents.

1. Warranty Period: Thirty (30) year limited warranty commencing on Date of Original Purchase from manufacturer.

C. Installation Warranty: Submit the contractor’s installation warranty signed by the General Contractor and Installer for Contracting Officer’s Acceptance, agreeing to repair or replace work which has failed as result of defects in workmanship. Failure shall include, but not limited to, tearing, cracking, separation, deterioration or loosening from substrate, seam failure, ripples, bubbling or puckering. Upon notification of such installation deficiencies, within the warranty period, make necessary repairs or

replacement at the convenience of the Government. Other guaranties or warranties may not be substituted by the Contractor for the terms of this warranty. Installation warranty is in addition to, and not a limitation of, other rights Government may have under Contract Documents.

1. Warranty Period: Two (2) year limited warranty commencing on Date of Substantial Completion from contractor.
2. Specifier Note: Article below should include special and unique requirements. Coordinate article below with Division 1 Product Requirements Section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with the Division 1 Product Requirements Sections.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1. All materials (including adhesives and accessories) should be stored in areas that are fully enclosed and weathertight. The permanent HVAC should be fully operational and controlled and set at a minimum temperature 65° F (18.3° C). If this is not possible, the areas should be acclimated and controlled by means of temporary HVAC to the service level conditions expected during occupancy. The temperature and humidity should range from 75° F ± 10°F (23.9° C ± 5.5° C) with a 50% ± 10% ambient relative humidity.
2. Store cartons stacked per manufacturer requirements. Ensure the color and batch numbers can be easily read.
3. Comply with the manufacturer’s recommendation for the acclimation of all materials in the space where they will be installed for at least 48 hours prior to the installation unless longer conditioning periods are required by the manufacturer.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install sheet flooring until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install sheet flooring until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive sheet flooring.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

D. Close spaces to traffic during flooring installation and for 72 hours after flooring installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: Homogeneous floor covering made from natural ingredients including flax seed oil, rosin binders, wood flour, limestone and dry pigments which are mixed and then calendared onto a natural jute backing.

1. Meets or exceeds all technical requirements set forth in ASTM 2-34 Standard Specification for Linoleum Sheet Flooring, Type I.
2. Flexibility: Will not crack or break when bent around a 1.4” diameter cylinder.
3. Slip Resistance: Meets or exceeds the industry recommendation of >0.5 for flat surfaces when tested in accordance with ASTM D 2047, Standard Test Method for Static Coefficient of Friction.
4. Fire Testing: Class 1 when tested in accordance with ASTM E 648/NFPA 253, Standard Test Method for Critical Radiant Flux. Meets 450 or less when tested in accordance with ASTM E 662/ NFPA 258, Standard Test Method for Smoke Density.
5. Finish: High-performance, double UV cured
6. Size: 50 cm x 50 cm (approx. 20 in x 20 in)
7. Gauge: 1/10” (2.5 mm)
8. Color and Pattern: Patterns shall be defined in any given area, applied in stripes, diagonals, checkerboard pattern and other designs as indicated on drawings or as selected by Contracting Officer from the manufacturer’s full product lines (including premium colors).

    a. Basis of Design: Forbo Marmoleum Sheet: “T3717 Moon Rock”

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by linoleum flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by linoleum flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements

specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents. Concrete substrates shall be cured per the concrete manufacturer’s recommendations. They must have a minimum compressive strength of 3,000 psi and a minimum dry density of 150 pounds per cubic foot.
3. Alkalinity and Adhesion Testing: Perform tests recommended by linoleum flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate as required by manufacturer.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum percent relative humidity level measurement as required by manufacturer.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install flooring until materials are the same temperature as space where they are to be installed.

1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing flooring.

B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, thresholds, door frames, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

E. Install flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

F. Adhere flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

G. Heat-Welded Seams: For seamless installation, comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.4 LINOLEUM SHEET FLOORING INSTALLATION

A. Allow materials to acclimate to jobsite conditions for a minimum of 48 hours prior to installation.

B. Lay out linoleum sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.
5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.

B. Perform the following operations immediately after completing linoleum flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from linoleum flooring surfaces before applying liquid floor polish.

1. Apply two coat(s).

E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 09 65 43

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Carpet tile for Exhibit 101 and 102, Auditorium 103, Wilderness Desk 107, and Admin Wing hallway, offices, conference room, and break room.

B. Related Requirements:

1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, showing the following:

1. Doorways, enclosing walls or partitions, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of edge, transition, and other accessory strips.
9. Transition details to other flooring materials.
10. Layout pattern and detailing around the floor register locations.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of carpet tile.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

D. Samples for Verification: Actual sample of finished products for each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in

schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

B. Qualification Statements: For Installer.

C. Sample Warranties: For carpet tile.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Government that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 full-size units.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed

and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
b. Loss of tuft-bind strength.
c. Excess static discharge.
d. Delamination.
e. Dimensional instability.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Performance Characteristics:

1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
3. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
4. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
5. ABAAS compliant.
6. Applied Treatments:

a. Applied Soil-Resistance Treatment: Manufacturer's standard material.
b. Antimicrobial Treatment: Manufacturer's standard material.

1) Antimicrobial Activity: Not less than 2-mm halo of inhibition for

gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

7. Carpet and Rug Institute Green Label Plus.
8. Cushion: Manufacturer standard.
9. 100% Solution Dyed Polyester fiber
10. Face weight: 12oz./sy
11. Smoke density: less than 450 flaming
12. Static test: less than 3 kv

B. Basis of Design CPT-1: Mohawk Group - Macro Bloom II

1. Color: 856 Jewel Leaf Bark
2. Installation: Vertical Ashlar
3. Dimensions: 12” x 36” modules
4. Warranty: Lifetime.

C. Basis of Design CPT-2: Mohawk Group - Mirco Bloom II

1. Color: 937 Map Rock Stone
2. Installation: Vertical Ashlar
3. Dimensions: 12” x 36” modules
4. Warranty: Lifetime.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: Extruded aluminum with black finish of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30

00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in

furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 84 33 - SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:

1. Sound-absorbing wall panels at Auditorium 103.
2. Sound-absorbing tackable wall panels at Conference Room 120 and Break Room 118.

1.2 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. SAA: Sound Absorption Average.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include fabric facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For unit assembly and installation.

1. Include plans, elevations, sections, and mounting devices and details.
2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
3. Include details at cutouts and penetrations for other work.
4. Include direction of fabric weave and pattern matching.

C. Samples for Initial Selection: For each type of fabric facing.

1. Include Samples of hardware, fabric, and accessories involving color or finish selection.

D. Samples for Verification: For the following products:

1. Fabric: Full-width by approximately 36-inch long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
2. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.
3. Core Material: 12-inch- square Sample at corner.
4. Mounting Devices: Full-size Samples.
5. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting

methods.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of unit.

B. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install units until a lighting level of not less than 50 fc is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

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

a. Acoustical performance.
b. Fabric sagging, distorting, or releasing from panel edge.

c. Warping of core.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with below as determined by testing identical products by UL

1. Surface Burning Characteristics: Comply with ASTM E84 or UL 723

a. Flame Spread: 25 or less.
b. Smoke-Developed index: 200 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 MATERIALS

A. Appearance:

1. Size: as indicated on drawings.
2. Tackable, 2” thick; direct attached, 1 ½” thick.
3. Color: as selected by Contracting Officer from manufacturer’s standard.

B. Core Materials: Manufacturer's standard from one of the following:

1. Medium-Density Fiberboard: Panels complying with ANSI A208.2, grade to suit performance requirements

a. Fire-retardant panels made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84 or UL 723.

2. For Auditorium: Direct attached acoustic panel
3. For Conference Room: Tackable acoustic panel

C. Facing Material: Fabric from same dye lot; color and pattern as selected by Contracting Officer from manufacturer's full range.

D. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:

1. Splines: Manufacturer's standard concealed metal or plastic splines that engage the kerfed edges of the unit, with other moldings and trim for interior corners, exterior

corners, and exposed edges, with factory-applied finish on exposed items.

2. Adhesive Tape Strips: Manufacturer's standard 1/16-inch- thick, double-sided foam tape.
3. Hook-and-Loop Strips: Manufacturer's standard.
4. Impaling Clips: Manufacturer's standard.
5. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

2.3 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Edge Hardening: For glass-fiber board and mineral-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.

C. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.

D. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

1. Square Corners: Tailor corners.
2. Radius and Other Nonsquare Corners: Attach facing material so there are no seams or gathering of material.
3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.

E. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align fabric pattern and grain with adjacent units.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.

B. Variation of Joint Width: Not more than 1/16-inch variation from reveal line in 48 inches, noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 84 33

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Primers and finish coatings for wood doors and frames and existing wood windows.
2. Primers and finish coatings for wood trim, fascia, columns, soffits.
3. Primers and finish coatings for metal and plastic substrates.

B. Related Requirements:

1. Section 06 03 12 “Historic Wood Repair”
2. Section 06 40 13 “Exterior Architectural Woodwork”.
3. Section 08 03 51.23 “Historic Treatment of Steel Windows”
4. Section 08 11 13 “Hollow Metal Doors and Frames”.
5. Section 08 14 16 “Flush Wood Doors”.
6. Section 09 03 91 “Historic Treatment of Plain Painting”.
7. Divisions 22, 23, and 26 for exposed conduits and vents to be painted.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples: For each type of topcoat product.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

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. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Contracting Officer will select one surface to represent surfaces and conditions for application of each paint system.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
   b. Other Items: Contracting Officer will designate items or areas required.
2. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Contracting Officer at no added cost to Government.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

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

B. Colors: As selected from manufacturer's full line.

2.2 PRIMERS

A. Water-Based Bonding Primer: Pigmented, water-based-emulsion primer formulated for exterior use and to promote adhesion of subsequent specified coatings.

2.3 FINISH COATINGS

A. Exterior Latex Paint, Semigloss: Water-based, pigmented emulsion coating formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as masonry, and primed wood and metal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint exterior side and edges of exterior doors and entire exposed surface of exterior door frames.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.

B. Tint undercoats same color as topcoat but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Contracting Officer, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Colors indicated are basis of design only: PPG colors shown. Contracting Officer to select colors from manufacturer's full line and select final colors from drawdowns submitted for verification.

B. Metal and Plastic Substrates:

1. Exposed Equipment, Plumbing Piping, Louvers, and Electrical Conduit, etc:
   a. Latex System:
      1) Prime Coat: Oil-based primer.
      2) Intermediate Coat: Matching topcoat.
      3) Topcoat: Interior latex paint, color and sheen to match adjacent finish

C. Woodwork and Finish Carpentry:

1. Fascia, column spacers, walls, doors:
   a. Latex System:
      1) Prime Coat: Oil-based primer.
      2) Intermediate Coat: Matching topcoat.
      3) Topcoat: Interior latex paint
      4) Color: As selected by Contracting Officer from manufacturer's standard colors. Basis of design: PPG "Clam Shell", PPG1023-6
2. Soffit, beams, mullions, columns:
   a. Latex System:
      1) Prime Coat: Oil-based primer.
      2) Intermediate Coat: Matching topcoat.
      3) Topcoat: Interior latex paint
      4) Color: As selected by Contracting Officer from manufacturer's standard colors to closely match the existing interior Exhibit hall ceiling color.

END OF SECTION 09 91 13

SECTION 09 91 24 - INTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Wood ceiling at Comfort Station.
2. Gypsum board walls and ceilings.

B. Related Requirements:

1. Section 06 20 23 "Interior Finish Carpentry".
2. Section 09 93 01 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

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. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Contracting Officer will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Contracting Officer will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Contracting Officer at no added cost to Government.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Contracting Officer specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

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

B. VOC Content: Comply with the following VOC limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings.

1. Flats: 50 g/L
2. Non-Flats: 150 g/L

C. Colors: As selected from manufacturer's full line.

1. Gypsum walls basis of design: Sherwin Williams 9165 “Gossamer Veil”

a. Gloss level: Eggshell.

2. Gypsum walls at damp areas basis of design: Sherwin Williams 7005 “Pure White”

a. Gloss level: Eggshell.

3. Gypsum ceiling basis of design: Sherwin Williams 7005 “Pure White”

a. Gloss level: Flat

2.3 PRIMERS

A. Interior Latex Primer Sealer: Water-based latex sealer used on new gypsum wallboard surfaces.

B. Interior, Institutional Low-Odor/VOC Primer Sealer: Water-based primer sealer with low-odor characteristics and a VOC of less than 10 grams per liter for use on new concrete and gypsum wallboard surfaces that are subsequently to be painted with latex finish coats.

C. Interior Latex Primer for Wood: Waterborne-emulsion primer formulated for resistance to extractive bleeding, mold, and microbials; for hiding stains; and for use on interior wood subject to extractive bleeding.

D. Interior Latex Primer for CMU: Acrylic Block Filler formulated to fill interior porous concrete block to guard against re-wetting and to provide alkalinity resistance.

2.4 WATER-BASED FINISH COATS

A. Interior, Latex, Low Sheen: Pigmented, water-based paint for use on primed/sealed interior gypsum board and on primed wood and metals.

1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.

B. Interior, Latex, Eggshell: Pigmented, water-based paint for use on primed/sealed interior gypsum board and on primed wood and metals.

1. Gloss and Sheen Level: Manufacturer's standard eggshell finish.

C. Interior, Latex, Satin: Pigmented, water-based paint for use on primed/sealed interior gypsum board and on primed wood and metals.

1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.

D. Interior, Latex, Semigloss: Pigmented, water-based paint for use on primed/sealed interior gypsum board and on primed wood.

1. Gloss Level: Manufacturer's standard semigloss finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture

meter as follows:

1. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed

surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces unless otherwise indicated on Drawings:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Contracting Officer, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or

defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Wood Substrates: Wood trim, Architectural woodwork.

1. Latex over Latex Primer System:

a. Prime Coat: Primer, latex, for interior wood:

1) Basis of Design: Sherwin Williams Premium Wall & Wood Primer

b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat:

1) Latex, interior, semigloss (MPI Gloss Level 5)

a) Basis of Design: Sherwin Williams Pro Industrial Acrylic

B. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer sealer, interior, institutional low odor/VOC:

1) Basis of Design: ProMar 200 Zero V.O.C. Latex Primer

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat:

1) Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1).

a) Basis of Design: Sherwin Williams Promar 200 Zero Voc

2) Latex, interior, institutional low odor/VOC (MPI Gloss Level 3).

a) Basis of Design: Sherwin Williams Promar 200 Zero Voc

C. Metal and Plastic Substrates:

1. Exposed Equipment, Plumbing Piping, Louvers, and Electrical Conduit, etc:

a. Latex System:

1) Prime Coat: Oil-based primer.
2) Intermediate Coat: Matching topcoat.
3) Topcoat: Interior latex paint, color and sheen to match adjacent finish

END OF SECTION 09 91 24

SECTION 09 93 01 - STAINING AND TRANSPARENT FINISHING (MPI STANDARDS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Transparent finishing of interior wood surfaces where indicated on the drawings – new wood doors and frames, new casework, existing wood doors, frames, windows and trim, existing wall paneling, existing ceiling boards. At least four different existing stains were identified and are to be custom matched.

B. Related Requirements:

1. Section 01 35 91 "Historic Treatment Procedures" for general historic treatment requirements.
2. Section 06 03 12 "Historic Wood Repair"
3. Section 06 40 23 “Interior Architectural Woodwork”
4. Section 06 42 16 “Flush Wood Paneling”
5. Section 08 03 14 “Historic Treatment of Wood Doors”
6. Section 08 14 16 “Flush Wood Doors”

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
2. Include preparation requirements and application instructions.
3. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
4. Indicate VOC content.

B. Samples for Initial Selection: Manufacturer's color sheets, showing full range of available colors for each type of product, including standard and custom to match historic existing throughout (minimum four different stains).

C. Samples for Verification: For each type of finish system and in each color and gloss of finish required.

1. Submit Samples on representative samples of actual wood substrates, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to finish system and locations of application areas. Use

same designations indicated on Drawings and in schedules. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials to Government that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 MOCKUPS

A. Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and, to set quality standards for materials and execution. Custom color matching and multiple rounds of mockups is to be anticipated.

1. Contracting Officer will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Contracting Officer will designate items or areas required.

2. Final approval of stain color selections will be based on mockups.

a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Contracting Officer at no added cost to Government.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures of less

than 5 deg F above the dew point, or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

a. Clear Wood Finishes (Varnishes, Sanding Sealers, and Lacquers): 275 g/L.

C. Stain Colors: Clear, as selected by Contracting Officer from manufacturer's full range to match existing color.

D. VOC Content: Comply with the following VOC limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings.

1. Clear wood finishes: varnish 350 g/L; lacquer 550 g/L

2.2 TRANSPARENT FINISHES

A. Varnish, Interior, Water Based, Clear, Satin: Water-based clear satin coating for interior wood trim, frames, doors, paneling and cabinetry.

1. Gloss and Sheen Level: As selected by Contracting Officer from manufacturer's full range to match existing sheens.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Interior Wood Substrates: 10 percent, when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
3. Sand surfaces exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Contracting Officer, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

A. Existing wood Substrates: doors, board ceiling, millwork, trim:

1. Each interior wood element noted will have a custom stain (four custom stains to match existing).
2. Select interior woodwork is painted and not stained as indicated on drawings.
3. Water-Based Varnish System:

    a. Prime Coat: Water-based varnish matching topcoat.
    b. Intermediate Coat: Water-based varnish matching topcoat.
    c. Topcoat, Satin: Varnish, water based, clear (MPI Gloss Level 4)

B. New doors, trim, millwork, shelving:

1. Select interior woodwork is painted and not stained as indicated on drawings.
2. Water-Based Varnish System:

    a. Prime Coat: Water-based varnish matching topcoat.
    b. Intermediate Coat: Water-based varnish matching topcoat.
    c. Topcoat, Satin: Varnish, water based, clear (MPI Gloss Level 4)

END OF SECTION 09 93 01

SECTION 10 14 23.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

1.2 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.3 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample.
2. Exposed Accessories: Full-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in Project.

E. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tools: One set(s) of specialty tools for assembling signs and replacing variable sign components.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

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

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the ABAAS of the Federal agency having jurisdiction and ICC A117.1.

2.2 SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

1. Size: As indicated on Drawings.
2. Thickness: 1/8”
3. Color: Matt Grey
4. Tactile lettering and graphics with Grade 2 Braille.

B. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

C. Wood: To match species and finish of adjacent wood materials.

1. Size: As indicated on Drawings.
2. Thickness: ¼”
3. Finish: Stained to match adjacent

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

D. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on sign back and looped side on mounting surface.

E. Magnetic Tape: Manufacturer's standard magnetic tape with adhesive on one side.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls according to the accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
3. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
4. Hook-and-Loop Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply sign component of two-part tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage; push to engage tape adhesive. Keep tape strips 0.250 inch away from edges to prevent visibility at sign edges when sign is initially installed or reinstalled. Apply substrate component of tape to substrate in locations aligning with tape on back of sign; push and rub well to fully engage tape adhesive to substrate.
5. Magnetic Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Contracting Officer.

3.3 INSPECTION

A. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

END OF SECTION 10 14 23.16

SECTION 10 21 00 – HDPE TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solid plastic toilet compartments configured as toilet enclosures and urinal screens including the following:
   1. Floor mounted overhead-braced toilet compartments.
   2. Privacy screens.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry for blocking.

B. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers and grab bars and coat hooks mounted on toilet compartments.

1.3 REFERENCES

A. ASTM A666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

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

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: Provide layout drawings and installation details with location and type of hardware required.
   1. Show widths, heights, and clear openings. Show all anchor points at floor and any overhead bracket requirements. Include locations of accessory installation.

C. Verification Samples: For each finish product specified, two samples representing actual product, color, and patterns.
   1. Include Samples of hardware and accessories involving material and color selection.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, ceilings, and other construction contiguous with toilet compartments by field measurements before shop drawings.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company regularly engaged in manufacture of products specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.

B. Installer Qualifications: A company regularly engaged in installation of products specified in this Section, with a minimum of 5 years experience.

C. Materials: Doors, panels and pilasters, constructed from high density polyethylene (HDPE) resins. Partitions to be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. Cover all plastic components with a protective plastic masking.

D. Performance Requirements:
   1. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with ASTM E 84, Class B:
      a. Tested to Meet ASTM E84, Class B flame spread/smoke developed rating.
   2. Material Fire Ratings:
      a. National Fire Protection Association (NFPA) 286: Pass.
      b. International Code Council (ICC): Class B.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.9 WARRANTY

A. Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge. Labor not included in warranty.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

2.2 MATERIAL

A. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface.
   1. Recycled Content; Post Industrial: 25 percent.
   2. Recycled Content; Post Industrial: 100 percent.
   3. Recycled Content; Post Consumer: 100 percent.

B. Stainless Steel Castings: ASTM A167, Type 304.

C. Aluminum: ASTM 6463-T5 alloy.

2.3 SOLID PLASTIC TOILET COMPARTMENTS

A. Style: Floor mounted overhead-braced toilet compartments.

B. Doors, Panels, and Pilasters: 1 inch (25 mm) thick with all edges rounded to a radius. Mount doors and dividing panels based on height of specified system.
   1. Door and Panel Height: 66 inches (1676 mm).
   2. Aluminum heat sink fastened to bottom edges.
   3. Door Design: Flush
   4. Panel Edge: Shiplap.
   5. Pilasters: 74 inches (2083 mm) high and fastened to floor.

C. Panel Color Basis od Design: Metallic series.
   1. Bronze - Hammered.

D. Pilaster Shoes: 3 inches (76 mm), 20 gauge stainless steel. Secured to pilasters with a stainless steel tamper resistant Torx head sex bolt.

E. Headrail: Heavy-duty extruded 6463-T5 alloy aluminum with anti-grip design. Finish to be clear anodized. Fastened to headrail brackets with stainless steel tamper resistant Torx head sex bolt, and fastened at the top of the pilaster with stainless steel tamper resistant Torx head screws.
   1. Headrail Brackets: 20 gauge stainless steel with satin finish. Secured to the wall with stainless steel tamper resistant Torx head screws.

F. Wall Brackets:
   1. Stainless Steel Brackets: Stainless steel type 201.
   2. Brackets are fastened to pilasters with stainless steel tamper resistant Torx head screws and fastened to the panels with stainless steel tamper resistant Torx head sex bolts.
   3. Bracket Type: Stirrup stainless steel double ear.

G. Door Hardware:
   1. Continuous Stainless Steel Spring Loaded Hinge:
      a. Hinges: 54 inches (1372 mm).
   2. Door Strike/Keeper: Heavy-duty extruded aluminum 6436-T5 alloy with a clear anodized finish. Secured to pilasters with stainless steel tamper resistant Torx head sex bolts. Bumper shall be made of extruded black vinyl.
      a. Style: 3 inches (76 mm) stainless steel emergency access.

3. Latch Mechanism: Stainless Steel Slide Bolt Latch and Housing: Heavy-duty stainless steel type 304. The latch and housing to have a bright finish. The slide bolt and button to have a black anodized finish.
4. Latch Mechanism: Occupancy Indicator Latch and Housing:
   a. Material: Satin stainless steel.
   b. Occupancy indicators: Green for occupied and red not occupied.
   c. Slide bolt and button.
5. Doors supplied with one coat hook/bumper and door pull, clear anodized aluminum or stainless steel.
6. Equip outswing accessible stall doors with self-closers, second door pull, and door stop that meet operable parts requirements.

2.4 SOLID PLASTIC PRIVACY SCREENS

A. Provide plastic privacy screens in urinal applications as indicated or scheduled.

B. Panels 1 inch (25 mm) thick with edges rounded to a radius. Screens to be mounted at 14 inches (356 mm) above the finished floor. Color as selected by Contracting Officer from manufacturer's full line of current colors to match full partitions.
   1. Aluminum heat sink fastened to bottom edges.
   2. Recycled Content: Minimum 25 percent.

C. Screen Type: Wall mounted.
   1. Urinal Screens: 24 inches (610 mm) wide by 42 inches (1067 mm) high.

D. Wall Brackets: Extruded PVC plastic. Fastened to the panel/pilaster with stainless steel tamper resistant torx head screws and fastened to wall with stainless steel tamper resistant torx head sex bolts.
   1. Length of Wall Brackets: 41 inches (1041 mm).
   2. Bracket Color: Black.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
   1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Examine areas to receive toilet partitions and screens for correct height and spacing of anchorage/blocking and plumbing fixtures that affect installation of partitions. Report

discrepancies to the Contracting Officer.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch.
      b. Panels and Walls: 1 inch.
   2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
      a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
      b. Align brackets at pilasters with brackets at walls.

B. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.4 INSPECTION

A. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

3.5 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10 21 00

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corner guards where indicated on drawings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

1. Include Samples of accent strips and accessories to verify color selection.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

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. Corner-Guard Covers: Full-size metal covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch-long units.
2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.
b. Store wall-guard covers in a horizontal position.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

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

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the ABAAS Accessibility Guidelines for Buildings and Facilities.

2.2 MATERIALS

A. Stainless Steel: Type 304

1. 2" wing at corners where indicated on drawings.

2. 4 foot length unless otherwise indicated

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

C. Adhesive: As recommended by protection product manufacturer.

2.3 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.4 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
3. Adjust end and top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

SECTION 10 28 00 – TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.

a. Twin Jumbo Roll Toilet Tissue Dispenser
b. Single Roll Toilet Tissue Dispenser
c. Semi-Recessed Combined Paper Towel Dispenser/ Waste receptacle
d. Recessed Waste receptacle
e. Soap Dispenser
f. Grab Bar
g. Coat Hook
h. Mirror Unit
i. Under-lavoratory Guards
j. Electric Hand Dryer

2. Childcare accessories.

a. Diaper-Changing Station

3. Utility room accessories.

a. Wood shelving in Utility Room
b. Mop shelf

B. Related Requirements:

1. Section 06 10 00 “Rough Carpentry” for blocking.
2. Section 07 92 00 “Joint Sealants”
3. Section 09 29 00 “Gypsum Board”
4. Section 09 30 13 “Ceramic Tiling” for ceramic toilet and bath accessories.
5. Section 10 21 13.17 “Phenolic-Core Pedestal-Mounted Privacy Toilet Compartments”
6. Division 22 for plumbing fixture coordination.

C. Reference Standards

1. ABAAS Standards – Architectural Barriers Accessibility Act Standards (Accessibility Standards for Federal Projects)
2. ASTM A269/A269M – Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).
3. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015
4. ASTM E84 – Standard Test Method for Surface Burning Characteristics of

Building Materials; 2019b
5. ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
6. ICC A117.1 – Accessible and Usable Buildings and Facilities; 2017

1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories. Install per ABAAS requirements.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

C. Coordinate the work with the placement of internal wall reinforcement and concealed ceiling supports to receive anchor attachments.

1.3 ACTION SUBMITTALS

A. Product Data: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: For each exposed product and for each finish specified, full size.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

D. Delegated Design Submittals: For grab bars

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

B. Copies of manufacturer's warranties.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers 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 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 WASHROOM ACCESSORIES

A. Twin Jumbo Roll Toilet Tissue Dispenser

1. Capacity: 2 rolls (up to 10 inches diameter)
2. Mounting: Surface mounted.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
4. Lockset: Tumbler type.
5. Refill Indicator: Pierced slots at front.
6. Theft-resistant
7. ABAAS Compliant
8. Install in Room 150 and 151.

B. Single Roll Toilet Tissue Dispenser:

1. Capacity: 1 rolls (up to 5-1/2 inches diameter)
2. Mounting: Surface mounted.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (bright polished).
4. ABAAS Compliant
5. Install in Room 112 and 113.

C. Semi-Recessed Combined Paper Towel Dispenser/ Waste receptacle: All welded stainless-steel construction; satin finish.

1. Manual paper towel dispenser accepts 600 C-fold or 800 multifold or 1100 single-fold paper towels
2. Waste Receptacle: 12 gal capacity, hemmed edges, tumbler lock.
3. ABAAS Compliant
4. Install in Room 150 and 151.

D. Recessed Waste receptacle: All welded stainless-steel construction; satin finish.

1. Waste Receptacle: 12 gal capacity, hemmed edges, tumbler lock.
2. ABAAS Compliant

E. Soap Dispenser:

1. Description: Designed for manual operation and dispensing soap in liquid or lotion form.
2. Mounting: Vertically oriented, surface mounted.
3. Capacity: 40-fl oz. (1.2 L).
4. Materials: high-impact-resistant ABS.
5. Lockset: Tumbler type.
6. Refill Indicator: Window type or translucent body.

F. Grab Bar:

1. Mounting: Flanges with concealed fasteners to wall.
2. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.

3. Push/Pull Point Load: 250 pound-force, minimum.
4. 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, snap flange, 1-1/2 inch clearance between wall and inside of grab bar.
5. Configuration and Length: As indicated on Drawings.

G. Coat Hook: Wall-mounted stainless-steel construction; satin finish.

1. Install in Restrooms 112 and 113 on back of door. Comfort Station coat hooks to be provided with toilet partitions.

H. Mirror Unit:

1. Frame: Stainless steel channel, satin finish.

    a. Corners: Welded and ground smooth.

2. Size: 24” x 36”.
3. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

I. Under-Lavatory Pipe and Supply Covers:

1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ABAAS Standards.
2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
3. Construction: 1/8 inch flexible PVC.

    a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
    b. Comply with ICC A117.1.
    c. Microbial and Fungal Resistance: Comply with ASTM G21.

4. Color: white
5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.

J. Electric Hand Dryer:

1. ABAAS compliant
2. Install in Room 150 and 151.
3. Electrical requirements:

    a. Input voltage/Frequency:

        1) Low voltage = 100-120 V, High voltage = 200-240 V
        2) 50&60 Hz

    b. Standby power consumption: Less then 0.5 W
    c. Motor specification: 1,000 W digital brushless motor

4. Construction:

    a. Fascia: Polycarbonate
    b. Antibacterial coating
    c. Exterior screw type: Anti-tamper 4 mm Pin-Hex
    d. Water ingress protection to IP24
    e. Finish: Sprayed nickel

5. Filter

    a. HEPA filter (Glass fiber and fleece prelayer)
    b. 99.9% of particles captured

6. Operation:

    a. Touch free capacitive sensor activation
    b. Hand dry time measurement: 12 seconds (Measurement based on NSF Protocol P.335)
    c. Sound power level: 79 dB(A)
    d. Sound pressure level @ 2 m: 63 dB(A)[1]
    e. Operation lock-out period: 30 seconds

2.3 CHILDCARE ACCESSORIES

A. Diaper-Changing Station:

1. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.

   a. Engineered to support minimum of 250 lb static load when opened.

2. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
3. Operation: By pneumatic shock-absorbing mechanism.
4. Material and Finish: HDPE with 304 stainless steel shell

2.4 UTILITY ROOM ACCESSORIES

A. SHELVING

1. Shelving: Closet, Utility shelving, made from one of the following materials, 3/4 inch thick:

   a. MDF with radiused front edge.
   b. MDO softwood plywood with solid-wood edge.
   c. Wood boards as specified above for lumber trim for opaque finish.

2. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.

2.5 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

F. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

G. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

H. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

I. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Government's representative.

PART 3 - EXECUTION

3.1 INSTALLATION OF TOILET ACCESSORIES

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated. Provide in-wall blocking at attachments for required structural integrity.

1. Remove temporary labels and protective coatings.
2. Mounting Heights: As required by accessibility regulations, unless otherwise indicated

B. Grab Bars: Install to comply with specified structural-performance requirements. Provide in-wall blocking at attachments for required structural integrity.

3.2 INSTALLATION OF SHELVING

A. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.

B. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. and within 6 inches of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

C. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled.

1. Install shelves, fully seated on brackets and supports.

D. Apply painted finish, per Section 09 91 24 "Interior Painting".

3.3 INSPECTION

A. Contractor will commence inspection immediately after finishing work. Observations, measurements, and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

3.4 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

C. Replace interior finish carpentry that is damaged or does not comply with requirements.

1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

D. Adjust joinery for uniform appearance.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for portable fire extinguisher:

a. Interior semi-recessed fire-protection cabinets at the Admin Wing.
b. Interior fully-recessed mounted fire-protection cabinet at the Auditorium.

B. Related Requirements:

1. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.2 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:

a. Schedules and coordination requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semi-recessed or fully-recessed mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

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

D. Samples for Initial Selection: For each type of exposed finish required.

E. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

F. Product Schedule: For fire-protection cabinets. Indicate whether semi-recessed or fully-

recessed mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

1. Semi-recessed and fully-recessed as indicated on drawings.

2.3 FABRICATION

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

1. Formed primed steel sheet; 0.036 inch thick base material.
2. Weld joints and grind smooth.
3. Miter corners and grind smooth.
4. Provide factory-drilled mounting holes.
5. Prepare doors and frames to receive locks.
6. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Size to accommodate fire extinguisher and any accessories.
2. Fabricate door frames with tubular stiles and rails and hollow-metal design,

minimum 1/2 inch thick.

3. Miter and weld perimeter door frames and grind smooth.
4. Door Style: Fully glazed panel with frame or center glass panel with frame
5. Door Glazing: Clear tempered glass.

    a. Tempered Break Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.
    b. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick

6. Handle: ADA recessed handle

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth. Flat rolled edge.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

E. Cabinet Exterior Trim and Door: Baked white enamel.

F. Cabinet Interior: White colored enamel.

2.5 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

B. Cabinet Signage: Vertical.

C. Lettering: "FIRE EXTINGUISHER" decal or vinyl self-adhering, pre-spaced black lettering in accordance with Authorities Having Jurisdiction (AHJ).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed and fully-recessed cabinets will be installed.

B. Verify rough openings for cabinet are correctly sized and located.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION OF FIRE-PROTECTION CABINETS

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Provide inside latch and lock for break-glass panels.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
3. Place extinguishers in cabinets.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 10 44 13 "Fire Protection Cabinets."

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a. Schedules and coordination requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

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

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Stored-Pressure Water Type: UL-rated 2-A, 2.5-gal. nominal capacity, with water in stainless steel container; with pressure-indicating gage.

B. Pressurized, AFFF-Foam Type: UL-rated 2-A:10-B, 1.6-gal. nominal capacity, with AFFF foam in stainless steel container; with pressure-indicating gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

3.3 MAINTENANCE

A. See Section 01 77 00 - Closeout Procedures for additional requirements relating to maintenance and service.

END OF SECTION 10 44 16

SECTION 10 81 19 – RODENT AND BIRD CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section consists of abating health hazards associated with rodents and birds and furnishing, installing, and maintaining barriers to protect from rodent/bird entry or intrusions during planned renovation and rehabilitation work at the Kawuneeche Visitors Center (KVC) at Rocky Mountain National Park (ROMO), located at 16018 US-34, Grand Lake, Colorado 80447 (Project Site).

B. Significant amounts of rodent droppings were observed in the attic access hatch in the main building during Landmark's October 16, 2017, Hazardous Material Survey Report for Kawuneeche Visitors Center. Live rodents and spiders were also discovered to be occupying the site. Any rodent or bird intrusion removal and exclusion work should be performed by a licensed and insured pest control contractor.

C. All removal of rodent feces, urine, and nesting materials must be conducted in accordance with the National Park Service's (NPS) *Hantavirus Risk Reduction Worker Protection* guidelines and requirements.

D. All removal of bird feces, urine, and nesting materials must be conducted in accordance with the *Histoplasmosis Protecting Workers from Risk* guidance document produced by National Institute for Occupational Safety and Health (NIOSH).

E. Locations on the exterior building envelope that are open and allow rodent and bird species to enter the interior of the Project Site will require treatment to exclude these animals. This project will also require the disinfection of surfaces contaminated with rodent feces and bird nesting areas prior to the start of work that will disturb these areas.

F. Items to be protected from animal entry include but are not limited to, interior ceilings, base trim, window and door trim, walls, floors, and other materials installed or replaced according to project requirements. Repair of portals on the north and west sides of the building, which were visibly damaged by birds, is also necessary.

G. Neoprene seals, spray-in-place foam, and similar products commonly used to close openings are not rodent-proof. Even in new buildings, utility pipes, electrical conduit (often at meters or circuit breaker panels), water and gas lines, and communication cables may have large openings that permit the entry of rodents and birds. Once animals have entered walls, they generally have ready access to much of a building via holes for utility pipes and wires in the framing, overhead ceilings, beneath raised floors, or other types of construction adjacent to utility enclosures.

H. The Contractor will maintain a clean and debris-free Project Site. If the areas are known to have serious rodent infiltration problems, the Contractor will use exterior surface materials that have a hard, smooth surface on at least the lower levels that will be subject to contact with the ground surface, ornamental plantings, fences, and other potential areas of rodent harborage.

I. The Contractor will tightly rodent and bird-proof any electrical penetrations associated with solar panels that may be installed for this building and openings associated with other potential planned utility alterations.

J. During construction, the Contractor will implement measures to keep the job site free of rubbish, foodstuff, and other items as necessary to avoid attracting animals and will trap/bait rodents as necessary to control rodent intrusion.

1.2 REFERENCE DOCUMENTATION

A. All work will also comply with the following:
   1. National Park Service, *Rodent Exclusion Manual,* Published by the U.S. Department of the Interior, National Park Service, Natural Resource Stewardship and Science: Fort Collins, CO, September 2014.
   2. National Park Service, *Hantavirus Risk Reduction Worker Protection* – Revised Edition, December 2013.
   3. National Institute for Occupational Safety and Health, Histoplasmosis: *Protecting Workers at Risk* – Revised Edition, December 2004.

1.3 FIELD VERIFICATION

A. Field-verify all new and existing dimensions affecting the work of this contract before ordering products.

1.4 CONSTRUCTION MATERIALS

A. The Government will not furnish any materials for this project.

1.5 PROJECT CONDITIONS

A. Do not damage any existing building materials not associated with the work or work area. Any damage to building materials not protected in or outside the work areas and not associated with the work will be repaired or replaced by the Contractor at no cost to the Government.

B. The Government will supply electricity and water service to the Project Site. The Contractor will provide the necessary temporary utility connections and the water source needed to complete the scope of work. If any generators are provided by the Contractor for temporary electric service, a

written Spill Prevention, Control, and Countermeasure (SPCC) plan and equipment will also be required. The Contractor will be required to operate generators at noise levels that do not exceed applicable regulatory limits.

PART 2 - PRODUCTS

2.1 PERSONAL PROTECTIVE EQUIPMENT

A. Respiratory Protection:

1. Workers who abate rodent droppings and/or bird nesting material wastes will be provided with personally issued and individually identified respirators that meet the required level of protection. During the pre-cleaning, installation of critical barriers, and High-Efficiency Particulate Air (HEPA) vacuuming activities, the Contractor will utilize (at a minimum) half-face air-purifying respirators with approved HEPA filter cartridges. At a minimum, the Contractor will also utilize the half-face air-purifying respirators with approved HEPA-filter cartridges for the removal and cleanup work. The respiratory cartridges used will be, at a minimum, N-100 or P-100 filters.
2. The Contractor will provide workers with, and require the use of, respirators approved by the NIOSH in accordance with the OSHA Standard 29 Code of Federal Regulations (CFR) 1926.1101. Minimum respiratory protection will be an approved half-mask air-purifying respirator with HEPA cartridges. Disposable single-use respirators will not be permitted. The initial respiratory protection provided will be chosen prior to the commencement of removal operations based on data from past exposure assessment monitoring or the initial monitoring performed to accurately determine the airborne concentration of dust/fibers to which employees may be exposed.
3. Workers must perform positive and negative air pressure fit tests each time a respirator is donned and whenever the respirator design permits. Powered air-purifying respirators will be tested for adequate flow as specified by the manufacturer.
4. Workers will be given a qualitative fit test in accordance with procedures detailed in the OSHA 29 CFR 1926.1101 requirements for all respirators to be used. An appropriately administered quantitative fit test may be substituted for a qualitative fit test. Documentation of adequate respirator fit must be provided to the Contractor. Fit tests will be administered annually.

B. Personal Protection Required for Rodent Removal/Rodent-Contaminated Material Handling:

1. Prior to the commencement of cleaning of animal-infested areas, all personnel who will be required to enter the work areas for handling animal-infested and contaminated materials will have hazard awareness training. Special onsite training on equipment and procedures unique to this job site will be performed as required. Training in emergency response and evacuation procedures will also be provided.
2. All respiratory protection will be provided to the workers through a written respiratory protection program. This program will be available at the Project Site.

3. Disposable clothing, including head, foot, and full body protection, will be provided in sufficient quantities and in adequate sizes for all workers and authorized visitors. All personnel engaged in the animal removal work will wear approved disposable protective clothing constructed of spun-bonded olefin, polypropylene fabrics, or other material of equivalent resistance to penetration. A full-body suit is recommended instead of a separate set of coveralls, head covers, and shoe covers. Disposable whole-body clothing, including head covers, gloves, and shoe coverings, will be provided to and worn by all personnel in the abatement work area. If elastic sleeve closures are not provided, sleeves will be secured with duct tape to the gloves. Washable footwear having a non-skid tracking surface will be provided and used by all personnel within the abatement work area.
4. Persons with facial hair that may interfere with the respirator's seal will not be allowed to enter the work area.
5. Respirators will be worn at all times if animal-contaminated materials are impacted to the extent that airborne emissions are created.
6. Protective eyewear, gloves, rubber boots, and/or other footwear will be provided as required for workers and authorized visitors. Safety shoes may be required for some activities.
7. Eating, drinking, smoking, and chewing gum or tobacco will not be allowed in the work areas.

2.2 EQUIPMENT

A. The materials utilized may be new or used but will be suitable for the intended purpose. Rodent exclusion barriers will be structurally adequate, neat in appearance, and consistent with historical preservation or the historical fabric on or within the structure.

2.3 SCREENS AND BARRIERS

A. Use only metal window screening materials where windows or doors are accessible to animals. Avoid unnecessary ledges outside of the windows. When necessary, screen ventilation openings and windows with a woven/welded galvanized hardware cloth. Such screening work is critical in a building where high animal pressures are found. For large openings or where the screen may be subject to abuse, add crossbars to support the hardware cloth. If the opening is an access route, install the screen on a hinged frame.

2.4 WIRE MESH

A. Material: Stainless steel or galvanized steel.
B. Mesh size: ¼-inch square openings.
C. Thickness: Minimum 18 gauge.
D. Finish: Corrosion-resistant coating suitable for indoor HVAC environments

2.5 DISINFECTING SOLUTIONS

A. Two types of disinfecting solutions are recommended for the cleanup of animal-contaminated materials:

1. General-Purpose Household Disinfectant: Prepare according to the label if not prediluted. Almost any agent commercially available in the U.S. is sufficient as long as the label states that it is a disinfectant product. Effective agents include those based on phenols, quaternary ammonium compounds, and hypochlorite.
2. Hypochlorite Solution: A chlorine solution that is freshly prepared by mixing 1½ cups of household bleach in one gallon of water (or a 1:10 solution) can be used in place of a commercial disinfectant product. When using a chlorine solution, avoid spilling the mixture on clothing or other items that might be damaged by bleach. Wear rubber, latex, vinyl, or nitrile gloves when preparing and using chlorine solutions. Chlorine solutions should be prepared fresh daily.

PART 3 - EXECUTION

3.1 PROTECTION OF STRUCTURES

A. Rodents and birds seek shelter behind, under, or in appliances, sinks, cabinets, drawers, stored goods, wall voids, false ceilings, and other undisturbed areas.

B. Rodents can climb the outside of vertical pipes and conduits up to 3 inches (7.6 cm) in diameter and the outsides of larger pipes attached to buildings by bracing themselves between the wall and pipe.

C. Rodents can also climb the inside of vertical pipes, wall voids, or structural/expansion seams and joints between 1.5 and 4 inches (3.8 and 10.2 cm) in diameter. All building installations must include systems that prevent these intrusions.

D. Junctures, where utilities (i.e., pipes, cables, etc.) enter the structure, require special consideration in preventing rodent entry.

E. Exclusion must include no exterior openings higher or wider than one-quarter inch.

F. Close openings around pipes and electric cables where they enter structures with Portland cement mortar, Concrete Patch®, masonry, or metal collars.

G. Install wire mesh over all supply air duct openings from underground ductwork as indicated on drawings.

3.2 RODENT REMOVAL

A. Completely remove rodents when approved by the Contracting Officer. Do not use poisons due

to the potential for negative environmental or health effects.

B. The Federal Migratory Bird Act from the U.S. Fish & Wildlife Service forbids Contractors from moving or destroying a nest that has eggs, chicks, or young birds in it. If live birds and eggs are present at the Project Site, the Contracting Officer needs to be informed, and the Contractor must seek approval from the NPS to cautiously work around any live animals and their offspring/eggs.

3.3 CLEANUP OF ANIMAL URINE, DROPPINGS, AND CONTAMINATED SURFACES

A. Prior to cleaning areas such as sheds, outbuildings, or attics, ventilate the area by opening doors or windows to the outdoors for at least 30 minutes. Provide cross ventilation where possible.

B. Utilize appropriate Personal Protective Equipment (PPE).

C. Spray all animal urine and the droppings with a disinfectant or chlorine solution until thoroughly soaked.

D. To avoid generating potentially infectious aerosols, do not vacuum or sweep the animal urine, droppings, or contaminated surfaces until they have been disinfected.

E. Use a paper towel to absorb the animal urine and pick up the droppings. Place the paper towel in the garbage.

F. After animal droppings and urine have been removed, disinfect items that might have been contaminated by animals or their urine and droppings.
   1. Mop floors with a disinfectant or chlorine solution.
   2. Disinfect countertops, cabinets, drawers, and other durable surfaces with a disinfectant or chlorine solution.
   3. Disinfect carpets with a disinfectant or commercial-grade steam cleaner or shampoo.
   4. Steam-clean or shampoo rugs and upholstered furniture.
   5. Leave books, papers, and other items that cannot be thrown away or cleaned with a liquid disinfectant outdoors in the sunlight for several hours or in an indoor area free of rodents for approximately one week before cleanup. After that time, the virus should no longer be infectious. However, to further reduce risk, wear rubber, latex, vinyl, or nitrile gloves and wipe the items with a cloth moistened with disinfectant.

3.4 CLEAN UP OF DEAD ANIMALS AND NESTS

A. Utilize appropriate PPE.

B. Use insect repellent (containing DEET) on clothing, socks, and arms to reduce the risk of fleabites that might transmit the plague.

C. Spray dead animals and nests with a disinfectant or a chlorine solution, soaking them thoroughly.

Wait 10 minutes before disturbing to ensure the inactivation of the virus.

D. Place the dead animal or nest in a plastic bag or remove the dead rodent from the trap and place it within a plastic bag. When the cleanup is complete (or when the bag is full), seal the bag, place it into a second plastic bag, and seal the second bag. Dispose of the material in the double bag by burning it or discarding it in a covered trash can that is regularly emptied.

E. Clean up the surrounding area(s) as described in Section 3.3 - Cleanup of Animal Urine and Droppings and Contaminated Surfaces above.

3.5 VERIFICATION OF RODENT EXCLUSION ACTIVITIES

A. The Contractor will procure the services of a third-party rodent and bird exclusion specialist to verify the animal exclusion activities.

B. The selected third-party specialist will document the measures taken to prevent animals from entering the Project Site.

END OF SECTION 10 81 19

SECTION 12 20 00 – WINDOW TREATMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated, cellular shades.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood blocking and grounds for mounting shades and accessories.
2. Section 07 92 00 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
b. Include rated capacities, operating characteristics, features, and furnished accessories.

B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type and color of shadeband material and for each type of exposed finish.

1. Include Samples of accessories involving color selection.

C. Samples for Verification: Actual sample of finished products for each type of shade including actual shadeband material and installation accessories.

1. Size: Manufacturers' standard size.

D. Product Schedule: For shades. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of shadeband material.

B. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

C. Qualification Statements: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For shades.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Government that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cellular Shades: Full-size units equal to 3 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units. Include mounting accessories.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Contracting Officer of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of products that fail in materials or workmanship within specified warranty period.

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

a. Defects in materials and workmanship beyond normal wear and tear.
b. Faulty operation of operating system components.
c. Deterioration of fabric beyond normal use.

2. Warranty Period:

a. Window Shades: Five year(s) from date of Substantial Completion.
b. Fabric: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Window Covering Safety Standard: Provide window shades that comply with WCMA A100.1.

B. Fire Performance: Tested in accordance with and meeting the flame propagation performance criteria of Test 1 or Test 2, as appropriate, of NFPA 701; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Accessibility Standards: Comply with applicable provisions in ICC A117.1 for window shades designated as accessible.

D. Color-coordinated headrail, bottom rail, and end caps

2.2 MANUAL OPERATION

A. Manual Corded Operation:

1. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

a. Bead Chains: Manufacturer's standard bead chain with WCMA A100.1 compliant tension device installed on window shade by manufacturer and mounted on jamb.

1) Loop Length: Full length of shade.
2) Limit Stops: Provide upper and lower ball stops.

2.3 SHADEBAND MATERIALS

A. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Cellular shade manufacturer.
2. Type: Double cellular 9/16” pleats with D-cell construction
3. Thickness: ½”

4. Roll Width: Match width of window as indicated on drawings.
5. Color: As selected by Contracting Officer from manufacturer's full range.

    a. Basis of Design: Off-white

B. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.

1. Source: Cellular shade manufacturer.
2. Type: Double cellular 9/16” pleats with D-cell construction with blackout
3. Thickness: ½”
4. Roll Width: Match width of window as indicated on drawings.
5. Color: As selected by Contracting Officer from manufacturer's full range.

    a. Basis of Design: Off-white

2.4 FABRICATION OF WINDOW SHADES

A. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Inside of Jamb Installation: Width and length as indicated on Drawings with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

B. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF WINDOW SHADES

A. Install shades level, plumb, aligned and centered on openings, and aligned with adjacent units in accordance with manufacturer's written instructions.

1. Mount on new wood blocking rather than historic trim.

B. Shade Locations: As indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance window shades to operate smoothly, easily, safely, and free from binding or malfunction through full operational range.

3.4 CLEANING AND PROTECTION

A. Clean window shade surfaces, after installation, in accordance with manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that window shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged shades that cannot be repaired, in a manner approved by Contracting Officer, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Park maintenance personnel to adjust, operate, and maintain window shades.

END OF SECTION 12 20 00

SECTION 12 32 13 - MANUFACTURED WOOD-VENEER-FACED CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood-veneer-faced casework at Break Room 118.
2. Hardware and accessories.

B. Related Requirements:

1. Section 01 60 00 "Product Requirements"
2. Section 06 10 00 "Rough Carpentry" for wood blocking for anchoring casework.
3. Section 12 36 61 “Simulated Stone Countertops”

1.2 DEFINITIONS

A. Definitions in the AWI/AWMAC/WI's "Architectural Woodwork Standards" apply to the Work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Wood-veneer-faced casework.
2. Hardware and accessories.

B. Shop Drawings: For wood-veneer-faced casework.

1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
2. Indicate types and sizes of casework.

3. Indicate manufacturer's catalog numbers for casework.
4. Show fabrication details, including types and locations of hardware.
5. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.
6. Apply AWI's Quality Certification Program label to Shop Drawings.
7. Indicate ABAAS dimensions with the countertop materials.

C. Samples: For casework and hardware finishes.

D. Samples for Initial Selection: For casework and hardware finishes.

E. Samples for Verification: For the following:

1. Casework Finishes: 8-by-10-inch Samples for each type and color of finish.
2. Base Cabinet: One full-size, 16-inch- wide, finished base cabinet complete with hardware, doors, and drawers but without countertop.
3. Wall Cabinet: One full-size, 12-inch- wide, finished wall cabinet complete with hardware, doors, and adjustable shelves.
4. Full-Size Samples: Maintain at Project site during construction in an undisturbed condition as a standard for judging the completed Work. Unless otherwise indicated, approved sample units may become part of the completed Work if in undisturbed condition at time of Substantial Completion. Notify Contracting Officer of their locations.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI's Quality Certification Program certificates.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish complete touchup kit for each casework finish provided. Include fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged casework finish.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during remainder of construction period. Maintain temperature and relative humidity during remainder of construction period in range recommended for Project location by the AWI/AWMAC/WI's "Architectural Woodwork Standards."

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.

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

a. Delamination of components or other failures of glue bond.
b. Warping of components.
c. Failure of operating hardware.
d. Deterioration of finishes.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CASEWORK

A. Quality Standard: Unless otherwise indicated, comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

1. Grade: Economy.
2. Provide labels and certificates from AWI certification program indicating that casework complies with requirements of grades specified.

a. Contractor to register the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 855-345-0991.

B. Product Designations:

1. Drawings indicate sizes, configurations, and finish materials of manufactured wood-veneer-faced casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered. See Section 01 60 00 "Product Requirements."

2.2 HARDWARE AND ACCESSORIES

A. Hardware: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.

1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, Type B01602, self-closing. Provide two hinges for doors less than 48 inches high and provide three hinges for doors more than 48 inches high.

1. Degrees of Opening: 100 degrees.

C. Pulls: Solid aluminum cabinet and drawer pulls, fastened from back with two screws.

1. Length: three inches
2. Width: ¾ inches
3. Projection: 1 ¾ inches
4. Finish: Black
5. Provide two pulls for drawers more than 24 inches wide.

D. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.

1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
2. Drawers: Provide one bumper on back side of drawer front at each corner.

E. Drawer Slides: ANSI/BHMA A156.9.

1. Manufacturer's standard.
2. Standard Duty (Grade 1): Side mount.
3. General-purpose drawers; provide 100 lb load capacity.

F. Adjustable Shelf Supports:

1. Pin-type, two-pin-locking plastic shelf rests complying with ANSI/BHMA A156.9, Type B04013.

2.3 MATERIALS

A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

B. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated. 5-ply minimum.

C. Hardboard: ANSI A135.4, Class 1 tempered.

D. Design: Frameless cabinet construction with the following door and drawer-front style:

1. Flush overlay.

E. Wood Species: White Maple.

1. Wood Stain Colors and Finishes: to match stain of adjacent wood trim, color as selected by Contracting Officer from Manufacturer's full line.

F. Face Veneer Cut: Quarter sliced.

G. Veneer Matching:

1. Provide veneers for each cabinet from a single flitch, slip and running matched.

a. Provide continuous matching of adjacent drawer fronts within each cabinet.

H. Grain Direction:

1. Doors: Vertical with continuous vertical matching.
2. Drawer Fronts: Horizontal.
3. Face Frame Members: Lengthwise.
4. End Panels: Vertical.
5. Bottoms and Tops of Units: Side to side.
6. Knee Space Panels: Vertical.
7. Aprons: Horizontal.

I. Exposed Materials:

1. Plywood: Hardwood plywood with face veneer of species indicated, selected for compatible color and grain. Provide backs of same species as faces.
2. Edgebanding: Solid wood, minimum 1/8 inch thick and of same species as face veneer .

J. Semiexposed Materials:

1. Wood: Provide solid wood or hardwood plywood for semiexposed surfaces unless otherwise indicated.

a. Plywood: Hardwood plywood of same species as exposed wood. Provide backs of same species as faces.

K. Concealed Materials:

1. Plywood: Hardwood plywood. Provide backs of same species as faces.

2.4 FABRICATION

A. Wood-Veneer-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms of Cabinets and Tops of Wall Cabinets: 3/4-inch- thick, veneer-core hardwood plywood.
2. Ends of Cabinets: 3/4-inch- thick, hardwood plywood.
3. Shelves: 3/4-inch- thick, veneer-core hardwood plywood or 1-inch- thick, particleboard-core hardwood plywood.
4. Base Cabinet Top Frames: 3/4-by-2-inch solid wood with mortise and tenon or doweled connections, glued and pinned or screwed.
5. Base Cabinet Stretchers: 3/4-by-4-1/2-inch plywood, particleboard, or MDF strips or solid-wood boards at front and back of cabinet, glued and pinned or screwed. May be provided as an option to base cabinet top frames.
6. Base Cabinet Subtops: 3/4-inch- thick plywood.
7. Backs of Cabinets: 3/4-inch- thick, particleboard-core hardwood plywood where exposed, 1/4-inch- thick hardboard,1/2-inch- thick hardwood plywood, dadoed into sides, bottoms, and tops where not exposed.
8. Drawer Fronts: 3/4-inch- thick, particleboard-core hardwood plywood or solid hardwood.
9. Drawer Sides and Backs: 1/2-inch- thick, solid-wood or veneer-core hardwood plywood, with glued dovetail or multiple-dowel joints.
10. Drawer Bottoms: 1/4-inch- thick, veneer-core hardwood plywood, glued and dadoed into front, back, and sides of drawers. Use 1/2-inch- thick material for drawers more than 24 inches wide.
11. Drawer Bodies: Steel drawer pans formed from 0.036-inch- thick metal, metallic phosphate treated, and finished with manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat with a minimum dry film thickness of 1 mil for topcoat and 2 mils for system.
12. Cabinet Doors:

    a. 48 Inches (1220 mm) or Less in Height: 3/4 inch thick, with solid hardwood stiles and rails, particleboard or MDF cores, and hardwood face veneers and crossbands.
    b. 48 Inches (1220 mm) or More in Height: 1-1/16 inches thick, with solid hardwood stiles and rails, honeycomb cores, and hardwood face veneers and crossbands.

B. Floating Shelves constructed of same materials to match adjacent casework.

C. Filler Strips: Provide as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as casework.

2.5 FINISH

A. Preparation: Sand lumber and plywood before assembling. Sand edges of doors and drawer fronts and molded shapes with profile-edge sander. Sand casework after assembling for uniform smoothness at least equivalent to that produced by 220-grit sanding and without machine marks, cross sanding, or other surface blemishes.

B. Staining: Remove fibers and dust and apply wash-coat sealer and stain to exposed and semi exposed surfaces as required to provide uniform color and to match approved Samples.

C. Finishing Open-Grain Woods: Apply manufacturer's standard three-coat, baked, clear finish consisting of a thermosetting catalyzed sealer and two coats of a thermosetting catalyzed conversion varnish. Sand and wipe clean between applications of sealer and topcoat and between topcoats. Topcoats may be omitted on concealed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Grade: Install casework to comply with same quality standard grade as item to be installed.

B. Install casework level, plumb, and true in line; shim as required using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.

D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten cabinets to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.

E. Fasten casework to adjacent units and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards."

F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

G. Adjust operating hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity to prepare and submit report of inspection.

B. Contractor will commence inspection immediately after finishing work. Observations, measurements and other notes will be recorded using DSC-CQC Accessibility Inspection Report as basis. Report can include digital images, product literature, drawings and sketches, etc. to communicate conditions, especially items not in compliance with ABAAS. Submit report to CO within 24 hours of commencing inspection.

3.4 CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Contracting Officer.

END OF SECTION 12 32 13

SECTION 12 36 61 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertop and backsplash.

B. Related Requirements:

1. Section 12 32 13 “Manufactured Wood-Veneer-Faced Casework”
2. Division 22 for drop-in sink and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of countertop material and sink.

B. Shop Drawings:

1. Plans, sections, details, edge and backsplash profiles, cutouts for plumbing fixtures, and attachment to other work.
2. Locations and details of joints.
3. Locations, quantity, and type of supports/brackets.
4. Direction of directional pattern, if any.
5. Apply AWI's Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification:

1. Countertop material, 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include product data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.7 FIELD CONDITIONS

A. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Quality Standard: Unless otherwise indicated, comply with ANSI/AWI 1236 for grades of simulated stone countertops indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that countertops comply with requirements of grade specified.

B. Performance/Design Criteria:

Property	**Requirement (min or max)**	**Test Procedure**
C. Tensile Strength	6000 psi min	ASTM D638
D. Tensile Modulus	1.5×10^6 psi min	ASTM D638
E. Tensile Elongation	0.4% min.	ASTM D638

F. Flexural Strength	10000 psi min		ASTM D790
G. Flexural Modulus	1.2 x 10^6 psi min		ASTM D790
H. Hardness	>85-Rockwell "M" scale min.		ASTM D785
I. Thermal Expansion	2.2 x 10^{-5} in./in./°F		ASTM E228
J. Fungi and Bacteria	Does not support microbial growth		ASTM G21 & G22
K. Microbial Resistance	Highly resistant to mold growth		UL 2824
L. Ball Impact	No fracture - 1/2 lb. Ball:		NEMA LD 3 6 mm slab - 36" drop Method 3.8, 12 mm slab - 144" drop
M. Weatherability	ΔE*94<5 in 1,000 hrs		ASTM G155
N. Flammability			ASTM E84, NFPA 255 & UL 723
All Colors	**6 mm**	**12 mm**	
O. Flame Spread	<25	<25	
P. Smoke Developed	<25	<25	
Q. Class	A	A	NFPA 101®, Life Safety Code

2.2 SOLID SURFACE MATERIAL COUNTERTOPS AND BACKSPLASH

A. Solid Surface Countertop Type:

1. Grade: Premium.
2. Finish: Ensure surfaces have uniform finish.

a. Color: White

1) Basis of Design: Corian “Designer White”

b. Matte, with a 60° gloss rating of 5 - 20.

3. Profile: ¾” thick, pencil profile.

B. Solid Surface Backsplash:

1. Match countertop material grade and finish.
2. Height: 4”
3. Thickness: 1/2”

2.3 FABRICATION

A. Fabricate countertops in sizes and shapes required to comply with requirements indicated.

B. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

C. Joints:

1. Fabricate countertops without joints.

D. Cutouts and Holes:

1. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
2. Fittings: Drill countertops in shop for grommets, plumbing fittings, undercounter soap dispensers, and similar items.

2.4 INSTALLATION MATERIALS

A. Particleboard: ANSI A208.1, Grade M-2.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

C. Adhesive: Product recommended by manufacturer.

D. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.3 INSTALLATION OF SIMULATED STONE COUNTERTOPS

A. Grade: Install countertops to comply with specified grade.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts not finished in the shop. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

C. Countertop Installation:

1. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
3. Anchor wall cleating necessary for proper setting for countertops not supported by casework.
4. Install countertops level to a tolerance of 1/8 inch in 8 ft., 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
5. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
6. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
7. Secure countertops to subtops with adhesive according to manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
8. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

    a. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
    b. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

9. Install backsplashes and end splashes by adhering to wall and countertops with

adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

10. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls. Comply with Section 07 92 00 "Joint Sealants."

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semi-exposed surfaces.

C. Protection: Provide protective paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 12 36 61

SECTION 12 48 13 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient entrance mats.
2. Recessed frames.

1.2 COORDINATION

A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.

B. Shop Drawings:

1. Items penetrating floor mats and frames, including door control devices.
2. Divisions between mat sections.
3. Perimeter floor frames.
4. Custom Graphics: Scale drawing indicating colors.

C. Samples: For the following products, in manufacturer's standard sizes:

1. Floor Mat: Assembled sections of floor mat.
2. Tread Rail: Sample of each type and color.
3. Frame Members: Sample of each type and color.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

1.5 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. Resilient-Tile Entrance Mats: Full-size tile units equal to 2 percent of amount

installed, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Structural Performance: Provide roll-up rail mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:

1. Uniform floor load of 300 lbf/sq. ft..
2. Wheel load of 350 lb per wheel.

B. Accessibility Standard: Comply with applicable provisions in ICC A117.1.

2.2 FRAMES

A. Recessed Frames: Manufacturer's standard extrusion.

1. Architectural Bronze: ASTM B455, Alloy UNS No. C38500.

2.3 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.4 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.5 COPPER-ALLOY (BRONZE) FINISHES

A. Finish designations prefixed by CDA comply with the system established by the Copper Development Association for designating copper-alloy finishes, as defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

   a. Run grain of directional finishes with long dimension of each piece.

B. CDA Mechanical Finish Designation: M11, specular, as fabricated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth,and other conditions affecting installation of floor mats and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install recessed mat frames and mats to comply with manufacturer's written instructions so that tops of mats will be flush with adjoining finished flooring. Set mats with tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.

1. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.
3. Delay setting mats until construction traffic has ended.

3.3 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 12 48 13

12 93 13 – PICNIC TABLES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to this section.

1.2 SUMMARY

A. Provide factory-manufactured, precast concrete picnic tables meeting ABAAS requirements and Rocky Mountain National Park (ROMO) durability, environmental, and aesthetic standards.
B. Work includes:
    1. Precast concrete table assemblies
    2. Accessible (ABAAS-compliant) picnic tables
    3. Anchorage and hardware
    4. Delivery and installation at locations shown on drawings.
C. Coordinate with Park staff to ensure protection of natural and cultural resources during installation.

1.3 REFERENCES

A. Architectural Barriers Act Accessibility Standards (ABAAS)
B. ASTM and ACI standards listed in Part 2
C. NPS Rocky Mountain National Park Design Standards (latest edition)
D. NPS Director's Order 10: Environmental Leadership
E. NPS Director's Order 28: Cultural Resource Management

1.4 SUBMITTALS

A. Product Data:
    1. Manufacturer's catalog sheets, dimensions, weights, finishes
    2. Concrete mix design
    3. Reinforcement details
    4. Anchorage requirements
B. Shop Drawings:
    1. Plan, elevation, and section views
    2. Reinforcement layout
    3. Lifting inserts and hardware
C. Samples:
    1. Concrete color and finish sample, minimum 4 in. x 4 in.
D. Quality Assurance Submittals:
    1. Concrete strength test reports
    2. Manufacturer certification of ABAAS compliance
E. Closeout Submittals**:**
    1. Maintenance recommendations
    2. Warranty documentation

1.5 QUALITY ASSURANCE

A. Manufacturer shall have minimum 5 years' experience producing precast concrete site furnishings for public lands.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original packaging.
B. Store off ground on non-staining supports.
C. Protect from chipping, staining, and moisture.
D. Avoid damage to vegetation, soils, and cultural resources during handling.

1.7 WARRANTY

A. Provide manufacturer's standard warranty.
B. Warranty shall cover cracking, spalling, and structural failure.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Precast concrete picnic table meeting ABAAS requirements and ROMO standards.
B. Acceptable manufacturers:
    1. NPS-approved precast concrete site furnishing manufacturers.
    2. Or approved equal meeting all requirements of this specification.

2.2 MATERIALS

A. Precast Concrete:
    1. Concrete mix design to include 7 sacks Portland cement per yard with minimum rock size of 3/4".
    2. Minimum compressive strength: 7,000 psi at 28 days
    3. Air entrainment: 5–7%
    4. Cement: ASTM C150 Type I or II
    5. Aggregates: ASTM C33
    6. Water-cement ratio: Maximum 0.45
    7. Mix designed for freeze-thaw durability at project site elevations
B. Reinforcement**:**
    1. ASTM A615 Grade 60 or ASTM A775 epoxy-coated
    2. Table will be reinforced with #4 and #5 rebar grid.
    3. Minimum cover: 1.5 in.
C. Hardware:
    1. Stainless steel Type 304 or 316
    2. Vandal-resistant fasteners where exposed

2.3 PICNIC TABLE ASSEMBLY

A. Requirements:
    1. Table length shall be 96”.
    2. Table width shall be 37”
    3. Seats to be 72” long by 12” wide.
    4. Seat height shall be 17” to 19”.
    5. Tabletop surface shall be 34” in height.
    6. Tabletop and seat planks shall be between 4” thick.
    7. Table to comply with ABASS guidelines for wheelchair seating at one end.
    8. The end of table that provides wheelchair seating, knee and toe clearance complying with ABASS section 306 shall be provided.
    9. Tabletop to be woodgrain appearance.
    10. Table seats to be woodgrain appearance.
    11. Table will have ¾” chamfer on all edges of top, seats and legs. Color to be two tone dyed cement with tabletop and seats being (Davis Colors) Sequoia Sand and the legs being (Davis Colors) Kailua, or equivalent.
    12. National Park Service logo to be cast in 3D on outside of both legs (reverse image wood mold/template to be supplied by NPS.
    13. The reverse image logo is 6” high, 5” wide at the widest point, and approximately ¾” deep.
    14. All concrete to be sealed with Matte finish.
    15. 18” bolts are acceptable and must be recessed flush with the surface of the tabletop and bench planks. All hardware and brackets shall be galvanized and sized and located to provide sufficient structural integrity for the intended use and for transport and setting while fully assembled.
    16. Tables are to be delivered assembled, squared, and tightened in not in one-piece. If tables are assembled on site, all trash and packing material must be disposed of by manufacturer before vacating the property.
    17. The manufacturer shall guarantee that the materials supplied will not be susceptible to alkali silica reaction under any conditions of use. The guarantee ensures that the materials have been tested and proven to be resistant to alkali silica reaction, thereby preventing any potential deterioration or damage caused by this reaction. The manufacturer commits to providing documentation and evidence of such testing upon request, ensuring the long-term durability and reliability of the materials supplied.

2.4 FABRICATION

A. Fabricate components in steel molds to ensure dimensional consistency.
B. Reinforcement shall be securely tied and supported to maintain required cover.
C. Provide lifting points that do not mar visible surfaces.
D. Cure concrete in controlled conditions to achieve required strength.
E. Fabrication shall minimize visible seams and imperfections.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify installation locations with NPS Representative.
B. Confirm concrete pads or bases are level and properly compacted and sized.

3.2 INSTALLATION

A. Install picnic tables in accordance with manufacturer's instructions and drawings.
B. Ensure accessible tables are oriented to provide clear approach and maneuvering space.
C. Anchor tables securely using specified hardware.
D. Avoid disturbance to surrounding natural features.
E. Restore any disturbed areas to ROMO standards.

3.3 ADJUSTING AND CLEANING

A. Remove debris, stains, and installation residue.
B. Repair minor chips with manufacturer-approved patching compound.
C. Replace components that are cracked or structurally damaged.

3.4 PROTECTION

A. Protect installed tables from damage until final acceptance by NPS.
B. Ensure site is left clean and free of construction impacts.

END OF SECTION 12 93 13

SECTION 21 00 00 - FIRE SUPPRESSION BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in this Section applies to Division 21, Fire Suppression work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Park's use of fire protection systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, and Contracting Officer/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly, and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete Item of work furnished.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability, or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Contracting Officer for consideration, in accordance with Division 01, General Requirements, and approved by the Contracting Officer.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, insurance underwriter, Contracting Officer, and other reviewing entities whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Content of Section applies to Division 21, Fire Suppression Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
   a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
   b. Drawings
   c. Addenda
   d. Contracting Officer/Contractor Agreement

e. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 21, Fire Suppression Sections, and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements, and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. International Code Council:
   a. International Building Code (IBC)
   b. International Fire Code (IFC)
   c. International Existing Building Code (IEBC)

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABAAS - Architectural Barriers Act Accessibility Standards
2. AHRI - Air-Conditioning Heating & Refrigeration Institute
3. ANSI - American National Standards Institute
4. ASCE - American Society of Civil Engineers
5. ASCE-7 Minimum Design Loads for Buildings and Other Structures
6. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
7. ASHRAE Guideline 0, the Commissioning Process
8. ASME - American Society of Mechanical Engineers
9. ASPE - American Society of Plumbing Engineers
10. ASSE - American Society of Sanitary Engineering
11. ASTM - ASTM International
12. AWWA - American Water Works Association
13. CFR - Code of Federal Regulations
14. EPA - Environmental Protection Agency
15. ETL - Electrical Testing Laboratories
16. FCC - Federal Communications Commission
17. FM - FM Global
18. FM Global - FM Global Approval Guide
19. ICC - International Code Council
20. IEC - International Electrotechnical Commission
21. ICC-ESR - International Code Council Evaluation Service Reports
22. HI - Hydraulic Institute Standards
23. ISO - International Organization for Standardization
24. MSS - Manufacturers Standardization Society
25. NEC - National Electric Code
26. NEMA - National Electrical Manufacturers Association

27. NFPA - National Fire Protection Association:
    a. NFPA 13 - Standard for the Installation of Sprinkler Systems
    b. NFPA 24 - Standard for Installation of Private Fire Service Mains and Their Appurtenances
    c. NFPA 25 - Standard for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
    d. NFPA 70 - National Electrical Code
    e. NFPA 72 - National Fire Alarm and Signaling Code
28. OSHA - Occupational Safety and Health Administration
29. UL - Underwriters Laboratories Inc.

D. See Division 21, Fire Suppression individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 21, Fire Suppression sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

D. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Contracting Officer on all transmissions/submissions.

E. Submit shop drawings, calculations, and product data sheets as one complete stand-alone package to the Contracting Officer.

F. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 21, Fire Suppression Sections.

G. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval.

H. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.

1. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed Item. Highlight connections by/to other trades.
2. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished, or provided. Reference Division 21, Fire Suppression specification Sections for specific Item required in product data submittal outside of these requirements.
3. See Division 21, Fire Suppression Sections for additional submittal requirements outside of these requirements.

I. Maximum of two reviews provided of complete submittal package. Arrange for additional reviews and/or early review of long-lead items. Incomplete submittal documentation will be returned to without review. Contractor must arrange for, and bear costs of, the reviewing entity's additional reviews.

J. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Contracting Officer's comments. Identify Contracting Officer's comments and provide an individual response to each of the Contracting Officer's comments. Cloud changes in the submittals and further identify changes which are in response to Contracting Officer's comments.

K. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 21, Fire Suppression coordination documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety and Security submittals.

L. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

M. Substitutions and Variation from Basis of Design:

1. The Basis of Design designated product where provided in the specifications or on the drawings, establishes the parameters used for space planning coordination with other disciplines.
2. If substitutions from the basis of design and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished.

3. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Contracting Officer for approval prior to purchase, delivery, or installation.

N. Shop Drawings:

1. Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout, pipe layout, hanger layout, sway brace layout, seismic restraints, sway brace calculations, drains, location of drain discharge, risers, valves, details, water test information, physical device layout plans, and control wiring diagrams. Reference individual Division 21, Fire Suppression Sections for additional requirements for shop drawings outside of these requirements.
2. Shop Drawings, hydraulic calculations, and the like to be prepared under the direct supervision and control of a Professional competent to do such work and licensed in the state of Colorado.
3. Provide Shop Drawings which indicate information required by NFPA 13. Include room names and fire sprinkler occupancy hazard classifications.
4. Provide Shop Drawings illustrating information for Hydraulic Information Sign for each hydraulic remote area calculated.
5. Utilizing the Reflected Ceiling backgrounds, provide Shop Drawings illustrating locations of fire sprinklers and piping.
6. Provide Shop Drawings illustrating each type of hanger, including fasteners to structure.
7. Provide Shop Drawings illustrating information for Sprinkler System General Information Sign.
8. Shop Drawings to include a cross-sectional view that shows the sprinkler heads and piping in relation to the building's architectural and structural information. View to be chosen based on a location that will display the most information.
9. Clearly indicate the elevation of the highest sprinkler in relation to the elevation of the flow test pressure gauge monitor hydrant.
10. On the drawings, provide a list of number, model, temperature, sprinkler Identification number, manufacturer, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the spare sprinkler cabinet and the issue date or revision date of the list.
11. Spare sprinkler head cabinet size indicating the number of spare sprinkler head to be contained therein.

O. Samples: Provide samples when requested by individual Sections.

P. Resubmission Requirements:

1. Make any corrections or change in submittals when required. Provide submittals as specified. The Contracting Officer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Clearly indicate changes on Drawings and cloud changes in the submittals.

2. Resubmit for review until review indicates no exceptions taken or make "corrections as noted".

Q. Operation and Maintenance (O&M) Manuals:

1. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or Item requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
   a. Include copies of certificates of code authority acceptance, code-required acceptance tests, test reports and certificates.
   b. Include Warranty per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 21, Fire Suppression Sections.
   c. Catalog description of each Item of equipment installed on job.
   d. Instructions for operation and maintenance of fire suppression systems composed of operating instructions, maintenance instructions and manufacturer's literature as follows:
      1) Testing and Maintenance Schedule Chart: Provide an 8-1/2- by 11-inch typewritten list of each item of installed equipment requiring testing inspection, lubrication, or service, describing and scheduling performance of maintenance.
      2) Manufacturer's Literature: Provide copies of manufacturer's instructions for operation and maintenance of fire suppression equipment, including replacement parts list with name and address of nearest distributor. Mark each copy with equipment identification label as listed in equipment schedule, i.e., F-5 etc.
   e. Include product certificates of warranties and guarantees.
   f. Include Record Drawings.
   g. Include hydraulic calculations and a copy of water supply flow test used as basis for hydraulic calculations.
   h. Include Contractor’s Material and Test Certificates for Aboveground Piping/Underground Piping.
   i. Include a copy of NFPA 25.
   j. Include a copy of valve charts and whether normally open or normally closed.
   k. Include a copy of drain, auxiliary, and low point drains charts.
   l. Include a copy of the list to be included in the spare sprinkler head box.
   m. Include copy of approved submittal data along with submittal review letters received from Contracting Officer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.

n. Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, and quantities relevant to each piece of equipment: i.e., belts, motors, lubricants, and filters.

o. Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.

p. Incomplete submittal documentation will be returned to without review. Contractor must arrange for, and bear costs of, the reviewing entity's additional reviews.

2. Thoroughly instruct Park Staff as directed by the Contracting Officer in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 21 00 00, Fire Suppression Basic Requirements, Article titled "Demonstration".

3. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

R. Record Drawings:

1. Maintain at site at least one set of Drawings for recording "As-constructed" conditions. Indicate on Drawings changes to original documents by referencing revision documents, include buried elements, location of cleanouts, and location of concealed mechanical Item. Include items changed by field orders, supplemental instructions, and constructed conditions.

2. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.

3. Invert elevations and dimensioned locations for water services and drainage piping below grade extending to 5-feet outside building line.

4. Record Drawings to include site information or reference site information for complete understanding of the fire protection system between the building and the point of connection to the water supply and location of flow test pressure hydrants.

5. See Division 21, Fire Suppression individual Sections for additional items to include in Record Drawings.

S. Calculations: Submit hydraulic and the like calculations.

1. Hydraulic Calculations:

a. Include friction losses between the hydraulically most remote design area and the hydrant flow test pressure hydrant.

b. Hydraulic calculations to be performed on a nationally recognized fire sprinkler hydraulic calculation computer program, with cover sheets in the format required by the latest edition of NFPA 13. Hydraulic calculations performed “by hand” or not on a nationally recognized fire sprinkler hydraulic calculations computer program will be returned without review by Contracting Officer.

c. Provide one or more hydraulic calculations for each hydraulically most remote area.

d. Where it is not obvious which area is most hydraulically remote, perform and submit for review additional hydraulic calculations proving the hydraulically most remote area.

e. Include pressure losses between the highest sprinkler and the elevation of the pressure gauge monitor hydrant of the flow test.

f. Include friction loss for flexible branch line connectors per manufacturer's schedule of equivalent feet for device length, maximum number of bends and expected radius of bends.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every Item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Contracting Officer in writing before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulation materials.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 21, Fire Suppression Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements, and the General Conditions. Confirm requirements in all Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to sprinkler heads, pipe, fittings, hangers, and bracing materials.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products listed in manufacturer's printed catalog data and are to be UL, ETL, FM, and ICC-ES listed and labeled for their intended fire protection function or be approved by State, County, and City authorities prior to procurement and installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of Colorado, and Federal regulations relating to hazardous materials.
2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Contracting Officer.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 21, Fire Suppression Sections.

B. Install equipment requiring access (i.e., drains, control operators, valves, motors, engines, pumps, controllers, air compressors, gauges, fill cups, tanks, cleanouts, and the like) so that they may be serviced, reset, replaced, or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles, or crawlspaces which would impede, or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Contracting Officer prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents.
2. In absence of specific requirements, comply with the following:
   a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions specified. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
   b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
   c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection.
2. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork, and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM International E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors, or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating coordinating installation of piping systems.
2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums: Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Contracting Officer of discrepancy.

3.2 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 21, Fire Suppression Sections.

B. Notify Contracting Officer in writing at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground piping installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
5. When mains or branchlines are to be permanently concealed by construction or insulation systems.
6. When fire suppression systems, or portions of, are being tested and ready for inspection by AHJ.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Contracting Officer at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.3 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections, and the following:

B. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections, and the following:

1. Cutting and patching performed under Division 21, Fire Suppression includes, but is not limited to:
   a. Cutting and patching of gypsum or partitions.
   b. Cutting and patching of finished ceilings.
2. Perform cutting and patching by skilled craftsmen in trade of work to be performed. Fill holes which are cut oversized for completed work. Match refinished areas with existing adjacent finish in a manner acceptable to Contracting Officer.
3. When masonry to concrete construction must be penetrated, provide a steel pipe sleeve in opening and grout in place in a neat manner. Leave grout surface to match existing finish. Provide escutcheons. If sleeves are not provided, core drill penetrations.
4. Locate concealed utilities to eliminate potential service interruption or damage.
5. Additional work required by lack of proper coordination will be provided at no additional cost adjustment to the Contract.
6. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Contracting Officer/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Contracting Officer for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
7. Cutting, patching, and repairing for work specified in this Division including gypsum, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftspeople of each respective trade in conformance with appropriate Division of Work.
8. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
9. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, landscaping, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
10. Repair mutilation of building around pipes, equipment, hangers, and braces.

3.4 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing at no additional cost adjustment to the Contract.

3.5 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

B. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections, and the following:

1. Handle materials delivered to project site with care to avoid damage and deterioration. Store materials in original containers which identify manufacturer, name, brand, and model numbers on site inside building or protected from weather, sun, dirt, and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt, and/or dust because of improper storage to be replaced before installation.
2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect bright finished shafts, bearing housings and similar items until in service.

3.6 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 21, Fire Suppression Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Contracting Officer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Maintenance Staff as specified in Division 01, General Requirements and individual Division 21, Fire Suppression Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Contracting Officer to instruct maintenance personnel, correct defects, or deficiencies, and demonstrate to satisfaction of Contracting Officer that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

D. Prior to acceptance of work and during time designated by Contracting Officer, provide necessary qualified personnel to operate system for a period of two hours.

E. Instruct the Park Staff as directed by the Contracting Officer in the operation of the sprinkler system, including main valve position (open or closed) recognition, system drainage, system testing, dry pipe valve reset and the relation to the fire alarm system.

F. Upon completion of work and adjustment of equipment, test systems to demonstrate to Contracting Officer that equipment is furnished and installed or connected under provisions of these Specifications.

3.7 CLEANING

A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, and individual Division 21, Fire Suppression Sections.

B. Upon completion of installation, except for sprinklers, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

C. Sprinklers may not be cleaned except for vacuuming in a way no part of the sprinkler is touched by the vacuuming equipment. Replace sprinklers which bear traces of foreign substances with sprinklers of same model, temperature, K-factor, orifice, finish, style, orientation, and the like.

3.8 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 21, Fire Suppression Sections.

B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start-up equipment, in accordance with manufacturer's start-up instructions, in the presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment. Provide pump impellers to obtain Basis of Design design capacities.

D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.9 PAINTING

A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes.

3.10 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

B. In absence of specific requirements, comply with individual Sections in Division 21, Fire Suppression. System cannot be considered for acceptance until work is completed and demonstrated to Contracting Officer that installation is in strict compliance with Specifications, Drawings, and manufacturer's installation instructions, particularly in reference to following:

1. Testing reports including Contractor's Material and Test Certificate for Underground Piping, Contractor's Material and Test Certificate for Aboveground Piping, Contractor's Material and Test Certificate for Private Fire Service Mains, Fire pump acceptance test data report, and the like.
2. Cleaning
3. Operation and Maintenance Manuals
4. Training of Operating Personnel
5. Record Drawings
6. Warranty and Guaranty Certificates
7. Start-up/Test Document and Commissioning Reports
8. Letter of Conformance

3.11 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 21, Fire Suppression Sections.

B. Upon completion of installation of equipment, sprinklers, hose valves and piping and after units are water pressurized, test system to demonstrate capability and compliance with requirements. When possible, correct malfunctioning items at site, then retest to demonstrate compliance; otherwise remove and replace with new Item and proceed with retesting.

C. Inspect each installed Item for damage to finish. If feasible, restore and match finish to original, except fire sprinklers, at site; otherwise, remove Item and replace with new Item. Feasibility and match to be judged by Contracting Officer. Remove cracked or dented Item and replace with new Item.

D. Fire sprinklers may not be reused, or cleaned, except for dusting. Replace damaged, field painted, oversprayed, overcoated or field coated sprinklers with new sprinklers of same manufacturer, model, finish, K-factor, and performance characteristics. Where identical replacement sprinklers are not available, provide sprinklers of similar finish, style, K-factor, and performance characteristics.

3.12 LETTER OF CONFORMANCE

A. Provide Letter of Conformance and copies of manufacturers' warranties and extended warranties with a statement that fire suppression items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals.

B. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.13 CONNECTIONS TO EXISTING

A. Prior to connection of piping to existing piping or utilities, field verify existing conditions and exact sizes and locations of existing piping.

B. Provide additional offsets, transitions, joints, cut ins, and replace portions of existing as required to facilitate connections of new.

END OF SECTION

SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Buried Ductile Iron Pipe and Fittings
2. Buried Stainless Steel Pipe
3. Joint Restraints
4. Aboveground Black Steel Pipe and Fittings
5. Wall and Floor Penetrations and Sleeves
6. Switches, Valve Supervisory
7. Switches, Water Detector
8. Hangers and Supports
9. Struts and Strut Clamps
10. Anchors and Attachments
11. Pipe Stands
12. Gauges
13. Horn/Strobes
14. Fire Department Connection
15. Valves
16. Backflow Prevention Devices
17. Pipe, Valve, and Fire Protection Equipment Identification
18. Signs
19. Drains
20. Expansion Drum

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 22, Plumbing
2. Division 23, Heating, Ventilating and Air Conditioning
3. Division 26, Electrical
4. Division 28, Electronic Safety and Security
5. Division 31, Earthwork
6. Section 21 00 00, Fire Suppression Basic Requirements
7. Section 21 08 00, Commissioning of Fire Suppression Systems

8. Section 21 13 00, Fire Suppression Sprinkler Systems
9. Section 21 13 19, Fire Suppression Preaction Sprinkler Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. Meet requirements of ASCE 7, Minimum Design Loads for Buildings and Other Structures, by American Society of Civil Engineers, latest adopted edition.

1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Material and Equipment: Listed for its intended fire protection use in current UL Fire Protection Equipment Directory or UL Online Certifications Directory for Fire Protection. All material and equipment to be new and from a current manufacturer.
2. Provide per AHJ requirements.
3. References to product Specifications for materials are listed according to accepted ANSI, ASTM, ASME, AWWA and other base standards. Materials to meet latest approved versions of these standards.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 FLOW TEST

A. Flow: 715 GPM at a residual pressure of 52 PSI.

B. Static Pressure: 81 PSI.

C. Location: Existing hydrant at main entrance.

D. Elevation: 8,720-feet.

E. Date: August 30, 2024.

F. Information Provided By: Interface Engineering, Inc.

1.8 SYSTEM IMPAIRMENT

A. When returning a water-based fire protection system to service after impairment or control valve closure, verify the system is in working order by performing a main drain test per NFPA 25.

PART 2 - PRODUCTS

2.1 BURIED DUCTILE IRON PIPE AND FITTINGS

A. Salient Characteristics:

1. Pipe:
   a. Thickness: Class 52 ductile iron, AWWA C151.
   b. Pressure: 150 psi or 10.34 bar.
   c. Cement mortar lined per AWWA C104, field encased with 8 mil polyethylene bag per AWWA C105. Coat all bolts, restraining rods, and the like with bitumastic prior to encasement in the polyethylene bag.
2. Fittings: AWWA C110, 350 psi or 24.13 bar. Cement mortar lined per AWWA C104, field encased with 8 mil polyethylene bag per AWWA C105. Coat all bolts, restraining rods, and the like with bitumastic prior to encasement in the polyethylene bag.
3. Fittings restrained with thrust blocks or restraining rods per NFPA 24.
4. Underground Valves: Factory coated with powdered epoxy or equivalent corrosion resistant coating. Bolts coated with bitumastic in the field. Encase the entire valve in 8-mil polyethylene bag in accordance with AWWA C-105.
5. Flexible Underground Expansion Joints:
   a. AWWA C153, AWWA C116, AWWA C105.
   b. Expansion joint designed and cast as an integral part of a ball and socket type flexible joint.
   c. Internal and external epoxy lined.
   d. Sealing Gasket: EPDM.
   e. Polyethylene sleeve.

2.2 BURIED STAINLESS STEEL PIPE

A. Salient Characteristics:

1. Single extended 90 degree fitting of fabricated stainless steel tubing, maximum working pressure 200 PSI.
2. Grooved-end connection on building outlet side and CISPI coupler on underground inlet side.

2.3 JOINT RESTRAINTS

A. Salient Characteristics:

1. Mechanical joint wedge action for ductile iron pipe.
2. Gland: Ductile Iron.
3. Wedges: Ductile iron.
4. Full restraint pressure rating of pipe with minimum safety factor of 2:1.

2.4 ABOVEGROUND BLACK STEEL PIPE AND FITTINGS

A. Salient Characteristics:

1. General: ASTM A53, ASTM A135, or ASTM A795; Schedule 40 only.
2. Joints:
   a. Threaded, flanged or bevel welded.
   b. Piping installed in plenums or shafts to have welded joints.
3. Fittings:
   a. Threaded:
      1) Malleable Iron: Class 150 and Class 300, ANSI B16.3.
      2) Cast Iron: Class 125 and 250, ANSI B16.3.
   b. Flanged:
      1) Cast iron; Class 125 and 250, ASME B16.1.
      2) Raised ground face, bolt holes spot faced.
   c. Welded:
      1) Carbon Steel: Long radius, standard weight or extra strong.
      2) Factory Wrought Steel Buttweld Fittings: ASME B16.9.
      3) Buttwelding Ends for Pipe, Valves, Flanges and Fittings: ASME B16.25.
      4) Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures: ASTM A234.
      5) Steel Pipe Flanges and Flanged Fittings: ASME B16.5.
      6) Forged Steel Fittings, Socket Welded and Threaded: ASME B16.11.

d. Mechanical Fittings and Grooved Couplings:

1) Couplings: UL 213, AWWA C606, ASTM A536 ductile iron or ASTM A47 malleable iron, with enamel finish and grooves or shoulders designed to accept grooved couplings. Synthetic-rubber gasket with central-cavity, pressure-responsive design, and ASTM A183 carbon-steel bolts and nuts.

2) FM Global approved.

4. Anti-Microbial Coating: Factory-applied coating to inhibit corrosion from microbiological organisms.

2.5 WALL AND FLOOR PENETRATIONS AND SLEEVES

A. Salient Characteristics:

1. Below Grade and High Water Table Areas: Waterproof elastomeric compound.

2.6 SWITCHES, VALVE SUPERVISORY

A. Salient Characteristics:

1. Provide to mount on applicable, compatible valve (OS&Y gate, or PIV), with SPDT switches to match requirements of fire alarm system.
2. Provide with cover tamper switch where required by AHJ.

2.7 SWITCHES, WATER DETECTOR

A. Salient Characteristics:

1. Provide with cover tamper switch where required by AHJ.
2. Water Flow Switches:
   a. Vane-type; SPDT switches; electronic retard, adjustable time delay (0 to 75 seconds).
   b. Wet Sprinkler Systems: 450 PSI, 18-feet per second, 4-10 gpm.
3. Pressure Operated Alarm Switches: Pressure actuated with SPDT electrical switches and adjustable time delay (0 to 75 seconds).

2.8 HANGERS AND SUPPORTS

A. Salient Characteristics:

1. General: Select size of hangers and supports to exactly fit pipe size for bare piping.
2. Hangers: Ferrous.
3. Hanger Rods: Zinc electroplated carbon steel.

4. Finishes: Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
5. Materials: Use carbon steel pipe hangers and supports, metal trapeze pipe hangers and attachments for general service applications.

2.9 STRUTS AND STRUT CLAMPS

A. Salient Characteristics:

1. Electro-galvanized steel.
2. Designed for supporting pipe runs from strut supports.

2.10 ANCHORS AND ATTACHMENTS

A. Salient Characteristics:

1. Anchor supports to masonry, concrete and block walls per anchoring system manufacturer's recommendations, or as modified by project Structural Engineer.
2. Materials: Ferrous.

2.11 PIPE STANDS

A. Salient Characteristics:

1. Adjustable Pipe Saddle Support with Yoke:
   a. Designed to support horizontal pipe from floor stanchion.
   b. U-bolt and hex nuts to hold pipe securely to saddle or pipe clamp type.
   c. ANSI/MSS SP-69; SP-58. Type 37.
   d. Steel pipe with steel saddle.
2. Base Stand:
   a. Steel pipe welded to steel base plate.
   b. Meet requirements of 12X anchor diameter hole spacing for seismic applications.

2.12 PRESSURE GAUGES

A. Salient Characteristics:

1. 3-1/2-inch, dial type, bronze bourdon tube or spring type, stainless steel case.
2. 0 to 300 PSI.

2.13 HORN/STROBES

A. Salient Characteristics:

1. Combination Weatherproof Horn/Strobe:
   a. Flush wall mount, insect-proof. Provide horn/strobes that meet the latest requirements of NFPA 72.
   b. Provide manufacturer's weatherproof back box listed for use with appliance.

2.14 FIRE DEPARTMENT CONNECTION

A. Salient Characteristics:

1. General:
   a. Thread to match fire department hardware; automatic drip connected to drain; threaded dust cap and chain of same material and finish as body.
   b. Provide with individual clappers.
2. Type: Free-Standing Type.
3. Finish: Ductile Iron.
4. Inlet Size: 2-1/2-inch.
5. Number of Inlets: Two.
6. Outlet Size: 4-inch.
7. Size of Pipe between Fire Department Connection and Sprinkler System: 4-inch.
8. Drain: 3/4-inch automatic ball drip, to outside.
9. Sign: Auto Sprinkler Fire Department Connection.

2.15 VALVES

A. Salient Characteristics:

1. OS&Y Gate:
   a. 2-1/2-inches and Larger: Iron body.
   b. 2-inches and Smaller: Bronze body.
2. NRS Gate:
   a. Iron body. Non-rising stem with indicator post.
   b. Underground Butterfly Valves: Telescopic barrel type.
3. Swing Check: Iron body, rubber and bronze faced checks.
4. Wafer Check: Iron body, rubber seat, spring actuated.
5. Butterfly Valves: Ductile iron body with factory-installed tamper switches. Use lug body next to pumps.
6. Pressure Relief: Bronze body, stainless steel spring.
7. Automatic Ball Drip Drain Valve: Bronze, spring-type.
8. Three-Way Gauge Valve: Brass; rated to 300 psi.

9. Automatic Air-Release Valve for Wet Systems:
    a. Rated to 175 psi.
    b. Automatic float-type with shutoff mounted in a water retention pan.
    c. Single set 24VAC@2A for electronic supervision.
    d. Ball valve switch with cover tamper.
10. Ball Valves: Brass body, brass stem; forged brass ball disc.

2.16 BACKFLOW PREVENTION DEVICES

A. Salient Characteristics:

1. Double Check Valve Assembly:
    a. Two check valves in series with OS&Y gate or butterfly valves at each end.
    b. Provide detector if required by local utility.
    c. UL listed or FM Global Approved for fire suppression service as an assembly.
    d. Approved by local and state authorities, including project's State Department of Health for the position in which it is installed.
2. Reduced Pressure Principle Backflow Prevention Assembly:
    a. Control valves on inlet and outlet with indentation for monitoring switch and strainer on inlet.
    b. Two independent operating, spring-loaded check valves with a pressure differential relief valve located between the two checks valves.
    c. Relief valve air gap drain funnel.
    d. Provide leak detection.
    e. UL Listed or FM Global approved for fire suppression service as an assembly and approved by local authorities and project's State Department of Health.

2.17 PIPE, VALVE, AND FIRE PROTECTION EQUIPMENT IDENTIFICATION

A. Salient Characteristics:

1. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.
2. Corrosion-resistant chain or permanent adhesive.

2.18 SIGNS

A. Salient Characteristics:

1. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.
2. Corrosion-resistant chain or permanent adhesive.

2.19 DRAINS

A. Salient Characteristics:

1. Reference Aboveground Black Steel Pipe and Fittings.

2.20 EXPANSION TANK

A. Salient Characteristics:

1. Tank: Welded stainless steel.
2. Bladder: Nitrile rubber.
3. 1-inch NPT test and fill pipe connections.
4. Maximum Working Pressure: 175 psi.
5. Mounting strap from manufacturer.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in conformance with UL Listing, FM Approval or ICC-ES requirements and restrictions.

B. Install per manufacturer's instructions and recommendations.

3.2 BURIED DUCTILE IRON PIPE AND FITTINGS

A. Pipe Sleeves:

1. Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with nonshrinking firestopping, smokestopping and water stopping grout or approved equivalent caulking compound.
3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with nonshrinking caulking compound. Caulk/seal piping passing through fire-rated building assemblies with UL Listed or FM approved fire-rated firestopping compound. Provide fire-rated assemblies per local AHJ requirements.
4. Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations.

B. Buried Pipe:

1. Hydraulically calculated pipe to be of sufficient size to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.
2. Excavation and Backfill:
   a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.
   b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock, or other approved material at no additional cost adjustment to the Contract.
   c. Tests: During progress of work for compacted fill, Contracting Officer reserves right to request compaction tests made under direction of a testing laboratory.
   d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e., muck, peat, and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no additional cost adjustment to the Contract. Adequate width of trench for proper installation of piping or conduit.
   e. Support Foundations:
      1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction, and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
      2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost adjustment to the Contract.
      3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
      4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.

f. Backfilling:

1) Following installation and successful completion of required tests, backfill piping in lifts.

(a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.

(b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.

2) Backfill Material:

(a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand, or pea gravel.

(b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:

1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:

(a) Mechanical tamper,

(b) Vibratory compacter, or

(c) Other approved methods appropriate to conditions encountered.

2) Contracting Officer to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

C. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping and fittings against dirty water, chemicals, and mechanical damage both before and after installation. Restore to original condition or replace damaged pipe and fittings prior to final acceptance of work.

3.3 BURIED STAINLESS STEEL PIPE

A. Underground Steel Piping Corrosion Protection: Factory wrap uninsulated underground stainless steel piping systems with protective coating composed of a coal-tar saturated wrapping tape over a 20 mil thick coal-tar epoxy coating, equivalent to "Republic X-Tru-Coat." Wrap joints spirally with a minimum overlap of 1/2 tape width. Extend wrap not less than 3-inches above grade. Provide cathodic protection to meet requirements of governing authorities and servicing utility.

B. Buried Pipe:

1. Hydraulically calculated pipe to be of sufficient size to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.

2. Excavation and Backfill:
   a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.
   b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock, or other approved material at no additional cost adjustment to the Contract.
   c. Tests: During progress of work for compacted fill, Contracting Officer reserves right to request compaction tests made under direction of a testing laboratory.
   d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e., muck, peat, and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no additional cost adjustment to the Contract. Adequate width of trench for proper installation of piping or conduit.
   e. Support Foundations:
      1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction, and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
      2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost adjustment to the Contract.
      3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
      4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.
   f. Backfilling:
      1) Following installation and successful completion of required tests, backfill piping in lifts.
         (a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.

(b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.

2) Backfill Material:

(a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand, or pea gravel.

(b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:

1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:

(a) Mechanical tamper,

(b) Vibratory compacter, or

(c) Other approved methods appropriate to conditions encountered.

2) Contracting Officer to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

C. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping and fittings against dirty water, chemicals, and mechanical damage both before and after installation. Restore to original condition or replace damaged pipe and fittings prior to final acceptance of work.

3.4 JOINT RESTRAINTS

A. Reference 3.01, General Installation Requirements.

3.5 ABOVEGROUND BLACK STEEL PIPE AND FITTINGS

A. Piping Routing:

1. Orient horizontal routes parallel with walls and beam lines.
2. Install piping as shown or described by diagrams, details, and notations on Drawings or, if not indicated, install piping to provide the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.
3. Install piping in concealed spaces above finished ceilings. Prior to design and installation. obtain pre-approval by Contracting Officer for exposed piping.
4. In open-to-structure areas which are open to public view, route exposed piping to minimize visual impact. Obtain Contracting Officer's approval of exposed piping installation.

5. Coordinate installation with other trades. Route piping as required to avoid building structure, equipment, plumbing piping, HVAC piping, ductwork, lighting fixtures, electrical conduits and bus ducts and similar work. Final location of lighting will have priority over final sprinkler locations. Provide drains to trapped sections of system which result from such routing. Other trades take precedence for installation space.
6. Support piping adjacent to walls, overhead construction, columns, and other structural and permanent enclosure elements of the building. Limit clearance to 2-inches wherever furring is indicated for concealment of piping. Allow for insulation thickness. Locate insulated piping to provide minimum 1-inch clearance outside insulation.
7. Wherever possible in finished and occupied spaces, conceal piping from view by locating within column or beam enclosures, hollow wall construction, or above suspended ceilings. Do not encase horizontal routes in solid partitions, except where approved.
8. General Electrical Equipment Clearances: Do not route piping through electrical rooms, transformer vaults, elevator equipment rooms and other electrical or electronic equipment spaces and enclosures. Do not route piping above electric power or lighting panel, switchgear, low voltage panel, or similar electric device.
9. Rooms Protected by Alternative Systems: Route water filled and dry system piping around rooms protected by pre-action systems, clean agent systems, gaseous suppression systems and other alternative fire suppression systems.
10. Install pipe runs to minimize obstruction to other work.
11. Pitch all dry and pre-action system piping 1/4-inch per 10-feet for mains and 1/2-inch per 10-feet for branch lines, including pipe passing through both warm and cold areas.

B. Couplings:

1. Install where indicated on Drawings and on each side of pieces of equipment to permit easy removal of equipment.
2. Deburr cut edges.

C. Pipe Penetrations: Wire pipe cutout coupon at point of pipe penetration.

D. Pipe and Pipe Fittings:

1. Expansion and Flexibility: Install work with due regard for expansion and contraction to prevent damage to the piping, equipment, building and its contents. Provide piping offsets, loops, approved type expansion joints, sway bracing, wire restraints, vertical restraints, flexible couplings, or other means to control pipe movement and to minimize pipe forces.
2. Coordinate support of pipe 4-inches and larger with Structural Engineer.
3. Provide clearances around piping per NFPA 13.
4. Install dry and pre-action welded pipe with welds facing vertically up, or where this is not possible, as close as possible to vertical between 46 degrees and 234 degrees. Intent is to minimize corrosion caused by moisture in the bottom of pipes.

3.6 WALL AND FLOOR PENETRATIONS AND SLEEVES

A. Escutcheons: Install on exposed pipes passing through walls or floors.

1. Pipe Sleeves: Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with nonshrinking fire and water resistant grout or approved equivalent caulking compound. Caulk/seal piping penetrations through fire rated building walls and floors with listed, fire-rated assemblies. Provide fire-rated assemblies per local AHJ requirements.
3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Caulk/seal piping penetrations through fire rated building walls and floors with listed, fire-rated assemblies. Provide fire-rated assemblies per local AHJ requirements.
4. Beam Sleeves:
   a. Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings.
   b. Field cutting of beams not allowed without written approval of Structural Engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
5. Penetrations in Fire-Rated Wall/Floor Assemblies:
   a. Reference Division 07, Thermal and Moisture Protection.
   b. Coordinate with Drawings location of fire rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material.
   c. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814 and NFPA.
   d. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814.

3.7 SWITCHES, VALVE SUPERVISORY

A. Coordinate with Division 28, Electronic Safety and Security.

3.8 SWITCHES, WATER DETECTOR

A. Wire pipe cutout coupon at point of connection of switch to pipe.

B. Flow switches: Connect to system side of valves and drain connections.

C. Coordinate with Division 28, Electronic Safety and Security.

3.9 HANGERS AND SUPPORTS

A. Installation of pipe hangers, inserts and supports to conform to NFPA 13. Provide adjustable hangers, inserts, brackets, clamps, supplementary steel, and other accessory materials required for proper support of pipelines and equipment.

B. Provide supplementary materials for proper support and attachment of hangers.

3.10 STRUTS AND STRUT CLAMPS

A. Install per manufacturer's listed orientation.

3.11 ANCHORS AND ATTACHMENTS

A. In post-tension construction, determine location of post-tension cables and install anchors to avoid contact or interference with post-tension cables. Coordinate with Structural.

B. Do not use powder-driven attachments.

C. Building Attachments and Inserts: Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves and flanges, for sizes NPS 2-1/2 and larger. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

D. Hanger and Support Attachments:

1. Concrete:
   a. Before Pouring: Prior to installation, coordinate locations of cast in place concrete inserts with other trades. Install in accordance with manufacturer's instructions.
   b. After Pouring:
      1) Where supports in slabs are required after concrete has been poured, provide drilled-in threaded inserts (mechanical-expansion anchors), installed in accordance with manufacturer's recommendations.
      2) Install mechanical-expansion anchors after concrete is completely cured and in accordance with manufacturer's installation instructions.
      3) Where anchors are to be installed in post-tension construction, determine and avoid locations of post-tension cables prior to drilling.
2. Metal Floor Deck: Support hangers per UL Listing or FM Approval for selected concrete insert before pouring of concrete topping, or from beam clamps fastened to structural steel.

3. Steel Joists: Support hangers from beam clamps fastened to bar joists or to auxiliary steel between bar joists as required.
4. C-Clamp Hangers: Do not attach to one side of double-angle bottom members.
5. Locate and install hangers, supports and attachments connecting to I-joists, structural insulated panels (SIPs), cross laminated timber and similar engineered structural products according to the structural product manufacturer specifications.

E. Make available to the Contracting Officer information required to verify the anchorage, sway bracing and restraint of fire protection systems.

3.12 PIPE STANDS

A. Secure to floor.

B. Install to maintain pipe level and plumb.

C. Securely attach to supported pipe by u-bolt.

3.13 GAUGES

A. Install gauges conveniently and accessibly located with reference to finished building for repairs, removal, and service.

B. Install with dial positioned for maximum visibility.

3.14 HORN/STROBES

A. Locate exterior horn/strobes at 8-feet above finished grade.

B. Coordinate with Division 26, Electrical and Division 28, Electronic Safety and Security.

3.15 FIRE DEPARTMENT CONNECTION

A. Locate with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

B. Provide method of draining FDC piping. Drain to sanitary sewer by indirect connection, or to exterior where damage, including damage to landscaping and staining of concrete, will not occur.

C. Locate away from building egress paths. Coordinate location with Fire Marshal.

3.16 VALVES

A. General:

1. Provide post indicator on buried control valves.
2. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
3. Install valves where required for proper operation, testing and drainage. Locate valves to be accessible and so that separate support can be provided when necessary. Install conveniently and accessibly located with reference to finished building for repairs, removal, and service.

B. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.

C. Wafer Check Valves: Install between two flanges in horizontal or vertical position, position for proper direction of flow.

D. Pressure Relief Valves: Provide piping to permanent drain.

3.17 BACKFLOW PREVENTION DEVICES

A. Install conveniently and accessibly located with reference to finished building for repairs, removal, and service.

B. Provide listed backflow assembly at sprinkler system water source connection. Coordinate with local utility; conform to their installation requirements.

C. Provide method of forward flow testing at full system demand without dismantling any part of the system. Indicate location, method of testing and location of test drain discharge on submittal and As-Built Drawings. Provide signage as required by NFPA 13. Locate drainage for forward testing where damage will not occur, including damage to landscaping.

D. Chain and padlock in "open" position. Provide two sets of keys.

E. Provide control valve supervisory switches connected to the fire alarm system.

F. Reduced Pressure Backflow Preventer:

1. Locate within 5-feet of finished floor near drain shown on Plumbing Drawings or an existing drain of sufficient size which can accept full discharge of relief valve without doing damage or arrange and pay for installation of a suitable size drain.
2. Provide drain piping to sanitary sewer. Coordinate with Division 22, Plumbing.

3.18 PIPE, VALVE, AND FIRE PROTECTION EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker, secured with corrosion-resistant chain or permanent adhesive on or near each Item of fire suppression equipment and each operational device, as specified in this specification if not otherwise specified for each Item or device.

B. Provide signs for the following general categories of equipment and operational devices: Valves, drains, pumps, standpipes, tanks, and similar equipment.

C. Each new piece of equipment to bear a permanently attached identification plate, listing manufacturer's name, capacities, sizes, and characteristics.

D. Piping to bear the manufacturer's name, schedule of thickness, size, and ASTM identification number.

E. Provide valve tag on every valve, control device, main drain, auxiliary drain, and drum drip in each system. Exclude check valves and valves within factory fabricated equipment units. List each tagged valve in valve schedule for each piping system.

F. List each tagged item and its location in valve schedule; identify on fire suppression drawings.

G. Install framed, glass or rigid transparent plastic covered, mounted valve schedule and valve location drawing in main riser or fire pump room.

H. Provide identification sign on ceiling tile below valve location.

I. Provide permanent identification sign at pressure regulating valves stating required setting of pressure regulator.

J. Adjusting: Relocate fire suppression identification device which has become visually blocked.

K. Cleaning: Clean face of identification devices and glass frames of valve charts.

3.19 SIGNS

A. General Information Signs: Provide a general information sign used to determine system design basis and information relevant to the inspection, testing and maintenance requirements required by NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems. Such general information is to be provided with a permanently marked weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire, chain, or other acceptable means. Such signs are to be placed at each system control rise loop and auxiliary system control valve. The sign is to include the following information:

1. Name and Location of the Facility Protected
2. Flow Test Data
3. Location of Auxiliary Drains and Low Point Drains
4. Original Results of Main Drain Flow Test
5. Name of Installing Contractor or Designer

6. Indication of presence and location of other auxiliary systems.

B. Dry Signs: At system riser supplying dry systems, provide the following information: volume in gallons contained in each system.

3.20 DRAINS

A. Locate drain connections within 7-feet of floor. Provide piping capable of being fully drained.

B. Provide a drain vent at top of vertical drains. Coordinate with Division 22, Plumbing.

C. Coordinate location of auxiliary drains with Contracting Officer. Contracting Officer to approve location before drain is installed.

D. Protect drains from tampering and accidental operation.

E. Protect drain discharge at the exterior with a turned down 45 degree elbow.

3.21 EXPANSION TANK

A. Locate near anti-freeze risers in an easily serviceable and accessible location. Install downstream of backflow preventer.

B. Provide with ball valves to facilitate solution testing and draining without removing tank from system.

END OF SECTION

SECTION 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Test Equipment.

B. Summary:

1. Fire suppression commissioning requirements are included in this Section.
2. Commissioning is the process of reviewing system installation and operation to confirm the systems are installed and operating per the design intent and contract documents. It does not replace the official testing and acceptance of the Authority Having Jurisdiction (AHJ).

C. Definitions:

1. Reference Division 21, Fire Suppression and Division 01, General Requirements.
2. Commissioning Authority: Commissioning Agent, representing the Contracting Officer and directing commissioning activities.

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 28, Electronic Safety and Security
2. Section 01 91 14, Total Building Commissioning
3. Section 21 00 00, Fire Suppression Basic Requirements
4. Section 21 05 00, Common Work Results for Fire Suppression
5. Section 21 13 19, Fire Suppression Preaction Sprinkler Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Division 21, Fire Suppression and Division 01, General Requirements.

B. In addition, meet the following:

1. ASHRAE Guideline 0 - The Commissioning Process

2. NFPA 3 - Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems

1.4 SUBMITTALS

A. Submittals as required by Division 21, Fire Suppression and Division 01, General Requirements.

B. In addition, provide:

1. Reference Section 01 91 14, Total Building Commissioning, for specific Commissioning submittal requirements.
2. In addition, submit NFPA 13 Record of Completion.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Division 21, Fire Suppression and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Division 21, Fire Suppression and Division 01, General Requirements.

B. In addition, provide:

1. Manufacturer's Warranty.
2. Commissioning, inspecting, and testing not to modify terms or time periods of fire suppression equipment, systems, and controls warranties including related equipment and systems, and adjacent work.

1.7 COORDINATION

A. Coordination as required by Division 21, Fire Suppression and Division 01, General Requirements. Reference Section 01 91 14 Total Building Commissioning, for requirements pertaining to coordination during the commissioning process.

B. In addition, reference Section 01 91 14, Total Building Commissioning, for requirements pertaining to coordination during the commissioning process.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide testing equipment required to perform startup, initial checkout and functional performance testing for the equipment being tested under Division 21, Fire Suppression. Furnish two-way radios for each testing participant.

B. Testing equipment to be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installation contractors, the Commissioning Authority will prepare Pre-Functional Checklists for commissioned systems.

B. Red-Lined Drawings:

1. Verify equipment, devices and wiring are shown correctly on red-lined drawings.
2. Record the red-lined drawing changes, because of Functional Testing and incorporate into the final As-Built Drawings.

C. Operation and Maintenance (O&M) Data:

1. Submit a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for commissioned equipment and systems.
2. The Commissioning Authority will review the O&M literature once for conformance to project requirements.
3. The Commissioning Authority will receive a copy of the final approved O&M literature once the Contractor has made corrections.

D. Demonstration and Training:

1. Provide demonstration and training as required by the specifications.
2. Submit complete training plan and schedule to the Commissioning Authority four weeks prior to training.
3. Submit training agenda for each training session to the Commissioning Authority one week prior the training session.
4. Notify the Commissioning Authority at least 72 hours in advance of scheduled tests so that the Commissioning Authority and Contracting Officer may observe testing. Submit copies of the test record to the Commissioning Authority and Contracting Officer.
5. Engage a Factory-authorized service representative to train Contracting Officer's maintenance personnel to operate and maintain specific equipment.

6. Train Contracting Officer's maintenance personnel on procedures and schedules for trouble shooting, servicing, and maintaining equipment.
7. Review data in O&M Manuals.

3.2 CONTRACTOR'S RESPONSIBILITIES

A. Provide submittals to the Commissioning Authority for review.

B. Provide information requested by the Commissioning Authority for final commissioning documentation.

C. Prepare preliminary schedule for system orientation and inspections, Operation and Maintenance (O&M) manual submissions, training sessions and functional performance testing for Contracting Officer. Distribute preliminary schedule to commissioning team members.

D. With input from the Commissioning Authority, update the construction schedule as required with detailed commissioning tasks throughout the construction period.

E. During the startup and initial checkout process, execute the related portions of the prefunctional checklists for commissioned equipment.

F. Provide ladders, radios, and test equipment to facilitate the commissioning process.

G. Gather O&M literature on equipment and assemble in binders as required by the specifications. Submit to Commissioning Authority 45 days after submittal acceptance.

H. Provide any proprietary equipment required to verify the system functionality.

I. Pretest all system components and controls and correct all deficiencies prior to scheduling the Commissioning Authority for functional performance testing.

J. Coordinate with the Commissioning Authority to provide 48-hour advance notice so that the witnessing of equipment and system testing can begin.

K. Perform commissioning tests at the direction of the Commissioning Authority.

L. Participate in, and schedule vendors and contractors to participate in the training sessions.

3.3 TESTING PREPARATION

A. Provide written notification to the Commissioning Authority that work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-systems are operating as required, and that testing has been completed.

B. Detection devices are installed, powered, programmed, labeled and pre-tested.

C. Check safety cutouts, alarms, and interlocks with life-safety systems during each mode of operation.

D. Prior to scheduling the Commissioning Authority for commissioning tests, certify in writing that testing procedures have been completed and that testing reports have been submitted, discrepancies corrected, and corrective work approved.

3.4 GENERAL TESTING REQUIREMENTS

A. Functional performance testing of the system, as observed by the Commissioning Authority, may not begin until the Fire Suppression contractor has completed all required pre-testing checklists and documentation.

B. The Commissioning Authority along with the fire suppression contractor to prepare detailed testing plans, procedures, and checklists for fire suppression systems, subsystems, and devices.

C. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the Commissioning Authority.

D. Scope of testing includes the entire fire suppression installation.

E. Test operating modes, interlocks, control responses, and responses to abnormal or trouble conditions, and verify proper response of the system control equipment.

F. If tests cannot be completed because of a deficiency outside the scope of the system, document the deficiency and report it to the Contracting Officer. After deficiencies are resolved, reschedule tests.

3.5 FIRE SUPPRESSION CONTROL PANEL TESTING PROCEDURES

A. The Commissioning Authority will witness the Fire Suppression contractor perform field tests as described in the Functional Performance Tests to ensure all initiating devices, alarming devices and programming associated with the fire suppression control panel operate per the fire suppression sequence of operation and contract documents.

3.6 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

A. Reference Section 01 91 14 Total Building Commissioning, for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.7 OPERATION AND MAINTENANCE (O&M) MANUALS

A. O&M manuals to conform to Contract Documents requirements as stated in Division 21, Fire Suppression and Division 01, General Requirements.

3.8 TRAINING OF CONTRACTING OFFICER PERSONNEL

A. Contractor Training Responsibilities:

1. Provide the Commissioning Authority with a training plan four weeks before the planned training.
2. Provide designated Contracting Officer personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned equipment or system.
3. Training starts with classroom sessions, if necessary, followed by hands on training on each piece of equipment, which illustrates the various modes of operation, including startup, shutdown, power failure, etc.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
5. The appropriate trade or manufacturer's representative provides the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installation contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. The training sessions follows the outline in the Table of Contents of the O&M manual and illustrate whenever possible the use of the O&M manuals and record drawings for reference.
7. Training Includes:
   a. Use the printed installation, operation and maintenance instruction material included in the O&M manuals.
   b. Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions.
   c. Discuss warranties and guarantees.
   d. Cover common troubleshooting problems and solutions.
   e. Explain information included in the O&M manuals and the location of plans and manuals in the facility.
   f. Discuss any peculiarities of equipment installation or operation.
8. Fully explain and demonstrate the operation, function, and overrides of any local packaged controls, not controlled by the central control system.

B. Schedule training after functional testing is complete, unless approved otherwise by the Contracting Officer.

END OF SECTION

SECTION 21 13 00 - FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Sprinklers
2. Riser Manifold
3. Inspector's Test Connection
4. Dry-Pipe Valve
5. Air Compressor
6. Dry System Drum Drip Drains
7. Wet System Air Vent
8. Spare Sprinkler Cabinet
9. Sprinkler Guards
10. Antifreeze Solution

B. Scope:

1. Wet-pipe sprinkler system filled with antifreeze solution to protect the Admin and Exhibit building.
2. Dry-pipe sprinkler system to protect the Covered Walkway and Comfort Station.

C. Coordinate location and type of tamper, flow and pressure switches and fire alarm system.

D. Provide electrical connections and wiring as required for a complete and operable system. Includes but is not limited to bells, air compressors, sump pumps, fire pumps, jockey pumps and pump controllers.

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 22, Plumbing
2. Division 23, Heating, Ventilating and Air-Conditioning
3. Division 26, Electrical
4. Division 28, Electronic Safety and Security
5. Section 21 00 00, Fire Suppression Basic Requirements
6. Section 21 05 00, Common Work Results for Fire Suppression
7. Section 21 08 00, Commissioning of Fire Suppression Systems

8. Section 21 13 19, Fire Suppression Preaction Sprinkler Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Hydraulic calculations.
2. On submittal and As-Built drawings, provide text of sprinkler list to be installed in the spare sprinkler cabinet.
3. Designer and installer proof of qualifications.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following requirements:

1. Fire sprinkler system to be designed by someone meeting or exceeding one or more of the following requirements:
   a. A fire protection engineer.
   b. A NICET III technician for the type of system designed.
   c. As approved by the AHJ.
2. Fire sprinkler system to be installed by someone meeting or exceeding one or more of the following requirements:
   a. State or municipal certified/licensed sprinkler contractor.
   b. NICET Level II.
   c. As approved by the AHJ.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

A. Provide coverage for all buildings and covered walkways. Field verify field conditions prior to submittal of offer. Adjust offer to provide protection features in accordance with applicable codes and interpretations by AHJ. Provide design and installation based on more stringent requirements if this specification and AHJ requirements differ from Code.

B. Sprinkler system design to include a 10 percent pressure and flow cushion between system demand point and available water supplies.

C. Extend hydraulic calculations from hydraulically most remote design area back to location of pressure hydrant of flow test or effective point of water supply where characteristics of water supply are known.

1.8 EXTRA STOCK

A. Provide extra sprinklers per code.

B. Provide suitable wrenches for each sprinkler type and metal storage cabinet in riser room.

1.9 CONTROL VALVES

A. Sprinkler system control valves to be OS&Y or butterfly valves located inside building in a room with outside door.

PART 2 - PRODUCTS

2.1 SPRINKLERS

A. Salient Characteristics:

1. Finished Areas:
   a. Type: Glass-Bulb
   b. Style:
      1) Concealed (for public area of Exhibit space)
      2) Recessed
   c. Response: Quick-Response.
   d. Finish: White Polyester.
   e. Escutcheon: White Polyester
   f. Coverplate for Concealed Sprinklers:
      1) Flat Plate
      2) Wood Grained
2. Nonfinished Areas:
   a. Type: Glass-Bulb
   b. Response: Quick-Response

c. Finish: Brass

3. Dry Sprinklers:
   a. Type: Glass-Bulb
   b. Style: Recessed Horizontal Sidewall.
   c. Response: Quick-Response
   d. Finish: Chrome
   e. Escutcheon: Chrome
   f. Dry Sprinkler Boot: Manufactured for use with the dry sprinkler it protects.

2.2 RISER MANIFOLD

A. Salient Characteristics:

1. Water-flow alarm, gauge, integral pressure relief valve connected to drain, pressure gauge with 3-way gauge control valve and drain valve, integral pressure relief valve connected to drain, sight glass, smooth bore orifice union of same size as smallest orifice sprinkler installed.
2. Provide cover tamper switch when required by AHJ.

2.3 INSPECTOR'S TEST CONNECTION

A. Salient Characteristics:

1. Bronze body, brass stem, steel handle with positive stops, tamper resistant test orifice, integral tamper resistant sight glasses.
2. Provide with pressure relief valve and drainage piping with bronze body and stainless steel spring.

2.4 DRY-PIPE VALVE

A. Salient Characteristics:

1. Ductile iron body, low pressure actuator type, hydraulically operated, mechanical clapper-type valve.
2. External Reset.

2.5 AIR COMPRESSOR

A. Salient Characteristics:

1. Wall or riser mounted, Oil-free, adjustable pressure type, UL listed pressure switch, air pressure gauge.
2. 1/2-inch minimum air supply outlet.

2.6 DRY SYSTEM DRUM DRIP DRAINS

A. Salient Characteristics:

1. Normally open upper ball valve.
2. Normally closed lower ball valve.

2.7 WET SYSTEM AIR VENT

A. Salient Characteristics:

1. Brass, UL 2573 with ball valve supervisory switch.

2.8 SPARE SPRINKLER CABINET

A. Salient Characteristics:

1. NFPA 13 Systems: Sized to accommodate a minimum of two spare sprinklers of each Sprinkler Identification Number (SIN), manufacturer, model, orifice, deflector type, temperature and thermal sensitivity, or a minimum of six sprinklers for facilities having under 300 sprinklers, or a minimum of 12 sprinklers for facilities having 300 to 1000 sprinklers, or a minimum of 24 sprinklers for facilities having over 1000 sprinklers, whichever is more.
2. Welded steel with hinged steel cover.
3. Red enamel or polyester coated finish inside and out.

2.9 SPRINKLER GUARDS

A. Salient Characteristics:

1. Metal.
2. Listed for use with sprinkler model to which it is attached.

2.10 ANTI-FREEZE SOLUTION

A. Salient Characteristics:

1. UL 2910, pre-mixed anti-freeze solution from a single manufacturer

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's requirements and recommendations.

3.2 SPRINKLERS

A. Center sprinklers in center or quarter points of suspended ceiling tile.

B. Align sprinklers with architectural column lines, lighting, diffusers, and other ceiling features. In unfinished ceilings, route piping to minimize visual impact. Sprinklers and piping not so aligned are to be removed and replaced at no additional cost adjustment to the Contract.

C. Install dry sprinklers in a manner which does not trap water.

3.3 RISER MANIFOLD

A. Install so valves and gauges are conveniently and accessibly located with reference to finished building for repairs, removal, and service.

B. Provide connection to drain.

C. Pipe pressure relief valve to drain.

D. Install with supervised control valve(s) and check valve.

3.4 INSPECTOR’S TEST CONNECTION

A. Locate where full flow discharges to plumbing drain or exterior of the building at a location that will not cause damage to the building or walkway.

3.5 DRY-PIPE VALVE

A. Install per manufacturer's instructions and recommendations with full-trim valve assembly.

B. Provide with sufficient access for ease of reset.

3.6 AIR COMPRESSOR

A. Provide air compressor sized to fill system and to maintain system pressure.

3.7 DRY SYSTEM DRUM DRIP DRAINS

A. Locate within 7-feet of finished floor.

3.8 WET SYSTEM AIR VENT

A. Locate at a point in the system that will vent the most air.

B. Connect at top of pipe.

C. Locate so as not to interfere with sprinkler spray pattern.

D. Locate where it can be easily accessed for inspection and cleaning.

E. Pipe output of air vent to drain with an indirect connector or to exterior where it will not cause damage.

3.9 SPARE SPRINKLER CABINET

A. Attach to wall at the main sprinkler system riser.

B. Locate so cover is easy to open and readily accessible.

C. Locate in an area with a temperature between 40 and 100 degrees Fahrenheit.

D. Locate sprinkler wrenches inside cabinet.

E. Inside the cabinet, provide a list of sprinklers installed in the property, including sprinkler identification number, manufacturer, model, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the cabinet and issue or revision date of the list.

3.10 SPRINKLER GUARDS

A. Install per manufacturer's instructions and recommendations.

3.11 ANTI-FREEZE SOLUTION

A. Install per manufacturer's instructions and recommendations.

B. Provide extra solution on site to facilitate periodic level maintenance and fill.

C. Provide system tag on riser identifying the manufacturer, type, concentration, and volume used.

END OF SECTION

SECTION 21 13 19 - FIRE SUPPRESSION PREACTION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Preaction Deluge Valves
2. Sprinklers
3. Nitrogen System
4. Preaction Control Panel
5. Photoelectric Type Analog Detectors
6. High/Low Pressure Alarm Switch
7. Alarm Pressure Switches
8. Valve Tamper Switches and Supervisory Pressure Switches
9. Circuit Conductors
10. Instruction Charts
11. Caution and Advisory Signs and Placards

B. Scope: Preaction sprinkler system for IT Server Room.

C. Coordinate location and type of tamper, flow, and pressure switches.

D. Provide electrical connections and wiring as required for a complete and operable system. Includes but is not limited to Nitrogen systems, compressors, bells, control equipment and power supplies.

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 22, Plumbing
2. Division 23, Heating, Ventilating and Air-Conditioning
3. Division 26, Electrical
4. Division 28, Electronic Safety
5. Section 21 00 00, Fire Suppression Basic Requirements
6. Section 21 05 00, Common Work Results for Fire Suppression
7. Section 21 08 00, Commissioning of Fire Suppression Systems
8. Section 21 13 00, Fire Suppression Sprinkler Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

A. Provide a complete and operable single-interlocked preaction sprinkler system for the IT Server Room.

B. Design Parameters:

1. Building Area: IT Server Room.
2. Occupancy Classification: Light.

C. Sprinkler system design to include a 10 percent pressure and flow cushion between system demand point and available water supplies.

D. Extend hydraulic calculations from hydraulically most remote design area back to location of pressure hydrant of flow test or effective point of water supply where characteristics of water supply are known.

1.8 EXTRA STOCK

A. Provide extra sprinklers per code.

B. Provide suitable wrenches for each sprinkler type and metal storage cabinet in riser room.

C. Inside the cabinet, provide a list of sprinklers installed in the property, including sprinkler identification number, manufacturer, model, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the cabinet an issue or revision date of the list.

PART 2 - PRODUCTS

2.1 PREACTION DELUGE VALVES

A. Salient Characteristics:

1. Electric release.
2. External reset.
3. Internal check diaphragm.

2.2 SPRINKLERS

A. Salient Characteristics:

1. Finished Areas:
   a. Type: Glass-Bulb
   b. Style: Recessed
   c. Response: Quick-Response
   d. Finish: White Polyester
   e. Escutcheon: White Polyester
2. Nonfinished Areas:
   a. Type: Glass-Bulb
   b. Style: Upright
   c. Response: Quick-Response
   d. Finish: Brass

2.3 NITROGEN SYSTEM

A. Salient Characteristics:

1. Complete system package from one manufacturer, consisting of: Nitrogen Generation System, Air Compressor, Auto Purge System, Supervisory Gas Monitoring and Air Maintenance Device. All components to be compatible with each other.
2. Install with corrosion-inhibiting system from same manufacturer.

2.4 PREACTION CONTROL PANEL

A. Salient Characteristics:

1. Utilize the control panel to operate the preaction sprinkler system.
2. Control panel compatible with initiating devices, notification appliances, preaction actuation solenoid.
3. Dedicated microprocessor or addressable control panel UL listed for releasing service.
4. Quantity of releasing circuits required for correct system operation.
5. Power Supply: Provide power supply(s), adequate to serve control panel modules, initiating and control devices, notification appliances and other connected devices.
6. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each function in this portion of the Specifications and for equipment interconnections required under fire alarm, electrical and mechanical specifications.
7. Auxiliary Switches: Provide auxiliary equipment control switches with labeled status indicating lights for each switch.
8. System Reset: Key-accessible control function returns system to normal, non-alarm state, if initiating circuits have cleared.
9. Lamp Test: Manual "lamp test" function causes the annunciation lamps to illuminate at control panel.
10. Power Requirements:
    a. Loss of normal and emergency power automatically causes system to transfer to battery power. Indicate battery power operation by yellow indicator and audible annunciation at control panel. Upon return of 120VAC power, unit recharges batteries to full capacity and maintains battery on float charge. Provide trickle charge adequate capacity to maintain battery fully charged with automatic rate charge.
    b. Provide batteries in locking cabinet manufactured for purpose. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.

2.5 PHOTOELECTRIC TYPE ANALOG DETECTORS

A. Salient Characteristics:

1. LED source, multiple cell, 360 degree smoke entry, visual latching operation indicator, insect screen, functional test switch and two- wire operation.
2. Provide device with vandal-resistant locking feature.

2.6 HIGH/LOW PRESSURE ALARM SWITCH

A. Salient Characteristics:

1. Pressure actuated to detect 10 PSI increase or decrease: SPDT switches.

2. Manufacturer: Potter PS40A, System Sensor.

2.7 ALARM PRESSURE SWITCHES

A. Salient Characteristics:

1. Monitor each alarm pressure switch with preaction control panel.

2.8 VALVE TAMPER SWITCHES AND SUPERVISORY PRESSURE SWITCHES

A. Salient Characteristics:

1. Monitor each tamper switch or supervisory pressure switch with preaction control panel.

2.9 CIRCUIT CONDUCTORS

A. Salient Characteristics:

1. Copper or optical fiber; color code and label. Type FPL, FPLR and FPLP as required by NEC. Provide conductors in compliance with the requirements of the manufacturer.
2. Minimum signaling line circuit and initiating device circuit wire size: AWG18. Minimum notification appliance circuit wire size: AWG14, or as approved by Contracting Officer.

2.10 INSTRUCTION CHARTS

A. Salient Characteristics:

1. Printed instruction chart for operators, showing steps to be taken when signal is received (normal, alarm, supervisory and trouble). Charts to be easily readable from normal operator's station.
2. Frame: Constructed from stainless steel or aluminum with polycarbonate or glass cover. Provide one for each control unit where operations are to be performed.

2.11 CAUTION AND ADVISORY SIGNS AND PLACARDS

A. Salient Characteristics:

1. Provide manual release station operation placards.
2. Provide signs and placards compliant with NFPA 13 and manufacturer requirements.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain approval of system design from AHJ prior to installation. Do not begin installation without approval from AHJ and submittal review comments from Contracting Officer.

B. Install per manufacturer's instructions and recommendations.

C. Install in accordance with applicable codes, NFPA 13, NFPA 72, NFPA 70 and the Contract Documents.

D. Provide pipe, fittings, detection and control system, shutdowns, auxiliary system interfaces, signs, wiring, conduit and outlet boxes, piping, bracing, hangers, etc., required for the erection of a complete system as described in these specifications, as shown on Drawings, and as required by AHJ.

E. Provide wiring to meet the requirements of national, state, and local electrical codes. Provide color coded wiring as recommended and specified by the preaction detection system manufacturer.

F. Conceal wiring, conduit, boxes and supports.

G. Provide complete conduit system for wiring.

H. At junction boxes and termination points, provide identification tags on wires and cables.

I. Route wiring and piping to avoid blocking access to equipment requiring service, access, or adjustment.

J. Provide machine printed address label on addressable devices visible from the floor without magnification.

K. Obtain Contracting Officer's approval of locations of devices before installation.

L. Install instruction placards in or adjacent to control panel.

M. Install warning and advisory placards adjacent to manual release stations and notification appliances at the entrance to the protected space and in the protected space.

N. Provide control panel and remote power supplies with 120VAC dedicated circuit per NFPA requirements.

O. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.

P. Coordinate location of auxiliary drains with Contracting Officer. Contracting Officer to approve location before drain is installed. Protect valves from tampering or accidental operation. Coordinate with Division 22, Plumbing.

Q. System Operation - Single Interlock:

1. Alarm Sequence of Operation:
   a. Activation of one automatic initiating device causes system to enter “alarm” mode including following operations:
      1) Provide local annunciation of alarm zone and condition and audible and visual alarm signal at control panel.
      2) Provide manual "acknowledge" function at control panel to silence audible alarm signal. Visual signal remains displayed until initiating alarm is cleared.
      3) Transmit “alarm” signal to building fire alarm control panel.
      4) Initiate the alarm bells located in the protected space.
      5) Open solenoid valve thereby operating sprinkler preaction valve and filling the sprinkler pipes with water in the protected space.
   b. Operation of sprinkler system fusible element in conjunction with automatic initiating device or manual release station discharges water from the operated sprinkler.

R. Fire Safety Systems Interfaces and Functions:

1. Provide power and control conduit, wiring, boxes and terminations to power devices and interface devices to preaction system.
2. Provide alarm, supervisory and trouble relay output connections to the building fire alarm system. Coordinate with Division 28, Electronic Safety, for providing input modules to monitor the preaction sprinkler system.

S. Contracting Officer Personnel Instruction:

1. Comply with all requirements of Division 01, General Requirements and Section 21 00 00, Fire Suppression Basic Requirements.
2. Provide the Following Instruction to Designated Contracting Officer Personnel:
   a. Hands-On Instruction: On-site, using operational system.
   b. Classroom Instruction: Contracting Officer furnished classroom, on-site or at other local facility.
   c. Factory Instruction: At control unit manufacturer's training facility.
3. Basic Operation: One-hour sessions for attendant personnel, security officers and engineering staff, combination of classroom and hands-on.
   a. Initial Training: One session pre-closeout.
   b. Refresher Training: One session post-occupancy.
4. Detailed Operation: Two-hour sessions for staff, combination of classroom and hands-on:
   a. Initial Training: One session pre-closeout.
   b. Refresher Training: One session post-occupancy.
5. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data and record drawings available during instruction.

6. Provide means of evaluation of trainees suitable to type of training given; report results to Contracting Officer.

T. Closeout:

1. Comply with all requirements of Division 01, General Requirements and Section 21 00 00, Fire Suppression Basic Requirements.
2. Closeout Demonstration: Demonstrate proper operation of functions to Contracting Officer.
   a. Be prepared to conduct any of the required tests.
   b. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix and operator instruction chart(s) available during demonstration.
   c. Have authorized technical representative of control unit manufacturer present during demonstration.
   d. Demonstration may be combined with inspection and testing required by AHJ. Notify AHJ in time to schedule demonstration.
   e. Repeat demonstration until successful.
3. Substantial Completion of the project cannot be achieved until inspection and testing is successfully completed.
4. Diagnostic Period:
   a. Specified diagnostic period without malfunction has been completed.
   b. Approved operating and maintenance data has been delivered.
   c. Aspects of operation have been demonstrated to Contracting Officer.
   d. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   e. Occupancy permit has been granted.
   f. Specified pre-closeout instruction is complete.
   g. Perform post-occupancy instruction within three months after date of occupancy.

U. Inspection, Testing and Maintenance, Post-Completion:

1. Reference Division 01, General Requirements and Section 21 00 00, Fire Suppression Basic Requirements, for additional requirements relating to maintenance service.
2. Provide to Contracting Officer, at no extra cost, a written maintenance contract for two years, to include the work described below.
3. Provide to Contracting Officer a proposal for later acceptance, for a maintenance contract for two years, to include the work described below; include the total cost of contract, proposal to be valid at least until 30 days after date of Substantial Completion.
4. Perform routine inspection, testing and preventive maintenance required by NFPA 72 and NFPA 13, including:
   a. Maintenance of fire safety interface connected to fire suppression system.
   b. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
5. Record keeping required by NFPA 13, NFPA 72 and authorities having jurisdiction.

6. Provide system test and inspection during the sixth, eleventh and twelfth month after substantial completion. Correct deficiencies and replace defective components at no cost to the Contract.
7. Provide trouble call-back service upon notification by Contracting Officer:
8. Provide on-site response within two hours of notification.
9. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.
10. Submit duplicate of each log entry to Contracting Officer upon completion of site visit.
11. Comply with Contracting Officer's requirements for access to facility and security.

3.2 PREACTION DELUGE VALVES

A. Install with sufficient access for ease of reset.

3.3 SPRINKLERS

A. Center sprinklers in center or quarter points of suspended ceiling tile.

3.4 NITROGEN SYSTEM

A. Coordinate fire alarm system monitoring of Nitrogen system.

B. Install per manufacturer's recommendations with corrosion-inhibiting system.

3.5 PREACTION CONTROL PANEL

A. Circuits:

1. Signaling Line Circuits (SLC): Class B.
2. Notification Appliance Circuits (NAC): Class B.

B. Power Sources:

1. Primary: Dedicated branch circuits of facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate fire alarm system under normal supervisory condition for 24 hours and operate alarm signals for five minutes at end of standby period.

3.6 PHOTOELECTRIC TYPE ANALOG DETECTORS

A. Coordinate with Division 28, Electronic Safety.

3.7 HIGH/LOW PRESSURE ALARM SWITCH

A. Coordinate with Division 28, Electronic Safety.

3.8 ALARM PRESSURE SWITCHES

A. Coordinate with Division 28, Electronic Safety.

3.9 VALVE TAMPER SWITCHES AND SUPERVISORY PRESSURE SWITCHES

A. Coordinate with Division 28, Electronic Safety.

3.10 CIRCUIT CONDUCTORS

A. Provide wiring to meet the requirements of national, state, and local electrical codes. Provide color coded wiring as recommended and specified by the fire alarm and detection system manufacturer.

B. Provide Type FPLR cable when in a riser application or FPLP cable when installed in plenums.

3.11 INSTRUCTION CHARTS

A. Locate charts as to be easily readable from operator's station.

B. Obtain approval of Contracting Officer prior to mounting. Mount in location acceptable to Contracting Officer.

C. Provide extra copy of Operation and Maintenance data submittal.

3.12 CAUTION AND ADVISORY SIGNS AND PLACARDS

A. Mount signs and placards at manual release stations and as required by NFPA 13, NFPA 72 and manufacturer's recommendations.

END OF SECTION

SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Piping materials and installation instructions common to most piping systems.
2. Concrete equipment base construction requirements.
3. Equipment nameplate data requirements.
4. Nonshrink grout for equipment installations.
5. Field-fabricated metal and wood equipment supports.
6. Installation requirements common to equipment specification sections.
7. Mechanical demolition.
8. Cutting and patching.
9. Touch-up painting and finishing.

B. The plans and specifications are complimentary and shall be used together in order to fully describe the Work. In the case of a conflict between the plans and specifications, the plans take precedence.

C. The Contracting Officer Technical Representative has based the drawings and design on non-certified information furnished by various equipment manufacturers. It is incumbent on the part of the CONTRACTOR to include in the bid all material and labor needed to install the actual equipment furnished.

D. Related Sections:

1. The following is work of Division 26 sections of the Specifications:

a. Power supply wiring from power source to power connection on equipment. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

b. Interlock wiring between field-installed equipment, except where specified as factory installed. Interlock wiring, as used in this specification, is defined as that wiring between electrically-interlocked equipment for the purpose of controlling one piece or pieces of equipment by the operation (on, off, etc.) of another piece or pieces of associated equipment.

2. Pipe and pipe fitting materials as specified in piping system sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 REFERENCES

A. Applicable Standards:

1. American Society for Testing and Materials (ASTM):
   a. A47 - Ferritic Malleable Iron Castings.
   b. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   c. A126 - Gray Iron castings for Valves, Flanges, and Pipe Fittings.
   d. A536 - Ductile Iron Castings.
   e. B32 - Solder Metal.
   f. C1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
   g. D709 - Laminated Thermosetting Materials.
2. American Society of Mechanical Engineers (ASME):
   a. Boiler and Pressure Vessel Code.
   b. A13.1 - Scheme for the Identification of Piping Systems.
   c. B1.20.1 - Pipe Threads, General Purpose (Inch).
   d. B16.20 - Ring-Joint Gaskets and Grooves for Steel Pipe Flanges.
   e. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
   f. B18.2.1 - Square and Hex Bolts and Screws-Inch Series.

g. B31 Series - Code for Pressure Piping.

3. American Welding Society (AWS):

a. Soldering Manual, latest.

b. Brazing Manual, latest.

c. A5.8 - Filler Metals for Brazing.

d. D1.1 - Structural Welding Code for Steel.

e. D10.12 - Recommended Practices and Procedures for Welding Low Carbon Steel Pipe.

1.5 SUBMITTALS

A. Submit manufacturer's data sheets on all system components, including the following:

1. Transition fittings

2. Dielectric fittings

3. Mechanical sleeve seals

4. Escutcheons

B. General, all Division 22 sections of the Specifications: Follow the procedures specified in Division 01. Prepare maintenance manuals in accordance with Division 01.

C. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" article of this section.

1.6 QUALITY ASSURANCE

A. Qualify welding processes and operators for structural steel according to AWS D1.1.

B. All welding on pressure piping shall conform with the requirements of the American National Standard Code for Pressure Piping, ANSI B31.3, "Chemical Plant and Petroleum Refinery Piping." All welds on piping having working pressures of 300 psig or greater shall be subjected to a full X-ray examination and will not be accepted until all welds meet the requirements of ANSI B31.1, "Power Piping." Faulty welds shall be removed at no additional cost to Contracting Officer. X-ray testing shall be performed by others at no additional cost to the Contractor.

1. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

C. Pressure Vessels: Prior to installation and acceptance, any power boiler, low-pressure heating boiler, or unfire pressure vessel operated at pressures of 15 pounds per square inch or greater, furnished under this contract will be stamped with ASME Boiler and Pressure Vessel Code Symbol and a National Board of Boiler and Pressure Vessel Inspector's number, thus certifying that the vessel has been fabricated and tested per the provisions of the ASME Boiler and Pressure Vessel Code. Manufacturers' data reports (unless exempted by the ASME Code) will be filed with the National Board in Columbus, Ohio. Two copies of these data reports shall be submitted to Contracting Officer. Testing, certification, and registration will be at the expense of the Contractor.

D. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

E. Materials and equipment furnished by others.

1. When equipment or materials are indicated to be furnished by others (F.B.O.) or by government furnished equipment (GFE) to the CONTRACTOR for installation and connection, the CONTRACTOR shall make a complete check of all materials and furnish a receipt to the Contracting Officer detailing the products received and the condition of the products delivered to him. After executing the receipt and acceptance by the CONTRACTOR, the CONTRACTOR shall assume full responsibility for the safe keeping, handling, and installation of the materials and equipment furnished by others or furnished by government, until completed installation and final approval by the Contracting Officer Technical Representative.

2. If the CONTRACTOR fails to issue said receipt it shall be assumed that all equipment and materials were then delivered to the CONTRACTOR in the proper quantities and in perfect condition.

1.8 PROJECT SITE CONDITIONS

A. Altitude Ratings: Unless otherwise noted, all specified equipment capacities, air quantities, etc., are for an altitude of 7,740 feet above sea level. Adjustments to manufacturers' ratings must be made accordingly.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate plumbing equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Interruption of Plumbing Utilities:

1. The Contractor shall not interrupt any main interior or exterior plumbing utility without written request for an outage and a subsequent approval of Contracting Officer nor shall he interrupt any branch line to an outlet or item of equipment without approval from the Contracting Officer.

2. Written request for outages shall be submitted seven calendar days in advance of the outage date. This request will delineate the particular utility or service in question, the time the service will be interrupted and the approximate hours the utility shall be off.

3. Unless otherwise noted on the drawings, or directed, any tie-ins or connections to existing utilities or equipment that necessitate interruptions of service shall be performed on a during non standard hours

4. The work to be performed during the interruption, will be preceded by all possible preparation, and will be carefully coordinated to minimize the duration of the interruption and work will proceed continuously until the system is restored to normal.

5. Unless otherwise directed, the manipulation of existing main valves to isolate piping, the shutdown of equipment will be done by maintenance personnel.

F. Coordinate installation of identifying devices after completion of covering and painting, where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Physical: None

B. Functional:
1. Pipe and Pipe Fittings:
   a. Refer to individual piping system specification sections for pipe and fitting materials and joining methods.
   b. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
2. Joining Materials:
   a. Refer to individual piping system specification sections in Division 22 for special joining materials not listed below.
   b. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.
      1) ASME B16.21 - Nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, except where thickness or specific material is indicated.
         a) Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
         b) Narrow-Face Type: For raised-face, class 250 cast-iron and steel flanges.
      2) ASME B16.20 - For grooved, ring-joint, steel flanges.
      3) AWWA C110 - Rubber, flat face, 1/8-inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.
   c. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.
   d. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated.
   e. Solder Filler Metal: ASTM B32.
      1) Alloy Sn95 or Alloy Sn94: Tin (approximately 95%) and silver (approximately 5%), having 0.10% lead content.
      2) Alloy E: Tin (approximately 95%) and copper (approximately 5%), having 0.10% maximum lead content.
      3) Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10% maximum lead content.

4) Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10% maximum lead content.
5) Alloy Sb5: Tin (95%) and antimony (5%), having 0.20% maximum lead content.

f. Brazing Filler Metals: AWS A5.8.
1) BCuP Series: Copper-phosphorous alloys.
2) BAgl: Silver alloy.

g. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

h. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.

i. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end, pressure pipes.
1) Sleeve: ASTM A126, Class B, gray iron.
2) Followers: ASTM A47, Grade 32510 or ASTM A536 ductile iron.
3) Gaskets: Rubber.
4) Bolts and Nuts: AWWA C111.
5) Finish: Enamel paint.

3. Piping Specialties:

a. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
1) Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
2) Insulating Material: Suitable for system fluid, pressure, and temperature.
3) Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180°F temperature.
4) Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system pressures.
5) Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
a) Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
b) Dielectric Couplings: Galvanized steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225°F temperature.
c) Dielectric Nipples: Electroplated steel nipple, having inert and noncorrosive, thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig working pressure at 225°F temperature.

b. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.

c. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
1) Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.
2) Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with one mechanical joint end conforming to AWWA C110 and one plain pipe sleeve end.

a) Penetrating Pipe Deflection: 5% without leakage.
b) Housing: Ductile-iron casting having water stop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
c) Pipe Sleeve: AWWA C151, ductile-iron pipe.
d) Housing-to-Sleeve Gasket: Rubber or neoprene, push-on type, of manufacturer's design.

3) Cast-Iron Sleeve Fittings: Commercially made sleeve having integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.

4. Escutcheons
   a. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
      1) One Piece, Deep-Pattern Type: Deep-drawn, box shaped brass with polished chrome plated finish.
      2) One-Piece, Cast-Brass Type: With set screw or Split-Casting, Cast-Brass-Type: With concealed hinge and set screw. Finish: Polished chrome plated.
      3) Split-Casting, Cast-Brass Type: With concealed hinge and set screw. Finish: Polished chrome plated.
      4) One-Piece, Floor-Plate Type: Cast-iron floor plate.
      5) Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.
5. Grout: Nonshrink, Nonmetallic Grout: ASTM C1107, Grade B.
   a. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
6. Design Mix: 5000 psi, 28-day compressive strength.

C. Performance: None

2.2 ELECTRIC MOTORS

A. Physical: None

B. Functional:
1. General: All motors (except as noted) shall conform to the following specifications:
   a. Comply with requirements in this Section except when stricter requirements are specified in fire suppression equipment schedules or sections.
   b. 1/2 hp and Small: Single-phase.
   c. Larger than 1/2 hp shall be three-phase, except where specifically noted otherwise
   d. Comply with NEMA MG 1 unless otherwise indicated.

2. Motor Characteristics:
   a. Duty: Continuous duty at ambient temperature of 40 C and at site elevation.
   b. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designed speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

3. Polyphase Motors:
   a. Description: General purpose NEMA MG 1, Design B, except "C" where required for high starting torque, medium induction motor.
   b. NEMA Premium Efficiency, as defined in NEMA MG 1 when available, otherwise energy efficient.
   c. Service Factor: 1.15.
   d. Multi-speed Motors: Separate winding for each speed.
   e. Rotor: Random-wound, copper windings, squirrel cage.
   f. Bearings:
      1) Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading, minimum 40,000 hour L 10 life.
      2) Sleeve type bearings are permitted for fractional horsepower and light-duty motors.
   g. Code Letter Designation:
      1)
      2) Motors Smaller than 15 hp: Manufacturer's standard starting characteristic.
   h. Enclosure
      1) Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.
      2) Open drip-proof motors for indoor use where satisfactorily housed and properly ventilated during operation.
      3) Weather protected Type I for outdoor use when enclosed or housed with adequate ventilation, or TEFC when exposed to weather or moist locations.
      4) Special enclosures required for hazardous areas (explosion-proof, etc.) per equipment schedules. Explosion-proof motors shall be UL listed.
   i. Motor Selection Criteria:
      1) Motor size shall be large enough so that the driven load will not require the motor to operate above 80% of its rated horsepower. Minimum horsepower ratings are shown or scheduled on the drawings.
      2) Pump motors shall be "non-overloading"; i.e. shall not operate in service factor at any point on pump curve.

4. Single Phase Motors:
   a. Motors shall be one of the following, to suit starting torque and requirements of specific motor application:
      1) Permanent-split capacitor.
      2) Spilt phase.
   b. Multi-speed Motors: Variable-torque, permanent-split-capacitor type.
   c. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
   d. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

C. Performance: None

2.3 MOTOR CONTROLLER

A. Physical: None

B. Functional:
1. General Motor Controller Characteristics:
a. Single speed and multi-speed motor controllers shall be combination type full NEMA rated starters with disconnect switch for all motors provided.

Exception: Starters that are shown to be provided integral within packaged equipment, control panels with door mounted disconnects or in motor control centers

b. All combination starters shall be adequately braced for the fault current available. All starters, whether separately furnished or integral with equipment, shall comply with the following:
1) Enclosures: NEMA Type 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA Type 3R with conduit hubs, or units in hazardous locations that shall have NEC proper class and division explosion proof enclosure.
2) All starters for three-phase motors shall be magnetic complete with the following accessories.
a) Three-leg Class 10 trip-free electronic overload protection with externally operated manual reset and visual trip indicator. Trip setting shall be adjustable with locking cover.
b) Built-in three-phase voltage monitor to provide quick-trip on single phasing, phase reversal, or high/ low voltage, manual reset.
c) Control transformers with fused primary and secondary per NEC.
d) 120-volt holding coils.
e) Integral Hand-Off-Auto switch for single-speed motors.
f) Integral High-Low-Off-Auto switch for two-speed starters.
g) High-to low-speed compelling time delay relay for two-speed starters.
h) Auxiliary contacts, one normally open and one normally closed minimum.
i) "Run" pilot light.

C. Performance: None

2.4 IDENTIFICATION

A. Physical: None

B. Functional:
1. Equipment Labels:
a. Metal Labels for Equipment:
1) Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2) Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3) Minimum Letter Size: 1/4 inch for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4) Fasteners: Stainless-steel rivets or self-tapping screws.

5) Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

b. Plastic Labels for Equipment:

1) Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2) Letter Color: White

3) Background Color: Black or blue.

4) Maximum Temperature: Able to withstand temperatures up to 160 ºF.

5) Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6) Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7) Fasteners: Stainless-steel rivets or self-tapping screws.

8) Adhesive: Contract-type permanent adhesive, compatible with label and with substrate.

c. Label Content: Include equipment's unique equipment number, Drawings numbers where equipment is indicated (plan, details, and schedules).

d. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the specification section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2. Pipe Labels:

a. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

b. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and t attach to pipe without fasteners or adhesive.

c. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

d. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1) Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2) Lettering Size: At least 1-1/2 inches high.

3. Stencils:

a. Stencils: Prepare with letter sizes according to ASME A 13.1 for piping; minimum letter height of 2 inches for equipment labels, and similar operational instructions.

b. Stencil Material: Fiberboard or metal.

c. Stencil Paint: Exterior, gloss enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.

d. Identification Paint: Exterior enamel in colors according to ASME A13.1 unless otherwise indicated.

4. Valve Tags:

a. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1) Tag Materials: Brass, 0.032-inch minimum thickness, and having pre-drilled or stamped holes for attachment hardware.

b. Valve Schedules: For each piping system, on 8-/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open or closed), and variations for identification. Mark valves for emergency shutoff and similar special uses.

c. Valve tag schedule shall be included in operation and maintenance data.

C. Performance: None

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 1 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to be removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to be abandoned in place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to be removed: Disconnect and cap services and remove equipment.
4. Equipment to be removed and reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to be removed and salvaged: Disconnect and cap services and remove equipment and deliver to Contracting Officer.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 ERECTION INSTALLATION APPLICATION

A. Piping Systems - Common Requirements:

1. General: Install piping as described below, except where system sections specify otherwise. Individual piping system specification sections in Division 22 specify piping installation requirements unique to the piping system.

2. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

3. Install piping at indicated slope.

4. Install components having pressure rating equal to or greater than system operating pressure.

5. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

6. Install piping free of sags and bends.

7. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

8. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

9. Install piping to allow application of insulation plus 1-inch clearance around insulation.

10. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

11. Install fittings for changes in direction and branch connections.

12. Escutcheons: Where uncovered exposed pipes pass through floors, finished walls, or finished ceilings, they shall be fitted with chromium-plated cast-brass plates on chromium-plated pipe, or with cast-iron or steel plates on ferrous pipe. Plates shall be large enough to completely close the holes around the pipes and shall be square, octangular, or round, with the least dimension not less than 1-1/2 inches or more than 2-1/2 inches larger than the diameter of the pipe. Plates shall be secured in an approved manner.

13. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

14. Above Grade, Exterior Wall, and Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

    a. Install steel pipe for sleeves smaller than 6 inches.

    b. Install cast-iron wall pipes for sleeves 6 inches and larger.

    c. Assemble and install mechanical seals according to manufacturer's printed instructions.

15. Below Grade, Exterior Wall, and Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

16. Below Grade, Exterior Wall, and Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.

17. Verify final equipment locations for roughing in.

18. Refer to equipment specifications in other sections of these specifications for roughing-in requirements.

19. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system specification sections.

    a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

    b. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

    c. Soldered Joints: Construct joints according to AWS "Soldering Manual."

    d. Brazed Joints: Construct joints according to AWS "Brazing Manual."

    e. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

f. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

20. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

a. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inches or smaller threaded pipe connection.

b. Install flanges, in piping 2-1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.

c. Dry Piping Systems (Gas, Compressed Air, and Vacuum): Install dielectric unions and flanges to connect piping materials of dissimilar metals.

d. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

B. Equipment Installation - Common Requirements:

1. Install equipment to provide the maximum possible head room, where mounting heights are not indicated.

2. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Contracting Officer.

3. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

4. Install plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

5. Install equipment giving right-of-way to piping systems installed at a required slope.

6. Shaft Alignment: All motors and pumps (or drives) connected by a shaft coupling, whether factory or field assembled, shall be aligned during installation using a dial indicator applied to both ends of both shafts for a full 360 degrees prior to operation. Alignment of the shafts shall be less than the maximum allowable tolerances as recommended by the coupling or equipment manufacturer. Alignment of shafts shall be rechecked after several hours of operation and equipment has reached operating temperature.

C. Painting and Finishing:

1. Field painting requirements are specified in Division 09.

2. Damage and Touch-Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

D. Identification Tags and Labels:

1. Materials:

a. Pipe Labels: Pipe labels shall be self-adhesive labels, all temperature Perma-Code pipe markers No. B-500, manufactured by the W. H. Brady Company. The background color code for all markers shall conform to the American National

Standard ANSI A-13.1 "Scheme for the Identification of Piping Systems." This standard establishes four basic backgrounds as follows: Yellow for dangerous materials, bright blue for protective materials, red for fire protection equipment, and green for safe materials.

b. Tags: Tags shall be aluminum, brass or laminated plastic 2" x 1" minimum with edges ground smooth or rolled. Each tag shall be punched to receive tie wires or chain. Letters and Numbers shall be evenly spaced and stamped or engraved into the surface.

2. Installation:

a. Identification of Piping:

1) Identify all piping according to the following procedures:

a) Bare pipes to be marked shall first be wiped clean of dirt, dust, grease, and moisture. Markers to be installed on painted piping shall be applied only after completion of final coat of paint. Insulated pipes shall first be painted to a smooth, hard surface in the area the label is to be applied. Labels shall be applied, using pressure, so that it lies smooth and flat. After application on insulated pipes, the label shall be stapled securely to the insulation. The labels shall be applied to the pipe so that the lettering is in the most legible position. For overhead piping apply markers on the lower half of the pipe where view is unobstructed, so that markers can be read at a glance from floor level. The wording on the labels shall correspond directly to the wording in the mechanical symbol lists, regardless of whether or not it is standard wording for the designated manufacturer.

b) Use an arrow marker with each pipe content marker. The arrow shall always point away from the pipe marker and in the direction of flow, with background color and height the same as content marker. If flow can be in both directions, use two arrow markers.

c) Apply pipe marker and arrow marker at each valve, at every point of pipe entry or exit through wall or ceiling, on each riser and branch of tee, and every 20 feet on long continuous lines or at every bay or aisle to show proper identification of pipe content and direction of flow.

b. Valves: All main service valves, including fire protection, located inside the building shall be tagged and identified as to the type of service. All valves controlling branch mains or risers to various portions of the building shall be tagged and identified as to the areas served.

c. Controls: All automatic controls, control panels, zone valves, pressure electric, electric pressure switches, relays and starters shall be clearly tagged and identified. Wording shall be identical to that on the control diagram in the contract drawings.

d. Pumps: All pumps shall be identified as to service with aluminum or brass tags secured by tie wires.

E. Concrete Bases: Construct concrete equipment bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000 psi, 28-day compressive strength concrete and reinforcement as specified in Division 3. Housekeeping pads under pumps, etc.,

shall be 3-1/2A inches thick with #4 reinforcing bars 12 inches on center each way unless otherwise noted.

F. Erection of Metal Supports and Anchorage:

1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

2. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel."

G. Cutting and Patching:

1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for plumbing installations. Perform cutting by skilled mechanics of the trades involved.

2. Repair cut surfaces to match adjacent surfaces.

H. Grouting:

1. Install nonmetallic, nonshrink grout for plumbing equipment base bearing surfaces, pump and other equipment base plates and anchors. Mix grout according to manufacturer's printed instructions.

2. Clean surfaces that will come into contact with grout.

3. Provide forms for placement of grout, as required.

4. Avoid air entrapment when placing grout.

5. Place grout, completely filling equipment bases.

6. Place grout on concrete bases to provide a smooth bearing surface for equipment.

7. Place grout around anchors.

8. Cure placed grout according to manufacturer's printed instructions.

3.3 DEMONSTRATION & TRAINING

1. Provide training or—if required in specific system sections—engage a system manufacturer's employed training instructor or factory-authorized service representative to train maintenance personnel to adjust, operate, and maintain each plumbing system.

END OF SECTION 220500

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves without waterstop.
2. Sleeves with waterstop.
3. Sleeve-seal systems.
4. Grout.
5. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES WITHOUT WATERSTOP

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.

C. Steel Sheet Sleeves: ASTM A653/A653M, 0.0239-inch minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

2.2 SLEEVES WITH WATERSTOP

A. Description: Manufactured PVC/HDPE and/or steel and/or stainless steel and/or galvanized steel, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Description: Manufactured, Dura-coated or Duco-coated and/or galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Designed to form a hydrostatic seal of 20 psig minimum.
2. Sealing Elements: EPDM-rubber and/or High-temperature-silicone and/or Nitrile (Buna N) and/or interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel and/or Composite plastic and/or Stainless steel and/or Stainless steel, Type 316.
4. Connecting Bolts and Nuts: Carbon steel, with ASTM B633 coating and/or Stainless steel and/or Stainless steel, Type 316 of length required to secure pressure plates to sealing elements.

2.4 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, 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, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.

1. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, T, NT: Single-component, 25 and/or 100/50, pourable, plus 25 percent and minus 25 percent and/or plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.

1. Standard: ASTM C920, Type S, Grade P, Class 25 and/or Class 100/50, Uses T and NT.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout and/or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout and/or silicone sealant, seal the space around outside of sleeves.

3.3 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
2. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

3.5 SLEEVE SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above and below Grade:

    a. Sleeves with waterstops.

        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs-on-Grade:

    a. Sleeves with waterstops.

        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:

    a. Sleeves with waterstops.

4. Interior Partitions:

    a. Sleeves without waterstops.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. Physical: None

B. Functional:
1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
3. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
4. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

C. Performance: None

2.2 FLOOR PLATES

A. Physical: None

B. Functional:
1. Split Floor Plates: Cast brass with concealed hinge.

C. Performance: None

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping and Relocated Existing Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece steel or split-casting brass with polished, chrome-plated finish.
c. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

2. Escutcheons for Existing Piping to Remain:

a. Chrome-Plated Piping: Split-casting, stamped steel with concealed hinge with polished, chrome-plated finish.
b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping and Relocated Existing Piping: Split floor plate.
2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 220518

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Standards:
   a. Domestic water valves intended to convey or dispense water for human consumption must comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or must be certified to be in compliance with NSF 61 and NSF 372 (by an ANSI-accredited third-party certification body) that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
2. ASME Compliance:
   a. ASME B1.20.1 for threads for threaded end valves.
   b. ASME B16.1 for flanges on iron valves.
   c. ASME B16.5 for flanges on steel valves.
   d. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   e. ASME B16.18 for cast copper solder-joint connections.
   f. ASME B16.22 for wrought copper and copper alloy solder-joint connections.
   g. ASME B16.34 for flanged and threaded end connections
   h. ASME B31.9 for building services piping valves.
3. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
4. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
5. Valve Sizes: Same as upstream piping unless otherwise indicated.

6. Valve Actuator Type:
    a. Hand Lever: For quarter-turn valves smaller than NPS 4 (DN 100).
7. Valves in Insulated Piping:
    a. Provide 2-inch (50-mm) extended neck stems.
    b. Extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
    c. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Physical: None

B. Functional:
1. Brass Ball Valves, One Piece, Threaded Ends:
    a. Standard: MSS SP-110, MSS SP-145.
    b. CWP Rating: 400 psig (2760 kPa).
    c. Body Design: One piece.
    d. Body Material: Forged brass or bronze.
    e. Ends: Threaded.
    f. Seats: PTFE.
    g. Stem: Brass or stainless steel.
    h. Ball: Chrome-plated brass or stainless steel.
    i. Port: Reduced.
2. Brass Ball Valves, Two Piece with Full Port and Brass Trim, Threaded or Soldered Ends:
    a. Standard: MSS SP-110; MSS SP-145.
    b. CWP Rating: 600 psig (4140 kPa).
    c. Body Design: Two piece.
    d. Body Material: Forged brass.
    e. Ends: Threaded or soldered.
    f. Seats: PTFE.
    g. Stem: Brass.
    h. Ball: Chrome-plated brass.
    i. Port: Full.
3. Brass Ball Valves, Two Piece with Full Port and Brass Trim, Press Ends:
    a. Standard: MSS SP-110; MSS SP-145; IAPMO/ANSI Z1157.
    b. CWP Rating: Minimum 200 psig (1380 kPa).
    c. Body Design: Two piece.
    d. Body Material: Forged brass.
    e. Ends: Press.
    f. Press-End Connections Rating: Minimum 200 psig (1380 kPa).
    g. Seats: PTFE or RPTFE.
    h. Stem: Brass.
    i. Ball: Chrome-plated brass.
    j. Port: Full.
    k. O-Ring Seal: Buna-N or EPDM.
4. Brass Ball Valves, Two Piece with Full Port and Stainless Steel Trim, Press Ends:
    a. Standard: MSS SP-110; MSS SP-145; IAPMO/ANSI Z1157.
    b. CWP Rating: Minimum 200 psig (1380 kPa).
    c. Body Design: Two piece.

d. Body Material: Forged brass.
e. Ends: Press.
f. Press-End Connections Rating: Minimum 200 psig (1380 kPa).
g. Seats: PTFE or RPTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.
k. O-Ring Seal: Buna-N or EPDM.

5. Brass Ball Valves, Two Piece with Regular Port and Brass Trim, Threaded or Soldered Ends:
   a. Standard: MSS SP-110; MSS SP-145.
   b. CWP Rating: 600 psig (4140 kPa).
   c. Body Design: Two piece.
   d. Body Material: Forged brass.
   e. Ends: Threaded or soldered.
   f. Seats: PTFE.
   g. Stem: Brass.
   h. Ball: Chrome-plated brass.
   i. Port: Regular.

C. Performance: None

2.3 BRONZE BALL VALVES

A. Physical: None

B. Functional:

1. Bronze Ball Valves, One Piece with Bronze Trim, Threaded Ends:
   a. Standard: MSS SP-110; MSS SP-145.
   b. CWP Rating: 400 psig (2760 kPa).
   c. Body Design: One piece.
   d. Body Material: Bronze.
   e. Ends: Threaded.
   f. Seats: PTFE.
   g. Stem: Bronze.
   h. Ball: Chrome-plated brass.
   i. Port: Reduced.
2. Bronze Ball Valves, Two Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:
   a. Standard: MSS SP-110; MSS SP-145.
   b. CWP Rating: 600 psig (4140 kPa).
   c. Body Design: Two piece.
   d. Body Material: Bronze.
   e. Ends: Threaded or soldered.
   f. Seats: PTFE.
   g. Stem: Bronze or brass.
   h. Ball: Chrome-plated brass.
   i. Port: Full.
3. Bronze Ball Valves, Two Piece with Full Port, and Bronze or Brass Trim, Press Ends:
   a. Standard: MSS SP-110; MSS SP-145; IAPMO/ANSI Z1157.

b. CWP Rating: Minimum 200 psig (1380 kPa).
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Press.
f. Press-End Connections Rating: Minimum 200 psig (1380 kPa).
g. Seats: PTFE or RTPFE.
h. Stem: Bronze or brass.
i. Ball: Chrome-plated brass.
j. Port: Full.
k. O-Ring Seal: EPDM or Buna-N.

4. Bronze Ball Valves, Two Piece with Regular Port, and Bronze or Brass Trim, Threaded Ends:
   a. Standard: MSS SP-110; MSS SP-145.
   b. CWP Rating: 600 psig (4140 kPa).
   c. Body Design: Two piece.
   d. Body Material: Bronze.
   e. Ends: Threaded.
   f. Seats: PTFE.
   g. Stem: Bronze or brass.
   h. Ball: Chrome-plated brass.
   i. Port: Regular.
5. Bronze Ball Valves, Three Piece with Regular Port, and Stainless Steel Trim, Threaded or Soldered Ends:
   a. Standard: MSS SP-110; MSS SP-145.
   b. CWP Rating: 600 psig (4140 kPa).
   c. Body Design: Three piece.
   d. Body Material: Bronze.
   e. Ends: Threaded or soldered.
   f. Seats: PTFE.
   g. Stem: Stainless steel.
   h. Ball: Stainless steel, vented.
   i. Port: Regular.

C. Performance: None

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow space for service, maintenance, and equipment removal without system shutdown.

B. Provide support to piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access.

D. For valves in horizontal piping, install valves with stem at or above center of pipe.

E. Install valves in position to allow full valve actuation movement.

F. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

G. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

H. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves exhibiting leakage.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, provide the same types of valves with higher CWP ratings.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Brass ball valve, one piece. Provide with threaded or press-connection-joint ends.
2. Bronze ball valve, one piece with bronze trim. Provide with threaded or press-connection-joint ends.

END OF SECTION 220523.12

SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze, swing check valves.
2. Bronze, swing check valves, press ends.

1.2 ACTION SUBMITTALS

A. Product data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic water piping check valves intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372, or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.5 for flanges for metric standard piping.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for cast-copper solder joint.
5. ASME B16.22 for wrought copper solder joint.
6. ASME B16.51 for press joint.
7. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for groove-end connections.

D. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE SWING CHECK VALVES

A. Physical: None

B. Functional:
1. Bronze, Swing Check Valves with Bronze Disc, Class 125:
   a. Description:
      1) Standard: MSS SP-80, Type 3.
      2) CWP Rating: 200 psig (1380 kPa).
      3) Body Design: Horizontal flow.
      4) Body Material: ASTM B62, bronze.
      5) Ends: Threaded or soldered. See valve schedule articles.
      6) Disc: Bronze.
2. Bronze, Swing Check Valves with Nonmetallic Disc, Class 125:
   a. Description:
      1) Standard: MSS SP-80, Type 4.
      2) CWP Rating: 200 psig (1380 kPa).
      3) Body Design: Horizontal flow.
      4) Body Material: ASTM B62, bronze.
      5) Ends: Threaded or soldered. See valve schedule articles.
      6) Disc: PTFE.
3. Bronze, Swing Check Valves with Bronze Disc, Class 150:
   a. Description:
      1) Standard: MSS SP-80, Type 3.
      2) CWP Rating: 300 psig (2070 kPa).
      3) Body Design: Horizontal flow.
      4) Body Material: ASTM B62, bronze.
      5) Ends: Threaded or soldered. See valve schedule articles.
      6) Disc: Bronze.
4. Bronze, Swing Check Valves with Nonmetallic Disc, Class 150:
   a. Description:
      1) Standard: MSS SP-80, Type 4.
      2) CWP Rating: 300 psig (2070 kPa).
      3) Body Design: Horizontal flow.
      4) Body Material: ASTM B62, bronze.
      5) Ends: Threaded or soldered. See valve schedule articles.
      6) Disc: PTFE.
5. Bronze, Swing Check Valves, Press Ends:
   a. Description:
      1) Standard: MSS SP-80 and MSS SP-139.
      2) CWP Rating: Minimum 200 psig (1380 kPa).
      3) Body Design: Horizontal flow.
      4) Body Material: ASTM B584, bronze.
      5) Ends: Press.
      6) Press Ends Connection Rating: Minimum 200 psig (1380 kPa).
      7) Disc: Brass or bronze.

PART 3 - EXECUTION

3.1 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Provide support of piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.

D. Install valves so that stems are horizontal or slope upward from centerline of pipe.

E. Install valves in position that does not project into aisles or block access to other equipment.

F. Install valves in position to allow full stem and manual operator movement.

G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.

H. Check Valves: Install check valves for proper direction of flow.

I. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

J. Adhere to manufacturer's installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 (DN 50) and Smaller: Bronze, swing check valves with bronze or nonmetallic disc.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded, soldered, or press-end connections.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze, swing check valves with bronze disc, Class 125, with soldered or threaded end connections.
2. Bronze, swing check valves with press-end connections.

END OF SECTION 220523.14

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal hanger-shield inserts.
4. Fastener systems.
5. Pipe-positioning systems.
6. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
2. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
   a. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
   b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Physical: None

B. Functional:
1. Carbon-Steel Pipe Hangers and Supports:
   a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   b. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
   c. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
   d. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
2. Stainless-Steel Pipe Hangers and Supports:
   a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   b. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   c. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
3. Copper Pipe and Tube Hangers:
   a. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   b. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

C. Performance: None

2.3 TRAPEZE PIPE HANGERS

A. Physical: None

B. Functional:
   1. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

C. Performance: None

2.4 THERMAL HANGER-SHIELD INSERTS

A. Physical: None

B. Functional:
   1. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.
   2. Insulation-Insert Material for Hot Piping: ASTM C552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength.
   3. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
   4. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
   5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

C. Performance: None

2.5 FASTENER SYSTEMS

A. Physical: None

B. Functional:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   2. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
      a. Indoor Applications: Zinc-coated or stainless steel.
      b. Outdoor Applications: Stainless steel.

C. Performance: None

2.6 PIPE-POSITIONING SYSTEMS

A. Physical:

1. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

B. Functional: None

C. Performance: None

2.7 EQUIPMENT SUPPORTS

A. Physical:
1. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

B. Functional: None

C. Performance: None

2.8 MATERIALS

A. Physical:
1. Aluminum: ASTM B221 (ASTM B221M).
2. Carbon Steel: ASTM A1011/A1011M.
3. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.
4. Stainless Steel: ASTM A240/A240M.
5. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   a. Properties: Nonstaining, noncorrosive, and nongaseous.
   b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

B. Functional: None

C. Performance: None

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. 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 (90 kg).

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
5. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal hanger-shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C) pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction occurs.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction occurs.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).

b. Medium (MSS Type 32): 1500 lb (680 kg).
c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material test reports.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
a. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Physical: None

B. Functional:

1. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule," and articles for where insulating materials shall be applied.
2. Products shall not contain asbestos, lead, mercury, or mercury compounds.
3. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
4. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
6. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.
   a. Preformed Pipe Insulation: Type II, Class 1, unfaced.
   b. Preformed Pipe Insulation: Type II, Class 2, with factory-applied ASJ jacket.
   c. Fabricated shapes in accordance with ASTM C450, ASTM C585, and ASTM C1639.
   d. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
7. Mineral Wool, Preformed Pipe: Mandrel-wound mineral wool fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to 1200 deg F (650 deg C) in accordance with ASTM C447. Comply with ASTM C547.
   a. Preformed Pipe Insulation: Type II, Grade A with factory-applied ASJ.
   b. Fabricated shapes in accordance with ASTM C450 and ASTM C585.

C. Performance: None

2.3 ADHESIVES

A. Physical: None

B. Functional:
1. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
2. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
3. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
4. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

C. Performance: None

2.4 MASTICS AND COATINGS

A. Physical: None

B. Functional:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.

a. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
b. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
c. Color: White.

3. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
   a. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm (0.66 metric perms) at manufacturer's recommended dry film thickness.
   b. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
   c. Color: White.

C. Performance: None

2.5 SEALANTS

A. Physical: None

B. Functional:
1. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.
2. Joint Sealants:
   a. Permanently flexible, elastomeric sealant.
   b. Service Temperature Range: Minus 58 to plus 176 deg F (Minus 50 to plus 80 deg C).
   c. Color: White or gray.
3. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
   a. Fire- and water-resistant, flexible, elastomeric sealant.
   b. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
   c. Color: White.

C. Performance: None

2.6 FACTORY-APPLIED JACKETS

A. Physical: None

B. Functional:
1. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   a. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

C. Performance: None

2.7 TAPES

A. Physical:

1. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
    a. Width: 3 inches (75 mm).
    b. Thickness: 11.5 mils (0.29 mm).
    c. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
    d. Elongation: 2 percent.
    e. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
    f. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. Functional: None

C. Performance: None

2.8 SECUREMENTS

A. Physical:
1. Bands:
    a. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal.
    b. Aluminum: ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal.
2. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
3. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

B. Functional: None

C. Performance: None

2.9 PROTECTIVE SHIELDING GUARDS

A. Physical: None

B. Functional:
1. Protective Shielding Pipe Covers:
    a. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
2. Protective Shielding Piping Enclosures, <Insert drawing designation>:
    a. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

C. Performance: None

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the contract documents.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches (100 mm) o.c.

   a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe

insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Color: Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless steel jackets.

3.8 FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Contracting Officer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: 1/2 inch (13 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: 1/2 inch (13 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch (25 mm) thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:
    a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
    b. Mineral Wool, Preformed Pipe Insulation, Type II: 1/2 inch (13 mm) thick.

D. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:

    a. Cellular Glass: 2 inches (50 mm) thick.
    b. Glass-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
    c. Mineral Wool, Preformed Pipe Insulation, Type II: 2 inches (50 mm) thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

B. Related Requirements:

1. Section 331415 "Site Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.4 WARRANTY

A. Polypropylene Piping (PP-R) Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.

1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
2. Warranty is to be in effect only upon submission by the Contractor to the manufacturer of valid pressure/leak documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Physical:
1. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
2. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

B. Functional: None

C. Performance: None

2.2 COPPER TUBE AND FITTINGS

A. Physical: None

B. Functional:
1. Drawn-Temper Copper Tube: ASTM B88, Type K.
2. Annealed-Temper Copper Tube: ASTM B88, Type K.
3. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
4. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
5. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
6. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
7. Wrought Copper Unions: ASME B16.22.
8. Copper Tube, Pressure-Seal-Joint Fittings:
   a. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
   b. Minimum 200-psig working-pressure rating at 250 deg F.
9. Copper Tube, Push-on-Joint Fittings:
   a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
   b. Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

C. Performance: None

2.3 PIPING JOINING MATERIALS

A. Physical: None

B. Functional:
1. Pipe-Flange Gasket Materials:
   a. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
   b. Full-face or ring type unless otherwise indicated.

2. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
3. Solder Filler Metals: ASTM B32, lead-free alloys.
4. Flux: ASTM B813, water flushable.
5. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

C. Performance: None

2.4 TRANSITION FITTINGS

A. Physical: None

B. Functional:
1. General Requirements:
   a. Same size as pipes to be joined.
   b. Pressure rating at least equal to pipes to be joined.
   c. End connections compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Plastic-to-Metal Transition Fittings:
   a. Description:
      1) CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
      2) One end with threaded brass insert and one solvent-cement-socket or threaded end.
4. Plastic-to-Metal Transition Unions:
   a. Description:
      1) CPVC or PVC four-part union.
      2) Brass or stainless steel threaded end.
      3) Solvent-cement-joint or threaded plastic end.
      4) Rubber O-ring.
      5) Union nut.

C. Performance: None

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.

3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
1. Nonconducting materials for field assembly of companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard or soft copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
1. Hard copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.

3.2 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.3 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction

loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install valves according to the following:

1. Section 220523.12 "Ball Valves for Plumbing Piping."

2. Section 220523.14 "Check Valves for Plumbing Piping."

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

F. Install domestic water piping level without pitch and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gages for Plumbing Piping."

Q. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

R. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.

I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

C. Install hangers for copper piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of copper piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

    a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

        1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
        2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.12 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Backflow preventers.
   2. Water pressure-reducing valves.
   3. Balancing valves.
   4. Temperature-actuated, water mixing valves.
   5. Strainers for domestic water piping.
   6. Water-hammer arresters.

B. Related Requirements:

   1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
   2. Section 221116 "Domestic Water Piping" for water meters.
   3. Section 331415 "Site Water Distribution Piping" for fire water-service backflow prevention devices.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

   1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Physical: None

B. Functional: None

C. Performance:
1. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle third of flow range.
4. Body: Bronze for NPS 2 and smaller; .
5. End Connections: Threaded for NPS 2 and smaller.
6. Configuration: Designed for horizontal, straight-through flow.
7. Accessories:

   a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.4 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:
1. Standard: ASSE 1003.
2. Pressure Rating: Initial working pressure of 150 psig.
3. Body: Bronze for NPS 2 and smaller.
4. Valves for Booster Heater Water Supply: Include integral bypass.

5. End Connections: Threaded or solder for NPS 2 and smaller; flanged or solder for NPS 2-1/2 and NPS 3.

2.5 BALANCING VALVES

A. Memory-Stop Balancing Valves:
1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 2 or smaller.
4. Body: Copper alloy.
5. Port: Standard or full port.
6. Ball: Chrome-plated brass or stainless steel.
7. Seats and Seals: Replaceable.
8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.

2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:
1. Standard: ASSE 1070.
2. Pressure Rating: 125 psig.
3. Type: Thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded inlets and outlet.
6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Valve Finish: Chrome plated.

B. Primary, Thermostatic, Water Mixing Valves:
1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Valve Finish: Chrome plated.
8. Piping Finish: Chrome plated.
9. Cabinet: Factory fabricated, stainless steel, for surface mounting and with hinged, stainless steel door.

2.7 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller.
3. End Connections: Threaded for NPS 2 and smaller.
4. Screen: Stainless steel with round perforations unless otherwise indicated.

5. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.020 inch.

6. Drain: Pipe plug.

2.8 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:
   1. Standard: ASSE 1010 or PDI-WH 201.
   2. Type: Diaphragm.
   3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
   3. Do not install bypass piping around backflow preventers.

B. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

C. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.

   1. Install cabinet-type units recessed in or surface mounted on wall as specified.

D. Y-Pattern Strainers: For water, install on supply side of each water pressure-reducing valve.

E. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.5 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Backflow preventers.
   2. Water pressure-reducing valves.
   3. Balancing valves.
   4. Temperature-actuated, water mixing valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

D. Adjust each reduced-pressure-principle backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections.

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221123.21 - INLINE, DOMESTIC-WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Horizontally mounted, in-line, close-coupled centrifugal pumps.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Detail pumps and adjacent equipment, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. UL Compliance: UL 778 for motor-operated water pumps.
3. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

2.2 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Physical: None

B. Functional:
1. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.
2. Pump Construction:
a. Casing:
1) Radially split brass or cast iron with threaded companion-flange connections for pumps with NPS 2 pipe connections.
2) Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
3) Gauge port tappings at suction and discharge nozzles.
b. Impeller: Bronze or brass, statically and dynamically balanced, closed, and keyed to shaft.
c. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
d. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
e. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
f. Bearings: Grease-lubricated or permanently lubricated ball type.
g. Minimum Working Pressure: 175 psig.
h. Continuous Operating Temperature: 225 deg F.
3. Motor: Single speed, with grease-lubricated ball bearings; resiliently or rigidly mounted to pump casing.

C. Performance: None

2.3 MOTORS

A. Physical: None

B. Functional: None

C. Performance:
1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."
a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 50 to 125 deg F.
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.

6. Power Requirement: 24 V ac.
7. Settings: Start pump at 105 deg F and stop pump at 120 deg F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with HI 1.4.

B. Mount pumps in orientation complying with manufacturer's written instructions.

C. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

D. Install thermostats in hot-water return piping.

E. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

F. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set thermostats for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.

C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
b. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties." Comply with requirements for valves specified in the following:

1. Section 220523.12 "Ball Valves for Plumbing Piping."
2. Section 220523.14 "Check Valves for Plumbing Piping."
3. Install pressure gauge at suction of each pump and pressure gauge at discharge of each pump. Install at integral pressure-gauge tappings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

3.3 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring between temperature controllers and devices.

C. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. 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.

D. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123.21

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. PVC pipe and fittings.
4. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product data.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations, or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

B. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

C. Field quality-control reports.

1.4 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:
   a. Soil, Waste, and Vent Piping: 10 ft. head of water.

2.2 PIPING MATERIALS

A. Physical:
   1. Piping materials to bear label, stamp, or other markings of specified testing agency.
   2. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Functional: None

C. Performance: None

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Physical: None

B. Functional:
   1. Pipe and Fittings:
      a. Marked with CISPI collective trademark.
      b. ASTM A74, service cast iron.
   2. Gaskets: ASTM C564, rubber.
   3. Caulking Materials: ASTM B29, pure lead and oakum or hemp fiber.

C. Performance: None

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Physical: None

B. Functional:
   1. Pipe and Fittings:
      a. Marked with CISPI collective trademark.
      b. ASTM A888 or CISPI 301.
   2. CISPI, Hubless-Piping Couplings:
      a. Standards: ASTM C1277 and CISPI 310.
      b. Description: Stainless steel corrugated shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.
   3. Heavy-Duty, Hubless-Piping Couplings:
      a. Standards: ASTM C1277 and ASTM C1540.
      b. Description: Stainless steel shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

C. Performance: None

2.5 PVC PIPE AND FITTINGS

A. Physical: None

B. Functional:

1. Comply with NSF 14 for plastic piping components. Include "NSF-dwv" marking for plastic drain, waste, and vent piping and "NSF-sewer" marking for plastic sewer piping.
2. Solid-Wall PVC Pipe: ASTM D2665 drain, waste, and vent.
3. Cellular-Core PVC Pipe: ASTM F891, Schedule 40.
4. PVC Socket Fittings: ASTM D2665, made in accordance with ASTM D3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
5. Adhesive Primer: ASTM F656.
6. Solvent Cement: ASTM D2564.

C. Performance: None

2.6 SPECIALTY PIPE FITTINGS

A. Physical: None

B. Functional:
1. Transition Couplings:
   a. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
   b. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
   c. Unshielded, Nonpressure Transition Couplings:
      1) Standard: ASTM C1173.
      2) Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
      3) End Connections: Same size as and compatible with pipes to be joined.
      4) Sleeve Materials:
         a) For Cast-Iron Soil Pipes: ASTM C564, rubber.
         b) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926 PVC.
         c) For Dissimilar Pipes: ASTM D5926 PVC or other material compatible with pipe materials being joined.
   d. Shielded, Nonpressure Transition Couplings:
      1) Standard: ASTM C1460.
      2) Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
      3) End Connections: Same size as and compatible with pipes to be joined.

C. Performance: None

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment".

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.

4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

L. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: Two percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: Two percent downward in direction of flow.
3. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

O. Install aboveground PVC piping in accordance with ASTM D2665.

P. Install underground PVC piping in accordance with ASTM D2321.

Q. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

    a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

    a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
    b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

    a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2.
3. PVC Piping: Join in accordance with ASTM D2855 and ASTM D2665 appendixes.

E. Joint Restraints and Sway Bracing:

1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:

a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. General valve installation requirements for general-duty valve installation are specified in the following Sections:

1. Section 220523.12 "Ball Valves for Plumbing Piping."
2. Section 220523.14 "Check Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install full-port ball valve for piping NPS 2 and smaller.
2. Install gate valve for piping NPS 2-1/2 and larger.

C. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment".

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42 clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Ft. and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Ft. if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52 spring hangers.

C. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

F. Support vertical runs of cast-iron soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections in accordance with the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller are to be any of the following:

1. Service Class cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI hubless-piping couplings; and coupled joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, vent piping NPS 4 and smaller is to be any of the following:

1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Solid-wall or Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 4 and smaller are to be any of the following:

1. Service cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; cast-iron hubless-piping couplings; and coupled joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:

   1. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashing assemblies.
   2. Section 077200 "Roof Accessories" for preformed flashings.
   3. Section 078413 "Penetration Firestopping" for through-penetration firestop assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

   1. Show fabrication and installation details for frost-resistant vent terminals.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Physical:
   1. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
   2. Comply with NSF 14 for plastic sanitary waste piping specialty components.

B. Functional: None

C. Performance: None

2.2 CLEANOUTS

A. Physical: None

B. Functional:
1. Cast-Iron Exposed Cleanouts:
   a. Standard: ASME A112.36.2M.
   b. Size: Same as connected drainage piping.
   c. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
   d. Closure: Countersunk, brass plug.
   e. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Performance: None

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Physical: None

B. Functional:
1. Deep-Seal Traps:
   a. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
   b. Size: Same as connected waste piping.
      1) NPS 2: 4-inch- minimum water seal.
      2) NPS 2-1/2 and Larger: 5-inch- minimum water seal.
2. Floor-Drain, Inline Trap Seal:
   a. Description: Inline floor drain trap seal, forming a physical barrier to slow trap evaporation while not impeding flow from drain.
   b. Material: Polymer.
   c. Standard: Tested and certified in accordance with ASSE 1072.
   d. Listing: ICC-ES or IAPMO listed.
   e. Size: Same as floor drain outlet or strainer throat.
3. Air-Gap Fittings:
   a. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
   b. Body: Bronze or cast iron.
   c. Inlet: Opening in top of body.
   d. Outlet: Larger than inlet.
   e. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Performance: None

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install deep-seal traps on floor drains and other waste outlets, if indicated.

E. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Commercial, electric, storage, domestic-water heaters.
   2. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

   1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale and coordinated with all building trades.

B. Seismic Qualification Data: Certificates, for commercial domestic-water heaters, accessories, and components, from manufacturer.

C. Product Certificates: For each type of commercial, electric, domestic-water heater.

D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

E. Source quality-control reports.

F. Field quality-control reports.

G. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.

a. Commercial, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: Three years.

b. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
2. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
3. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
4. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Physical: None

B. Functional:
1. Commercial, Electric, Storage, Domestic-Water Heaters:
a. Standard: UL 1453.
b. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.
1) Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
a) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
2) Pressure Rating: 150 psig.
3) Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
c. Factory-Installed, Storage-Tank Appurtenances:
1) Anode Rod: Replaceable magnesium.

2) Drain Valve: Corrosion-resistant metal with hose-end connection.
3) Insulation: Comply with ASHRAE/IES 90.1.
4) Jacket: Steel with enameled finish or high-impact composite material.
5) Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
6) Temperature Control: Adjustable thermostat.
7) Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
8) Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

d. Special Requirements: NSF 5 construction.

C. Performance: None

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Physical: None

B. Functional:

1. Domestic-Water Expansion Tanks:
   a. Description: Steel pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
   b. Construction:
      1) Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
      2) Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
      3) Air-Charging Valve: Factory installed.
2. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.
3. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.
4. Heat-Trap Fittings: ASHRAE/IES 90.1.
5. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- maximum outlet pressure unless otherwise indicated.
6. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
7. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than working-pressure rating of domestic-water heater.
8. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
9. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

10. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
11. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

C. Performance: None

2.4 SOURCE QUALITY CONTROL

A. Physical: None

B. Functional: None

C. Performance:
1. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
2. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
3. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install thermometers on inlet and outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 221119 "Domestic Water Piping Specialties."

J. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

K. Fill electric, domestic-water heaters with water.

L. Charge domestic-water expansion tanks with air to required system pressure.

M. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

N. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. 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 operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION 223300

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Commercial, direct-vent, gas-fired, storage, domestic-water heater.
   2. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

   1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale and coordinated with all building trades.

B. Product Certificates: For each type of commercial, gas-fired, domestic-water heater.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.

    a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

        1) Storage Tank: Three years.
        2) Controls and Other Components: One year(s).

    b. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
2. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.
3. ASME Compliance:
    a. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
    b. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
4. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Physical: None

B. Functional:
1. Commercial, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
    a. Standard: ANSI Z21.10.1/CSA 4.1.
    b. Storage-Tank Construction: Steel.
        1) Tappings: ASME B1.20.1 pipe thread.
        2) Pressure Rating: 150 psig (1035 kPa).
        3) Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
    c. Factory-Installed Storage-Tank Appurtenances:
        1) Anode Rod: Replaceable magnesium.
        2) Dip Tube: Required unless cold-water inlet is near bottom of tank.
        3) Drain Valve: Corrosion-resistant metal with hose-end connection.

4) Insulation: Comply with ASHRAE/IES 90.1.
5) Jacket: Steel with enameled finish.
6) Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
7) Burner: For use with direct-vent, gas-fired, domestic-water heaters and natural-gas fuel.
8) Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
9) Temperature Control: Adjustable thermostat.
10) Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

d. Direct-Vent System: Through-wall, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.

C. Performance: None

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Physical: None

B. Functional:

1. Domestic-Water Expansion Tanks:
   a. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
   b. Construction:
      1) Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
      2) Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
      3) Air-Charging Valve: Factory installed.
2. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads.
3. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.
4. Heat-Trap Fittings: ASHRAE 90.1.
5. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
   a. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."
6. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.
7. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig (3.5-kPa) pressure rating as required to match gas supply.

8. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
9. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
    a. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
10. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domestic-water heater.
    a. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
11. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
12. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of 18 inches (457 mm) above the floor.
13. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

C. Performance: None

2.4 SOURCE QUALITY CONTROL

A. Physical: None

B. Functional: None

C. Performance:
1. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
2. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
3. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.
9.

B. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters in accordance with NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

J. Fill domestic-water heaters with water.

K. Charge domestic-water expansion tanks with air to required system pressure.

L. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

M. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.2 PIPING CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. 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 operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION 223400

SECTION 230130.52 - EXISTING HVAC AIR DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cleaning existing HVAC air-distribution equipment, ducts, plenums, and system components.

1.2 DEFINITIONS

A. ACAC: American Council for Accredited Certification.

B. ASCS: Air systems cleaning specialist.

C. CESB: Council of Engineering and Scientific Specialty Boards.

D. CMI: Certified Microbial Investigator.

E. CMR: Certified Microbial Remediator.

F. CMRS: Certified Microbial Remediation Supervisor.

G. IEP: Indoor Environmental Professional.

H. IICRC: Institute of Inspection, Cleaning, and Restoration Certification.

I. NADCA: National Air Duct Cleaners Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. ASCS Qualifications: A certified member of NADCA.
   1. Supervisor Qualifications: Certified as an ASCS by NADCA.

B. IEP Qualifications: CMI who is certified by ACAC and accredited by CESB.

C. CMR Qualifications: Certified by ACAC and accredited by CESB.

D. CMRS Qualifications: Certified by ACAC and accredited by CESB.

PART 2 - PRODUCTS

2.1 HVAC CLEANING AGENTS

A. Physical: None

B. Functional:
   1. Description:
      a. Formulated for each specific soiled coil condition that needs remedy.

C. Performance: None

2.2 ANTIMICROBIAL SURFACE TREATMENT

A. Physical: None

B. Functional:
   1. Description: Specific product selected shall be as recommended by the IEP based on the specific antimicrobial needs of the specific Project conditions.
      a. Formulated to kill and inhibit growth of microorganisms.
      b. EPA-registered for use in HVAC systems and for the specific application in which it will be used.
      c. Have no residual action after drying, with zero VOC off-gassing.
      d. OSHA compliant.
      e. Treatment shall dry clear to allow continued visual observation of the treated surface.

C. Performance: None

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspect HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.

B. Cleaning Plan: Prepare a written plan for air-distribution system cleaning that includes strategies and step-by-step procedures.

C. Proceed with work only after conditions detrimental to performance of the Work have been corrected and cleaning plan has been approved.

D. Use the existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.

E. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning.

3.2 CLEANING

A. Comply with NADCA ACR.

B. Perform electrical lockout and tagout according to standards set by Contracting Officer or authorities having jurisdiction.

C. Remove non-adhered substances and deposits from within the HVAC system.

D. Systems and Components to Be Cleaned: All air-moving and -distribution equipment.

E. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.

1. Particulate Collection: For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.

F. Control odors and mist vapors during the cleaning and restoration process.

G. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.

H. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.

I. Clean all air-distribution devices, registers, grilles, and diffusers.

J. Clean non-adhered substance deposits according to NADCA ACR and the following:

1. Clean air-handling units, airstream surfaces, components, condensate collectors, and drains.
2. Ensure that a suitable operative drainage system is in place prior to beginning wash-down procedures.
3. Clean evaporator coils, reheat coils, and other airstream components.

K. Air-Distribution Systems:

1. Create service openings in the HVAC system as necessary to accommodate cleaning.
2. Mechanically clean air-distribution systems specified to remove all visible contaminants, so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).

L. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.

M. Mechanical Cleaning Methodology:

1. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.

   a. Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
   b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials, such as duct and plenum liners.

2. Cleaning Mineral-Fiber Insulation Components:

   a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR.
   b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).
   c. Fibrous materials that become wet shall be discarded and replaced.

N. Application of Antimicrobial Treatment:

1. Apply antimicrobial agents and coatings if active fungal growth is determined by the IEP to be at Condition 2 or Condition 3 status according to IICRC S520, as analyzed by a laboratory, and with results interpreted by an IEP. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.
2. Apply antimicrobial treatments and coatings after the system is rendered clean.
3. Apply antimicrobial agents and coatings directly onto surfaces of interior ductwork.
4. Microbial remediation shall be performed by a qualified CMR and CMRS.

3.3 CLEANLINESS VERIFICATION

A. Verify cleanliness according to NADCA ACR, "Verification of HVAC System Cleanliness" Section.

B. Surface-Cleaning Verification: Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.

C. Verification of Coil Cleaning: Coil will be considered clean if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection.

D. Prepare a written cleanliness verification report.

3.4 RESTORATION

A. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR, "Restoration and Repair of Mechanical Systems" Section.

B. Restore service openings capable of future reopening. Comply with requirements in Section 233113 "Metal Ducts."

C. Replace fibrous-glass materials that cannot be restored by cleaning or resurfacing. Comply with requirements in Section 233113 "Metal Ducts."

D. Replace damaged insulation according to Section 230713 "Duct Insulation."

E. Ensure that closures do not hinder or alter airflow.

F. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.

G. Restore manual volume dampers and air-directional mechanical devices inside the system to their marked position on completion of cleaning.

END OF SECTION 230130.52

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Piping materials and installation instructions common to most piping systems.
2. Concrete equipment base construction requirements.
3. Equipment nameplate data requirements.
4. Nonshrink grout for equipment installations.
5. Field-fabricated metal and wood equipment supports.
6. Installation requirements common to equipment specification sections.
7. Mechanical demolition.
8. Cutting and patching.
9. Touch-up painting and finishing.

B. The plans and specifications are complimentary and shall be used together in order to fully describe the Work. In the case of a conflict between the plans and specifications, the plans take precedence.

C. The engineer has based the drawings and design on non-certified information furnished by various equipment manufacturers. It is incumbent on the part of the CONTRACTOR to include in the bid all material and labor needed to install the actual equipment furnished.

D. Related Sections:

1. The following is work of Division 26 sections of the Specifications:

a. Power supply wiring from power source to power connection on equipment. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

b. Interlock wiring between field-installed equipment, except where specified as factory installed. Interlock wiring, as used in this specification, is defined as that wiring between electrically-interlocked equipment for the purpose of controlling one piece or pieces of equipment by the operation (on, off, etc.) of another piece or pieces of associated equipment.

E. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. 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.
3. Requirements for Contractor to provide quality-assurance and -control services required by Government, Contracting Officer, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 REFERENCES

A. Applicable Standards:

1. American Society for Testing and Materials (ASTM):

a. A47 - Ferritic Malleable Iron Castings.
b. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
c. A126 - Gray Iron castings for Valves, Flanges, and Pipe Fittings.
d. A536 - Ductile Iron Castings.
e. B32 - Solder Metal.
f. C1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
g. D709 - Laminated Thermosetting Materials.

2. American Society of Mechanical Engineers (ASME):
    a. Boiler and Pressure Vessel Code.
    b. A13.1 - Scheme for the Identification of Piping Systems.
    c. B1.20.1 - Pipe Threads, General Purpose (Inch).
    d. B16.20 - Ring-Joint Gaskets and Grooves for Steel Pipe Flanges.
    e. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
    f. B18.2.1 - Square and Hex Bolts and Screws-Inch Series.
    g. B31 Series - Code for Pressure Piping.
3. American Welding Society (AWS):
    a. Soldering Manual, latest.
    b. Brazing Manual, latest.
    c. A5.8 - Filler Metals for Brazing.
    d. D1.1 - Structural Welding Code for Steel.
    e. D10.12 - Recommended Practices and Procedures for Welding Low Carbon Steel Pipe.

1.5 SUBMITTALS

A. Submit manufacturer's data sheets on all system components, including the following:
    1. Transition fittings
    2. Dielectric fittings
    3. Mechanical sleeve seals
    4. Escutcheons

B. General, all Division 23 sections of the Specifications: Follow the procedures specified in Division 1. Prepare maintenance manuals in accordance with Division 1 sections of the Specifications.

C. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" article of this section.

1.6 QUALITY ASSURANCE

A. Qualify welding processes and operators for structural steel according to AWS D1.1.

B. All welding on pressure piping shall conform with the requirements of the American National Standard Code for Pressure Piping, ANSI B31.3, "Chemical Plant and Petroleum Refinery Piping." All welds on piping having working pressures of 300 psig or greater shall be subjected to a full X-ray examination and will not be accepted until all welds meet the requirements of ANSI B31.1, "Power Piping." Faulty welds shall be removed at no additional cost to the client. X-ray testing shall be performed by others at no additional cost to the Contractor.
    1. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

C. Pressure Vessels: Prior to installation and acceptance, any power boiler, low-pressure heating boiler, or unfire pressure vessel operated at pressures of 15 pounds per square inch or greater,

furnished under this contract will be stamped with ASME Boiler and Pressure Vessel Code Symbol and a National Board of Boiler and Pressure Vessel Inspector's number, thus certifying that the vessel has been fabricated and tested per the provisions of the ASME Boiler and Pressure Vessel Code. Manufacturers' data reports (unless exempted by the ASME Code) will be filed with the National Board in Columbus, Ohio. Two copies of these data reports shall be submitted to the client. Testing, certification, and registration will be at the expense of the Contractor.

D. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

E. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

F. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

G. 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.

H. 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.

I. 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.

J. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

K. 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.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes ducts and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and ducting/piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

E. Materials and equipment furnished by others.

1. When equipment or materials are indicated to be furnished by others (F.B.O.) or by government furnished equipment (GFE) to the CONTRACTOR for installation and connection, the CONTRACTOR shall make a complete check of all materials and furnish a receipt to the Contracting Officer detailing the products received and the condition of the products delivered to him. After executing the receipt and acceptance by the CONTRACTOR, the CONTRACTOR shall assume full responsibility for the safe keeping, handling, and installation of the materials and equipment furnished by others or furnished by government, until completed installation and final approval by the engineer and Contracting Officer.

2. If the CONTRACTOR fails to issue said receipt it shall be assumed that all equipment and materials were then delivered to the CONTRACTOR in the proper quantities and in perfect condition.

1.8 PROJECT SITE CONDITIONS

A. Altitude Ratings: Unless otherwise noted, all specified equipment capacities, air quantities, etc., are for an altitude of 5,280 feet above sea level. Adjustments to manufacturers' ratings must be made accordingly.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate mechanical piping, ducting, and equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Interruption of Mechanical Utilities:

1. The Contractor shall not interrupt any main interior or exterior mechanical utility without written request for an outage and a subsequent approval of contracting officer nor shall he interrupt any branch line to an outlet or item of equipment without approval from the contracting officer.

2. Written request for outages shall be submitted seven calendar days in advance of the outage date. This request will delineate the particular utility or service in question, the time the service will be interrupted and the approximate hours the utility shall be off.

3. Unless otherwise noted on the drawings, or directed, any tie-ins or connections to existing utilities or equipment that necessitate interruptions of service shall be performed on a during non standard hours

4. The work to be performed during the interruption, will be preceded by all possible preparation, and will be carefully coordinated to minimize the duration of the interruption and work will proceed continuously until the system is restored to normal.

F. Coordinate installation of identifying devices after completion of covering and painting, where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe and Pipe Fittings:

1. Physical: None
2. Functional:
   a. Refer to individual piping system specification sections for pipe and fitting materials and joining methods.
   b. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
3. Performance: None

B. Joining Materials:

1. Physical: None
2. Functional:
   a. See individual piping system specification sections in Division 22 for special joining materials not listed below.
   b. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.
      1) ASME B16.21 - Nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, except where thickness or specific material is indicated.
         a) Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
         b) Narrow-Face Type: For raised-face, class 250 cast-iron and steel flanges.
      2) ASME B16.20 - For grooved, ring-joint, steel flanges.

3) AWWA C110 - Rubber, flat face, 1/8-inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.

c. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.

d. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated.

e. Solder Filler Metal: ASTM B32.

1) Alloy Sn95 or Alloy Sn94: Tin (approximately 95%) and silver (approximately 5%), having 0.10% lead content.

2) Alloy E: Tin (approximately 95%) and copper (approximately 5%), having 0.10% maximum lead content.

3) Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10% maximum lead content.

4) Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10% maximum lead content.

5) Alloy Sb5: Tin (95%) and antimony (5%), having 0.20% maximum lead content.

f. Brazing Filler Metals: AWS A5.8.

1) BCuP Series: Copper-phosphorous alloys.

2) BAgl: Silver alloy.

g. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

h. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.

i. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end, pressure pipes.

1) Sleeve: ASTM A126, Class B, gray iron.

2) Followers: ASTM A47, Grade 32510 or ASTM A536 ductile iron.

3) Gaskets: Rubber.

4) Bolts and Nuts: AWWA C111.

5) Finish: Enamel paint.

3. Performance: None

C. Piping Specialties:

1. Physical: None

2. Functional:

a. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

1) Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.

2) Insulating Material: Suitable for system fluid, pressure, and temperature.

3) Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180°F temperature.

4) Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system pressures.

5) Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

a) Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.

b) Dielectric Couplings: Galvanized steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225°F temperature.

c) Dielectric Nipples: Electroplated steel nipple, having inert and noncorrosive, thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig working pressure at 225°F temperature.

b. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.

c. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1) Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.

2) Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with one mechanical joint end conforming to AWWA C110 and one plain pipe sleeve end.

a) Penetrating Pipe Deflection: 5% without leakage.

b) Housing: Ductile-iron casting having water stop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.

c) Pipe Sleeve: AWWA C151, ductile-iron pipe.

d) Housing-to-Sleeve Gasket: Rubber or neoprene, push-on type, of manufacturer's design.

3) Cast-Iron Sleeve Fittings: Commercially made sleeve having integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.

3. Performance: None

D. Grout: Nonshrink, Nonmetallic Grout: ASTM C1107, Grade B.

1. Physical: None

2. Functional:

a. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

b. Design Mix: 5000 psi, 28-day compressive strength.

3. Performance: None

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 1 Section “Cutting and Patching” and Division 02 Section “Selective Structure Demolition” for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to be removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to be abandoned in place: Drain piping and cap or plug piping with same or compatible piping material.

3. Equipment to be removed: Disconnect and cap services and remove equipment.
4. Equipment to be removed and reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to be removed and salvaged: Disconnect and cap services and remove equipment and deliver to Contracting Officer.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 ERECTION INSTALLATION APPLICATION

A. Mechanical Systems - Common Requirements:

1. General: Install piping and ducting as described below, except where system sections specify otherwise. Individual piping system specification sections in Division 23 specify piping installation requirements unique to the piping system.
2. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of mechanical systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install as indicated, except where deviations to layout are approved on coordination drawings.
3. Install piping at indicated slope.
4. Install components having pressure rating equal to or greater than system operating pressure.
5. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
6. Install ducting and piping free of sags and bends.
7. Install exposed interior and exterior ducting and piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
8. Install ducting and piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
9. Install ducting and piping to allow application of insulation plus 1-inch clearance around insulation for all exterior insulated ducts and pipes.
10. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
11. Install fittings for changes in direction and branch connections.
12. Escutcheons: Where uncovered exposed pipes and ducts pass through floors, finished walls, or finished ceilings, they shall be fitted with chromium-plated cast-brass plates on chromium-plated pipe, or with cast-iron or steel plates on ferrous pipe. Plates shall be large enough to completely close the openings around the ducts and pipes and shall be square, octangular, or round, with the least dimension not less than 1-1/2 inches or more than 2-1/2 inches larger than the diameter of the duct/pipe. Plates shall be secured in an approved manner.
13. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

14. Above Grade, Exterior Wall, and Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

    a. Install steel pipe for sleeves smaller than 6 inches.

    b. Install cast-iron wall pipes for sleeves 6 inches and larger.

    c. Assemble and install mechanical seals according to manufacturer's printed instructions.

15. Below Grade, Exterior Wall, and Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

16. Below Grade, Exterior Wall, and Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.

17. Verify final equipment locations for roughing in.

18. See equipment specifications in other sections of these specifications for roughing-in requirements.

19. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system specification sections.

    a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

    b. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

    c. Soldered Joints: Construct joints according to AWS "Soldering Manual."

    d. Brazed Joints: Construct joints according to AWS "Brazing Manual."

    e. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

    f. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

20. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

    a. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inches or smaller threaded pipe connection.

    b. Install flanges, in piping 2-1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.

    c. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

B. Equipment Installation - Common Requirements:

1. Install equipment to provide the maximum possible head room, where mounting heights are not indicated.

2. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the engineer.

3. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

4. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

5. Install equipment giving right-of-way to piping systems installed at a required slope.

6. Shaft Alignment: All motors and pumps (or drives) connected by a shaft coupling, whether factory or field assembled, shall be aligned during installation using a dial indicator applied to both ends of both shafts for a full 360 degrees prior to operation. Alignment of the shafts shall be less than the maximum allowable tolerances as recommended by the coupling or equipment manufacturer. Alignment of shafts shall be rechecked after several hours of operation and equipment has reached operating temperature.

C. Painting and Finishing:

1. Field painting requirements are specified in Division 9 sections of the Specifications.

2. Damage and Touch-Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

D. Identification Tags and Labels:

1. Materials:

a. Pipe Labels: Pipe labels shall be self-adhesive labels, all temperature Perma-Code pipe markers No. B-500, manufactured by the W. H. Brady Company. The background color code for all markers shall conform to the American National Standard ANSI A-13.1 "Scheme for the Identification of Piping Systems." This standard establishes four basic backgrounds as follows: Yellow for dangerous materials, bright blue for protective materials, red for fire protection equipment, and green for safe materials.

b. Tags: Tags shall be aluminum, brass or laminated plastic 2" x 1" minimum with edges ground smooth or rolled. Each tag shall be punched to receive tie wires or chain. Letters and Numbers shall be evenly spaced and stamped or engraved into the surface.

2. Installation:

a. Identification of Piping:

1) Identify all piping according to the following procedures:

a) Bare pipes to be marked shall first be wiped clean of dirt, dust, grease, and moisture. Markers to be installed on painted piping shall be applied only after completion of final coat of paint. Insulated pipes shall first be painted to a smooth, hard surface in the area the label is to be applied. Labels shall be applied, using pressure, so that it lies smooth and flat. After application on insulated pipes, the label shall be stapled securely to the insulation. The labels shall be applied to the pipe so that the lettering is in the most legible position. For overhead piping apply markers on the lower half of the pipe where view is unobstructed, so that markers can be read at a glance from floor level. The wording on

the labels shall correspond directly to the wording in the mechanical symbol lists, regardless of whether or not it is standard wording for the designated manufacturer.

b) Use an arrow marker with each pipe content marker. The arrow shall always point away from the pipe marker and in the direction of flow, with background color and height the same as content marker. If flow can be in both directions, use two arrow markers.

c) Apply pipe marker and arrow marker at each valve, at every point of pipe entry or exit through wall or ceiling, on each riser and branch of tee, and every 20 feet on long continuous lines or at every bay or aisle to show proper identification of pipe content and direction of flow.

b. Valves: All main service valves, including fire protection, located inside the building shall be tagged and identified as to the type of service. All valves controlling branch mains or risers to various portions of the building shall be tagged and identified as to the areas served.

c. Controls: All automatic controls, control panels, zone valves, pressure electric, electric pressure switches, relays and starters shall be clearly tagged and identified. Wording shall be identical to that on the control diagram in the contract drawings.

E. Concrete Bases: Construct concrete equipment bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000 psi, 28-day compressive strength concrete and reinforcement as specified in Division 3 sections of the Specifications. Housekeeping pads under pumps, etc. shall be 3-1/2 inches thick with #4 reinforcing bars 12 inches on center each way unless otherwise noted.

F. Erection of Metal Supports and Anchorage:

1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

2. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel."

G. Cutting and Patching:

1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

2. Repair cut surfaces to match adjacent surfaces.

H. Grouting:

1. Install nonmetallic, nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates and anchors. Mix grout according to manufacturer's printed instructions.

2. Clean surfaces that will come into contact with grout.

3. Provide forms for placement of grout, as required.

4. Avoid air entrapment when placing grout.

5. Place grout, completely filling equipment bases.

6. Place grout on concrete bases to provide a smooth bearing surface for equipment.

7. Place grout around anchors.

8. Cure placed grout according to manufacturer's printed instructions.

3.3 DEMONSTRATION & TRAINING

1. Provide training or—if required in specific system sections—engage a system manufacturer's employed training instructor or factory-authorized service representative to train maintenance personnel to adjust, operate, and maintain each HVAC system.

END OF SECTION 230500

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems:

   a. Constant-volume air systems.
2. Testing, adjusting, and balancing of equipment.
3. Testing, adjusting, and balancing of existing HVAC systems and equipment.
4. Duct leakage tests verification.
5. HVAC-control system verification.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

G. UFAD: Underfloor air distribution.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.4 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by AABC:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC.

B. TAB Specialists Qualifications, Certified by NEBB or TABB:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

E. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.5 FIELD CONDITIONS

A. Partial Occupancy: Completed areas of building may be occupied before Substantial Completion. Cooperate with Contracting Officer during TAB operations to minimize conflicts with Contracting Officer's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data, including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

I. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainer baskets are installed and clean.

J. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.

N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.

4. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230713 "Duct Insulation," and Section 230716 "HVAC Equipment Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:

1. Motors.
2. Fans and ventilators.
3. Furnaces.
4. Unit heaters.
5. Condensing units.
6. Split-system air conditioners.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' Record drawings duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

   a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
   b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
   c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

2. Measure fan static pressures as follows:

   a. Measure static pressure directly at the fan outlet or through the flexible connection.
   b. Measure static pressure directly at the fan inlet or through the flexible connection.
   c. Measure static pressure across each component that makes up the air-handling system.
   d. Report artificial loading of filters at the time static pressures are measured.

3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Contracting Officer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR AIR-COOLED CONDENSING UNITS

A. Verify proper rotation of fan(s).

B. Measure and record entering- and leaving-air temperatures.

C. Measure and record entering and leaving refrigerant pressures.

D. Measure and record operating data of compressor(s), fan(s), and motors.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Entering and leaving refrigerant pressure and temperatures.

3.10 DUCT LEAKAGE TESTS

A. Witness the duct leakage testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified limits.

C. Report deficiencies observed.

3.11 HVAC CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify HVAC control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.12 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent. If design value is less than 100 cfm, within 10 cfm.
2. Air Outlets and Inlets: Plus or minus 10 percent. If design value is less than 100 cfm, within 10 cfm.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.13 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents, including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Notes to explain why certain final data in the body of reports vary from indicated values.
14. Test conditions for fans performance forms, including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Heating coil, dry-bulb conditions.
    e. Face and bypass damper settings at coils.
    f. Fan drive settings, including settings and percentage of maximum pitch diameter.
    g. Settings for pressure controller(s).
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Balancing stations.
4. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and speed.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan speed.
    d. Inlet and discharge static pressure in inches wg.
    e. For each filter bank, filter static-pressure differential in inches wg.
    f. Preheat-coil static-pressure differential in inches wg.
    g. Cooling-coil static-pressure differential in inches wg.
    h. Heating-coil static-pressure differential in inches wg.
    i. List for each internal component with pressure-drop, static-pressure differential in inches wg.
    j. Outdoor airflow in cfm.
    k. Return airflow in cfm.
    l. Outdoor-air damper position.
    m. Return-air damper position.

F. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Fuel type in input data.
   g. Output capacity in Btu/h.
   h. Ignition type.
   i. Burner-control types.
   j. Motor horsepower and speed.
   k. Motor volts, phase, and hertz.
   l. Motor full-load amperage and service factor.
   m. Sheave make, size in inches, and bore.
   n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

   a. Total airflow rate in cfm.
   b. Entering-air temperature in deg F.
   c. Leaving-air temperature in deg F.
   d. Air temperature differential in deg F.
   e. Entering-air static pressure in inches wg.
   f. Leaving-air static pressure in inches wg.
   g. Air static-pressure differential in inches wg.
   h. Low-fire fuel input in Btu/h.
   i. High-fire fuel input in Btu/h.
   j. Manifold pressure in psig.
   k. High-temperature-limit setting in deg F.
   l. Operating set point in Btu/h.
   m. Motor voltage at each connection.
   n. Motor amperage for each phase.
   o. Heating value of fuel in Btu/h.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches, and bore.
   h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and speed.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan speed.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

H. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System fan and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

I. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.15 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Contracting Officer.

B. Contracting Officer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.

E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
2. If the second final inspection also fails, Contracting Officer may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.

B. Related Requirements:
1. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

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

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

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

2.2 All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.INSULATION MATERIALS

A. Physical: None

B. Functional:
1. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials are applied.
2. Products do not contain asbestos, lead, mercury, or mercury compounds.
3. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
4. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
5. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
6. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 450 deg F in accordance with ASTM C411. Comply with ASTM C553, Type II, and ASTM C1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
7. Glass-Fiber Board Insulation: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F and 250 deg F for jacketed and between 35 deg F and 450 deg F for unfaced in accordance with ASTM C411. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

C. Performance: None

2.3 ADHESIVES

A. Physical: None

B. Functional:
1. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
2. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
3. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
4. PVC Jacket Adhesive: Compatible with PVC jacket.

C. Performance: None

2.4 MASTICS AND COATINGS

A. Physical: None

B. Functional:
1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Vapor-Retarder Mastic, Water Based, Interior Use: Suitable for indoor use on below ambient services.
    a. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
    b. Service Temperature Range: Minus 20 to plus 180 deg F.
    c. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
    d. Color: White.
3. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
    a. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
    b. Service Temperature Range: Minus 20 to plus 180 deg F.
    c. Color: White.

C. Performance: None

2.5 SEALANTS

A. Physical: None

B. Functional:
1. FSK and Metal Jacket Flashing Sealants:
    a. Materials are compatible with insulation materials, jackets, and substrates.
    b. Fire- and water-resistant, flexible, elastomeric sealant.
    c. Service Temperature Range: Minus 40 to plus 250 deg F.
    d. Color: Aluminum.
2. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
    a. Materials are compatible with insulation materials, jackets, and substrates.
    b. Fire- and water-resistant, flexible, elastomeric sealant.
    c. Service Temperature Range: Minus 40 to plus 250 deg F.
    d. Color: White.

C. Performance: None

2.6 FACTORY-APPLIED JACKETS

A. Physical: None

B. Functional:
1. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
    a. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
    b. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
    c. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
    d. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.

e. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested in accordance with ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.
f. ASJ+: All-service jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film leaving no paper exposed; complying with ASTM C1136, Types I, II, III, IV, and VII
g. PSK Jacket: Aluminum foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

C. Performance: None

2.7 TAPES

A. Physical: None

B. Functional:
1. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
   a. Width: 3 inches.
   b. Thickness: 11.5 mils.
   c. Adhesion: 90 ounces force/inch in width.
   d. Elongation: 2 percent.
   e. Tensile Strength: 40 lbf/inch in width.
   f. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
2. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
   a. Width: 3 inches.
   b. Thickness: 6.5 mils.
   c. Adhesion: 90 ounces force/inch in width.
   d. Elongation: 2 percent.
   e. Tensile Strength: 40 lbf/inch in width.
   f. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
3. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   a. Width: 2 inches.
   b. Thickness: 6 mils.
   c. Adhesion: 64 ounces force/inch in width.
   d. Elongation: 500 percent.
   e. Tensile Strength: 18 lbf/inch in width.
4. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   a. Width: 2 inches.
   b. Thickness: 3.7 mils.
   c. Adhesion: 100 ounces force/inch in width.
   d. Elongation: 5 percent.
   e. Tensile Strength: 34 lbf/inch in width.

C. Performance: None

2.8 SECUREMENTS

A. Physical: None

B. Functional:

1. Aluminum Bands: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

2. Insulation Pins and Hangers:

a. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

1) Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

2) Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

3) Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

b. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

1) Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.

2) Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.

3) Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

c. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

1) Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

2) Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

3) Adhesive-backed base with a peel-off protective cover.

d. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

1) Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

e. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

3. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
4. Wire: 0.080-inch nickel-copper alloy.

C. Performance: None

2.9 CORNER ANGLES

A. Physical: None

B. Functional:
1. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC in accordance with ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.
2. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum in accordance with ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

C. Performance: None

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

   a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. 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.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF GLASS-FIBER AND MINERAL-WOOL INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

B. Comply with manufacturer's written installation instructions.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Comply with manufacturer's written installation instructions.

B. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

C. Insulate duct access panels and doors to achieve same fire rating as duct.

D. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.6 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

    a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless steel jackets.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Contracting Officer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Glass-fiber, 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

B. Concealed, Return-Air Duct and Plenum Insulation: Glass-fiber, 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

C. Concealed, Outdoor-Air Duct and Plenum Insulation: Glass-fiber, 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

D. Concealed, Exhaust-Air Duct and Plenum Insulation: Glass-fiber, 1-1/2 inches thick and 0.75 lb/cu. ft. nominal density.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulation for HVAC piping systems.

B. Related Requirements:

1. Section 230713 "Duct Insulation" for duct insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

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

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Preformed Pipe Insulation Materials: 12 inches (300 mm) long by NPS 2 (DN 50).
2. Sheet Form Insulation Materials: 12 inches (300 mm) square.
3. Jacket Materials for Pipe: 12 inches (300 mm) long by NPS 2 (DN 50).
4. Sheet Jacket Materials: 12 inches (300 mm) square.
5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of manufacturer, fabricator, type, description, and size.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authority having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
   1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule" articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F (minus 57 deg C) and 220 deg F (104 deg C). Comply with ASTM C534/C534M, Type I, for tubular materials, Type II for sheet materials.

2.3 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Solvent-based adhesive.
   1. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
   2. Wet Flash Point: Below 0 deg F (minus 18 deg C).
   3. Service Temperature Range: 40 to 200 deg F (4 to plus 93 deg C).
   4. Color: Black.

2.4 MASTICS AND COATINGS

A. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
   1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
   2. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
   3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
   4. Color: White.

B. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on below-ambient services.
   1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
   2. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
   3. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm (0.66 metric perm) at manufacturer's recommended dry film thickness.
2. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
3. Color: White.

2.5 LAGGING ADHESIVES

A. Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.
   1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
   2. Service Temperature Range: 20 to plus 180 deg F (Minus 6 to plus 82 deg C).
   3. Color: White.

2.6 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:
   1. Permanently flexible, elastomeric sealant.

      a. Service Temperature Range: Minus 150 to plus 250 deg F (Minus 101 to plus 121 deg C).
      b. Color: White or gray.

C. FSK and Metal Jacket Flashing Sealants:
   1. Fire- and water-resistant, flexible, elastomeric sealant.
   2. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
   3. Color: Aluminum.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

B. Metal Jacket:
   1. Aluminum Jacket: Comply with ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

      a. Sheet and roll stock ready for shop or field sizing.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Outdoor Applications: 53-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
      d. Factory-Fabricated Fitting Covers:

         1) Same material, finish, and thickness as jacket.
         2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.

3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches (50 mm).
2. Thickness: 3.7 mils (0.093 mm).
3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.9 SECUREMENTS

A. Bands:
1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal.
2. Aluminum: ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal.
3. Springs: Twin spring set constructed of stainless steel, with ends flat and slotted to accept metal bands. Spring size is determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4 inch (19 mm) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 2 inches (50 mm) o.c.
4. For below-ambient services, apply vapor-barrier mastic over staples.
5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using prefabricated fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with prefabricated fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for

above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches (300 mm) o.c. and at end joints.

3.8 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless steel jackets.

3.9 FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

E. All insulation applications will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation is the following:
   a. Flexible Elastomeric: 3/4 inch (19 mm) thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation is the following:
   a. Flexible Elastomeric: 1 inch (25 mm) thick.

C. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation is the following:
   a. Flexible Elastomeric: 1 inch (25 mm) thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation is the following:
   a. Flexible Elastomeric: 2 inches (50 mm) thick.

B. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation is the following:

   a. Flexible Elastomeric: 1 inch (25 mm) thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:
1. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
   1. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.

END OF SECTION 230719

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Valves and specialties.
3. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product data: For the following:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Strainers.
4. Filter dryers.
5. Pressure-regulating valves.

B. Product Data Submittals: For each product.

1. Submit data for each type of refrigerant piping, fitting, valve, piping specialty, and refrigerant.

C. Delegated Design Submittals: For refrigerant piping size and layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

D. Shop Drawings:

1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Show interface and spatial relationships between piping and equipment.
3. Shop Drawing Scale: 1/8 inch equals 1 foot.

1.3 INFORMATIONAL SUBMITTALS

A. Welding Certificates: For each welder performing shop or field welding on Project.

B. Field Quality-Control Reports: For each field quality control test and inspection.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding, Brazing, and Fusing Qualifications."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," for refrigerant piping size and layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Comply with ASHRAE 15.
3. Comply with ASME B31.5.
4. Line Test Pressure for Refrigerant R-410A:
   a. Suction Lines for Refrigeration and Air-Conditioning Applications Other than Heat Pumps: 300 psig (2068 kPa).
   b. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).
   c. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

2.2 COPPER TUBE AND FITTINGS

A. Physical: None

B. Functional:
1. Copper Tube: ASTM B280, Type ACR.
2. Wrought-Copper Fittings, Solder Joint: ASME B16.22.
3. Wrought-Copper Fittings, Brazed Joint: ASME B16.50.
4. Wrought-Copper Unions: ASME B16.22.
5. Solder Filler Metals: ASTM B32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
6. Brazing Filler Metals: AWS A5.8M/A5.8.
7. Flexible Connectors:
   a. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.

b. End Connections: Socket ends.
c. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
d. Working Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
e. Maximum Operating Temperature: 250 deg F (121 deg C).

8. Copper-Tube, Pressure-Seal-Joint Fittings for Refrigerant Piping:
a. Standard: UL 207; certified by UL for field installation. Certification as a UL-recognized component alone is unacceptable.
b. Housing: Copper.
c. O-Rings: HNBR compatible with specific refrigerant.
d. Tools: Manufacturer's approved special tools.
e. Minimum Rated Pressure: 700 psig (48 bar).

C. Performance: None

2.3 VALVES AND SPECIALTIES

A. Physical: None

B. Functional:
1. Diaphragm Packless Valves:
a. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
b. Diaphragm: Phosphor bronze and stainless steel with stainless steel spring.
c. Operator: Rising stem and hand wheel.
d. Seat: Nylon.
e. End Connections: Socket, union, or flanged.
f. Working Pressure Rating: 500 psig (3450 kPa).
g. Maximum Operating Temperature: 240 deg F (116 deg C).

2. Packed-Angle Valves:
a. Body and Bonnet: Forged brass or cast bronze.
b. Packing: Molded stem, back seating, and replaceable under pressure.
c. Operator: Rising stem.
d. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
e. Seal Cap: Forged-brass or valox hex cap.
f. End Connections: Socket, union, threaded, or flanged.
g. Working Pressure Rating: 500 psig (3450 kPa).
h. Maximum Operating Temperature: 275 deg F (135 deg C).

3. Check Valves:
a. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
b. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
c. Piston: Removable polytetrafluoroethylene seat.
d. Closing Spring: Stainless steel.
e. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
f. End Connections: Socket, union, threaded, or flanged.
g. Maximum Opening Pressure: 0.50 psig (3.4 kPa).
h. Working Pressure Rating: 500 psig (3450 kPa).
i. Maximum Operating Temperature: 275 deg F (135 deg C).

4. Service Valves:
a. Body: Forged brass with brass cap, including key end to remove core.

b. Core: Removable ball-type check valve with stainless steel spring.
c. Seat: Polytetrafluoroethylene.
d. End Connections: Copper spring.
e. Working Pressure Rating: 500 psig (3450 kPa).
f. Maximum Operating Temperature: 275 deg F (135 deg C).

5. Refrigerant Locking Caps:
   a. Description: Locking-type, tamper-resistant, threaded caps to protect refrigerant-charging ports from unauthorized refrigerant access and leakage.
   b. Material: Brass, with protective shroud or sleeve.
   c. Refrigerant Identification: Universal design.
   d. Special Tool: For installing and unlocking.
6. Solenoid Valves: Comply with AHRI 760 I-P (AHRI 761 SI) and UL 429; listed and labeled by an NRTL.
   a. Body and Bonnet: Plated steel.
   b. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
   c. Seat: Polytetrafluoroethylene.
   d. End Connections: Threaded.
   e. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-mm) conduit adapter, and 24 V ac coil.
   f. Working Pressure Rating: 400 psig (2760 kPa).
   g. Maximum Operating Temperature: 240 deg F (116 deg C).
7. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
   a. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
   b. Piston, Closing Spring, and Seat Insert: Stainless steel.
   c. Seat: Polytetrafluoroethylene.
   d. End Connections: Threaded.
   e. Working Pressure Rating: 400 psig (2760 kPa).
   f. Maximum Operating Temperature: 240 deg F (116 deg C).
8. Thermostatic Expansion Valves: Comply with AHRI 750 I-P (AHRI 751 SI).
   a. Body, Bonnet, and Seal Cap: Forged brass or steel.
   b. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
   c. Packing and Gaskets: Non-asbestos.
   d. Capillary and Bulb: Copper tubing filled with refrigerant charge.
   e. Suction Temperature: 40 deg F (4.4 deg C).
   f. Superheat: Adjustable.
   g. Reverse-flow option (for heat-pump applications).
   h. End Connections: Socket, flare, or threaded union.
   i. Working Pressure Rating: 450 psig (3100 kPa).
9. Straight-Type Strainers:
   a. Body: Welded steel with corrosion-resistant coating.
   b. Screen: 100-mesh stainless steel.
   c. End Connections: Socket or flare.
   d. Working Pressure Rating: 500 psig (3450 kPa).
   e. Maximum Operating Temperature: 275 deg F (135 deg C).
10. Angle-Type Strainers:
   a. Body: Forged brass or cast bronze.
   b. Drain Plug: Brass hex plug.
   c. Screen: 100-mesh monel.
   d. End Connections: Socket or flare.
   e. Working Pressure Rating: 500 psig (3450 kPa).

f. Maximum Operating Temperature: 275 deg F (135 deg C).

11. Moisture/Liquid Indicators:
    a. Body: Forged brass.
    b. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
    c. Indicator: Color-coded to show moisture content in parts per million (ppm).
    d. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
    e. End Connections: Socket or flare.
    f. Working Pressure Rating: 500 psig (3450 kPa).
    g. Maximum Operating Temperature: 240 deg F (116 deg C).
12. Replaceable-Core Filter Dryers: Comply with AHRI 730 I-P (AHRI 731 SI).
    a. Body and Cover: Painted-steel shell with ductile-iron cover, stainless steel screws, and neoprene gaskets.
    b. Filter Media: 10 micron, pleated with integral end rings; stainless steel support.
    c. Desiccant Media: Activated alumina.
    d. End Connections: Socket.
    e. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
    f. Maximum Pressure Loss: 2 psig (14 kPa).
    g. Rated Flow: 2.5 tons (8.79 kW).
    h. Working Pressure Rating: 500 psig (3450 kPa).
    i. Maximum Operating Temperature: 240 deg F (116 deg C).
13. Permanent Filter Dryers: Comply with AHRI 730 I-P (AHRI 731 SI).
    a. Body and Cover: Painted-steel shell.
    b. Filter Media: 10 micron, pleated with integral end rings; stainless steel support.
    c. Desiccant Media: Activated alumina.
    d. End Connections: Socket.
    e. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
    f. Maximum Pressure Loss: 2 psig (14 kPa).
    g. Rated Flow: 2.5 tons (8.79 kW).
    h. Working Pressure Rating: 500 psig (3450 kPa).
    i. Maximum Operating Temperature: 240 deg F (116 deg C).

C. Performance: None

2.4 REFRIGERANTS

A. R-410A, ASHRAE 34: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATION SCHEDULES R-410A

A. Suction, Hot-Gas, and Liquid Tubing for Conventional Air-Conditioning (Cooling-Only) Applications, NPS 1-1/2 (DN 40) and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Safety-Relief-Valve Discharge Piping for Conventional Air-Conditioning (Cooling-Only) Applications, Steel: Schedule 40, black steel and wrought-steel fittings with welded joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gauge taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety-relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside in accordance with ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

L. Install flexible connectors at compressors.

M. Provide refrigerant locking caps on refrigerant charging ports that are located outdoors unless otherwise protected from unauthorized access by a means acceptable to authority having jurisdiction.

3.3 INSTALLATION OF PIPING, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping in accordance with ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves in accordance with Section 230553 "Identification for HVAC Piping and Equipment."

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Construct joints in accordance with ASTM B828 or CDA's "Copper Tube Handbook."

D. Brazed Joints: Construct joints in accordance with AWS BRH, "Brazing Handbook," Ch. 35, "Pipe and Tubing."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

E. Threaded Joints: Thread steel pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and to restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 ft. (6 m) long.

2. Roller hangers and spring hangers for individual horizontal runs 20 ft. (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 ft. (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches (300 mm) of each fitting.

E. Support vertical runs of copper tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System must maintain test pressure at the manifold gauge throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

C. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves but not bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Requirements:
1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of all duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated Design Submittals:

1. Sheet metal thicknesses.

2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Welding certificates.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
2. Structural Performance: Duct hangers and supports are to withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
3. Airstream Surfaces: Surfaces in contact with airstream comply with requirements in ASHRAE 62.1.
4. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
5. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
6. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Physical: None

B. Functional:

1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
   a. Construct ducts of galvanized sheet steel unless otherwise indicated.
   b. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
2. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   a. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
   b. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
4. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Performance: None

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. Physical: None

B. Functional:

1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
   a. Construct ducts of galvanized sheet steel unless otherwise indicated.
   b. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
2. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
4. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Performance: None

2.4 SHEET METAL MATERIALS

A. Physical: None

B. Functional:
1. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
2. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
   a. Galvanized Coating Designation: G60.
   b. Finishes for Surfaces Exposed to View: Mill phosphatized.
3. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.
4. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish is to be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.
5. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
6. Factory- or Shop-Applied Antimicrobial Coating:
   a. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating is to be applied to the exterior surface.
   b. Antimicrobial compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   c. Coating containing the antimicrobial compound is to have a hardness of 2H, minimum, when tested in accordance with ASTM D3363.
   d. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
   e. Shop-Applied Coating Color: Black.
   f. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
7. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

a. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

8. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches.

C. Performance: None

2.5 SEALANT AND GASKETS

A. Physical: None

B. Functional:

1. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets are to be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
2. Two-Part Tape Sealing System:
   a. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
   b. Tape Width: 3 inches.
   c. Sealant: Modified styrene acrylic.
   d. Water resistant.
   e. Mold and mildew resistant.
   f. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   g. Service: Indoor and outdoor.
   h. Service Temperature: Minus 40 to plus 200 deg F.
   i. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
3. Water-Based Joint and Seam Sealant:
   a. Application Method: Brush on.
   b. Solids Content: Minimum 65 percent.
   c. Shore A Hardness: Minimum 20.
   d. Water resistant.
   e. Mold and mildew resistant.
   f. VOC: Maximum 75 g/L (less water).
   g. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   h. Service: Indoor or outdoor.
   i. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
   j. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
   k. Service: Indoor or outdoor.
   l. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
4. Flanged Joint Sealant: Comply with ASTM C920.
   a. General: Single-component, acid-curing, silicone, elastomeric.
   b. Type: S.
   c. Grade: NS.
   d. Class: 25.
   e. Use: O.

5. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
6. Round Duct Joint O-Ring Seals:
   a. Seal is to provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and is to be rated for10-inch wg static-pressure class, positive or negative.
   b. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
   c. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

C. Performance: None

2.6 HANGERS AND SUPPORTS

A. Physical: None

B. Functional:
1. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
3. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
4. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
5. Steel Cables for Stainless Steel Ducts: Stainless steel complying with ASTM A492.
6. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
7. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
8. Trapeze and Riser Supports:
   a. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
   b. Supports for Stainless Steel Ducts: Stainless steel shapes and plates.
   c. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

C. Performance: None

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install fire and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

3.2 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
3. Conditioned Space, Exhaust Ducts: Seal Class B.
4. Conditioned Space, Return-Air Ducts: Seal Class C.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC."

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 DUCTWORK CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Contracting Officer, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

   a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media is to not exceed 0.75 mg/100 sq. cm.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. For cleaning of existing ductwork, see Section 230130.52 "Existing HVAC Air Distribution System Cleaning."

C. Use duct cleaning methodology as indicated in NADCA ACR.

D. Use service openings for entry and inspection.

1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

E. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

F. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

G. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.8 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

B. Supply Ducts:

1. Ducts Connected to Furnaces:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 4.

C. Return Ducts:

1. Ducts Connected to Furnaces:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 4.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Round: 4.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Furnaces:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round: 8.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. Stainless Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Galvanized.

3. Aluminum Ducts: Aluminum.

G. Elbow Configuration:

1. Rectangular Duct - Requirements for Different Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct Requirements for All Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Conical spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Flange connectors.
4. Turning vanes.
5. Duct-mounted access doors.
6. Duct access panel assemblies.
7. Flexible connectors.
8. Duct accessory hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1. Detail duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, or BIM model, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Source quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Comply with NFPA 90A and NFPA 90B.
2. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Physical: None

B. Functional:
1. Description: Gravity balanced.
2. Performance:
a. Maximum Air Velocity: 1250 fpm.
b. Maximum System Pressure: 2 inches wg.
c. AMCA Certification: Test and rate in accordance with AMCA 511.
d. Leakage:
1) Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
2) Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
3) Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.
4) Class III: Leakage shall not exceed 40 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Construction:
a. Frame:
1) Hat shaped.
2) 16-gauge- thick, galvanized sheet steel, with welded or mechanically attached corners.
b. Blades:
1) Multiple single-piece blades.
2) Center pivoted, maximum 6-inch width, 16-gauge- thick, galvanized sheet steel with sealed edges.
c. Blade Action: Parallel.
4. Blade Seals: Neoprene, mechanically locked.
5. Blade Axles:
a. Material: Galvanized steel.
b. Diameter: 0.20 inch.
6. Tie Bars and Brackets: Aluminum.

7. Return Spring: Adjustable tension.
8. Accessories:
    a. Adjustment device to permit setting for varying differential static pressure.
    b. Counterweights and spring-assist kits for vertical airflow installations.
    c. Chain pulls.
    d. Screen Mounting:
        1) Front mounted in sleeve.
            a) Sleeve Thickness: 20 gauge minimum.
            b) Sleeve Length: 6 inches minimum.
    e. Screen Material: Aluminum.
    f. Screen Type: Bird.
    g. 90-degree stops.

C. Performance: None

2.3 MANUAL VOLUME DAMPERS

A. Physical: None

B. Functional:
1. Standard, Steel, Manual Volume Dampers:
    a. Performance:
        1) Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.
    b. Construction:
        1) Linkage out of airstream.
        2) Suitable for horizontal or vertical airflow applications.
    c. Frames:
        1) Hat-shaped, 16-gauge- thick, galvanized sheet steel.
        2) Mitered and welded corners.
        3) Flanges for attaching to walls and flangeless frames for installing in ducts.
    d. Blades:
        1) Multiple or single blade.
        2) Parallel- or opposed-blade design.
        3) Stiffen damper blades for stability.
        4) Galvanized steel; 16 gauge thick.
    e. Blade Axles: Galvanized steel.
    f. Bearings:
        1) Oil-impregnated bronze.
        2) Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
    g. Tie Bars and Brackets: Galvanized steel.
    h. Locking device to hold damper blades in a fixed position without vibration.
2. Jackshaft:
    a. Size: 0.5-inch diameter.
    b. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
    c. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
3. Damper Hardware:

a. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
b. Include center hole to suit damper operating-rod size.
c. Include elevated platform for insulated duct mounting.

C. Performance: None

2.4 FLANGE CONNECTORS

A. Physical: None

B. Functional:
1. Description: Add-on or roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.
2. Material: Galvanized steel.
3. Gauge and Shape: Match connecting ductwork.

C. Performance: None

2.5 TURNING VANES

A. Physical: None

B. Functional:
1. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
   a. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
2. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
3. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
4. Vane Construction:
   a. Single wall.
   b. Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

C. Performance: None

2.6 DUCT-MOUNTED ACCESS DOORS

A. Physical: None

B. Functional:

1. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."
    a. Door:
        1) Double wall, rectangular.
        2) Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
        3) 24-gauge- thick galvanized steel door panel.
        4) Vision panel.
        5) Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
        6) Fabricate doors airtight and suitable for duct pressure class.
    b. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
        1) 24-gauge- thick galvanized steel or 0.032-inch- thick aluminum frame.
    c. Number of Hinges and Locks:
        1) Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
        2) Access Doors up to 18 Inches Square: Two hinges and two sash locks.

C. Performance: None

2.7 DUCT ACCESS PANEL ASSEMBLIES

A. Physical: None

B. Functional:
1. Panel and Frame: Minimum thickness 16-gauge carbon steel.
2. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
3. Gasket: Comply with NFPA 96, grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
4. Minimum Pressure Rating: 10 inches wg positive or negative.

C. Performance: None

2.8 FLEXIBLE CONNECTORS

A. Physical: None

B. Functional:
1. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
3. Materials: Flame-retardant or noncombustible fabrics.
4. Coatings and Adhesives: Comply with UL 181, Class 1.
5. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
6. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
    a. Minimum Weight: 26 oz./sq. yd..

b. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
c. Service Temperature: Minus 40 to plus 200 deg F.

C. Performance: None

2.9 DUCT ACCESSORY HARDWARE

A. Physical: None

B. Functional:
1. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
2. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

C. Performance: None

2.10 MATERIALS

A. Physical: None

B. Functional:
1. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
a. Galvanized Coating Designation: G60.
b. Exposed-Surface Finish: Mill phosphatized.
2. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2 finish for concealed ducts.
3. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.
4. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.
5. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
6. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

C. Performance: None

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.

E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

F. Set dampers to fully open position before testing, adjusting, and balancing.

G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.

H. Install fire dampers in accordance with UL listing.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-ft. spacing.
8. Upstream from turning vanes.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.

5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5 inches wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Install duct test holes where required for testing and balancing purposes.

P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233416 - CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Forward-curved centrifugal fans.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.
   4. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
   5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Fan room layout and relationships between components and adjacent structural and mechanical elements, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Physical: None

B. Functional: None

C. Performance:
1. Unusual Service Conditions
   a. Base fan-performance ratings on the following:
      1) Altitude: 8,841 feet (m) above sea level.
2. 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.
3. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.
4. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
5. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 FORWARD-CURVED CENTRIFUGAL FANS

A. Physical: None

B. Functional:
1. Description:
   a. Factory-fabricated, -assembled, -tested, and -finished, direct-driven centrifugal fans, consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
   b. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
   c. Factory-installed and -wired disconnect switch.
2. Housings:
   a. Housing Material: Galvanized steel.
   b. Housing Coating: None.
   c. Outlet flange.
   d. Discharge Arrangement: Provide fan with discharge positioned in proper direction to minimize connected duct turns.
3. Wheels:
   a. Wheel Configuration: SWSI construction with a curved inlet flange, and a backplate fastened to shaft with setscrews.
   b. Wheel and Blade Material: Steel.
   c. Wheel and Blade Coating: None.
   d. Cast-iron or cast-steel hub riveted to backplate and fastened to shaft with setscrews.
   e. Forward-Curved Wheels:
      1) Black-enameled or galvanized-steel construction with inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow.
      2) Mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with setscrews.
4. Motor Enclosure: Totally enclosed, fan cooled.

C. Performance: None

2.3 SOURCE QUALITY CONTROL

A. Physical: None

B. Functional: None

C. Performance:
   1. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.
   2. AMCA Certification for Fan Aerodynamic Performance Ratings: Test, rate, and label in accordance with AMCA 211.
   3. AMCA Certification for Fan Energy Index (FEI): Test, rate, and label in accordance with AMCA 211.
   4. Operating Limits: Classify fans in accordance with AMCA 99, Section 14.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:
   1. Support duct-mounted and other hanging centrifugal fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
   2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
   3. Comply with requirements in Section 230548.13 "Vibration Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK AND PIPING CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
   1. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch (13 mm) high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 STARTUP SERVICE:

A. Perform startup service.

   1. Complete installation and startup checks in accordance with manufacturer's written instructions.
   2. Verify that shipping, blocking, and bracing are removed.
   3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   4. Verify that cleaning and adjusting are complete.
   5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
   6. Adjust damper linkages for proper damper operation.
   7. Verify lubrication for bearings and other moving parts.
   8. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
   9. Shut unit down and reconnect automatic temperature-control operators.
   10. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Lubricate bearings.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Fans and components will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 DEMONSTRATION

A. Train maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233416

SECTION 233713.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fixed face registers and grilles.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 REGISTERS

A. Physical: None

B. Functional:
1. Fixed Face Register:
a. Material: Steel or Aluminum.
b. Finish: Baked enamel.
c. Face Blade Arrangement: Vertical spaced 3/4 inch (19 mm) apart.
d. Core Construction: Integral.
e. Frame: 1-1/4 inches (32 mm) wide.
f. Mounting: Countersunk screw.
g. Damper Type: Adjustable opposed blade.

C. Performance: None

2.2 GRILLES

A. Physical: None

B. Functional:
1. Fixed Face Grille:
a. Material: Aluminum.
b. Finish: Baked enamel, white.
c. Face Blade Arrangement: Horizontal; spaced 3/4 inch (19 mm) apart.

d. Core Construction: Integral.
e. Frame: 1-1/4 inches (32 mm) wide.
f. Mounting: Countersunk screw.

C. Performance: None

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Contracting Officer for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 235416.13 - GAS-FIRED FURNACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Gas-fired, condensing furnaces and accessories complete with controls.
2. Air filters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Furnace and accessories complete with controls.
b. Air filter.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Disposable Air Filters: Furnish two complete sets.

1.7 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

C. Comply with NFPA 70.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

1. Warranty Period, Commencing on Date of Substantial Completion:

a. Furnace Heat Exchanger: 10 years.
b. Integrated Ignition and Blower Control Circuit Board: Five years.
c. Draft-Inducer Motor: Five years.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Physical: None

B. Functional:
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency, and marked for intended location and application.
2. General Requirements for Noncondensing Gas-Fired Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

C. Performance: None

2.2 GAS-FIRED FURNACES, CONDENSING

A. Physical: None

B. Functional:
1. Cabinet: Steel.
   a. Cabinet interior around heat exchanger shall be factory-installed insulation.
   b. Lift-out panels shall expose burners and all other items requiring access for maintenance.
   c. Factory paint external cabinets in manufacturer's standard color.
   d. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
2. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
   a. Special Motor Features, ECM: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.
3. Type of Gas: Natural.
4. Heat Exchanger:
   a. Primary: Aluminized steel.
5. Burner:
   a. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
   b. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
6. Gas-Burner Safety Controls:
   a. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
   b. Flame Rollout Switch: Installed on burner box; prevents burner operation.
   c. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
7. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
8. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories.
9. Accessories:
   a. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through roof.

C. Performance: None

2.3 THERMOSTATS

A. Physical: None

B. Functional:
1. Controls shall comply with requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."
2. Solid-State Thermostat: Wall-mounted, programmable, microprocessor-based unit with manual switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, and battery backup protection against power failure for program settings. Thermostat shall be capable of future utilization of cooling mode.
3. Control Wiring: Balanced twisted-pair cabling complying with requirements for Category 5e in Section 260523 "Control-Voltage Electrical Power Cables."

a. Description: Unshielded twisted pairs (UTP), No. 24 AWG, 100 ohms, four pair.
b. Cable Jacket Color: Blue.

C. Performance: None

2.4 AIR FILTERS

A. Physical: None

B. Functional:
1. Disposable Filters: 1-inch- (25-mm-) thick fiberglass media in sheet metal frame.

C. Performance: None

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for gas piping systems to verify actual locations of piping connections before equipment installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.

B. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

C. Controls: Install thermostats at mounting height of 48 inches (1500 mm) above floor.

D. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

3.3 PIPING CONNECTIONS

A. Gas piping installation requirements are specified in Section 231123 "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

    a. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
    b. CPVC Piping: Join according to ASTM D2846/D2846M, Appendix.
    c. PVC Pressure Piping: Join schedule number ASTM D1785 PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.

4. Slope pipe vent back to furnace or to outside terminal.

3.4 DUCTWORK CONNECTIONS

A. Connect ducts to furnace with flexible connector. Comply with requirements in Section 233300 "Air Duct Accessories."

3.5 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
1. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch (13 mm) high.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.7 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for physical damage to unit casings.
2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

B. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.

C. Measure and record airflows.

D. Verify proper operation of capacity control device.

3.8 ADJUSTING

A. Adjust initial temperature set points.

B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.9 CLEANING

A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

B. Install new filters in each furnace within 14 days after Substantial Completion.

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and test for leaks. Repair leaks, replace lost refrigerant, and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

3.11 DEMONSTRATION

A. Train maintenance personnel to adjust, operate, and maintain condensing units. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 235416.13

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
1.

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

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: Five year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Physical: None

B. Functional:
1. Wall-Mounted, Evaporator-Fan Components:
a. Cabinet: Enameled steel with removable panels on front and ends, and discharge drain pans with drain connection.
b. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
c. Fan: Direct drive, centrifugal.
d. Fan Motors:
1) Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2) Multitapped, multispeed with internal thermal protection and permanent lubrication.
3) Enclosure Type: Totally enclosed, fan cooled.
4) NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
5) Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
6) Mount unit-mounted disconnect switches on exterior of unit.
e. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
f. Air Filtration Section:
1) General Requirements for Air Filtration Section:
a) Comply with NFPA 90A.
b) Minimum MERV according to ASHRAE 52.2.
c) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

C. Performance: None

2.2 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Physical: None

B. Functional:
   1. Air-Cooled, Compressor-Condenser Components:
      a. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
      b. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
         1) Compressor Type: Scroll.
         2) Refrigerant: R-454B or R-32.
         3) Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
      c. Fan: Aluminum-propeller type, directly connected to motor.
      d. Motor: Permanently lubricated, with integral thermal-overload protection.
      e. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
      f. Mounting Base: Polyethylene.

C. Performance: None

2.3 ACCESSORIES

A. Physical: None

B. Functional:
   1. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
   2. Automatic-reset timer to prevent rapid cycling of compressor.
   3. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
   4. Drain Hose: For condensate.

C. Performance: None

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 238239.19 - WALL AND CEILING UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include details of anchorages and attachments to structure and to supported equipment.
4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
5. Wiring Diagrams: Power, signal, and control wiring.

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

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Physical: None

B. Functional:
1. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
2. 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. Performance: None

2.2 CABINET

A. Physical:
1. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
2. Finish: Baked enamel over baked-on primer with manufacturer's standard color, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
3. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

B. Functional: None

C. Performance: None

2.3 COIL

A. Physical: None

B. Functional:
1. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

C. Performance: None

2.4 FAN AND MOTOR

A. Physical: None

B. Functional:
1. Fan: Aluminum propeller directly connected to motor.
2. Motor: Permanently lubricated. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

C. Performance: None

2.5 CONTROLS

A. Physical: None

B. Functional:
1. Controls: Unit-mounted thermostat.
2. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.
3.

C. Performance: None

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A.

B. Install wall and ceiling unit heaters level and plumb.

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 238239.19

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. Applicable codes include the following:
1. International Building Code 2024
2. ASHRAE 90.1-2016
3. International Fire Code 2024
4. National Electric Code 2023
5. NPS Building Standards

1.2 SUMMARY

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

1.3 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
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. To connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

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-mounting items, except as otherwise indicated in drawings.

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.

F. Exposed raceways/conduit: Where conduit or raceway is routed in an exposed location, the conduit and raceway shall be painted to match adjacent finishes. Coordinate required finishes with Contracting Officer.

END OF SECTION

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

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Salient Characteristics
1. Physical:
a. Conductors shall be new and unused. Wire and cable shall be copper single conductor type with 600 V insulation, unless otherwise noted. Conductor shall be soft annealed Class B, per ASTM B-3 for solid wire and ASTM B-8 for stranded wire. Conductors shall be minimum 98% conductive.
2. Functional:
a. Insulation shall be flame retardant, heat resistant polyvinyl chloride (PVC), ethylene propylene (EP) or polyethylene (PE) with minimum insulation thicknesses per table 310-13 of the NEC. The insulation shall conform to the requirements of UL 83 ICEA S-68-516 for EP, ICEA S-61-402 for PVC and PE.
b. Type THWN or THHN wire and cable shall have a outer nylon jacket conforming to UL-83. Cables shall be manufactured to meet the standards of Insulated Cable Engineer's Association (ICEA).
c. Copper Conductors: Comply with NEMA WC 70.
d. Conductor Insulation: Comply with NEMA WC 70 for Types THWN-2 or XHHW-2.

3. Performance:
   a. None.

2.2 CONNECTORS AND SPLICES

A. Salient Characteristics:
   1. Physical:
      a. Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
   2. Functional:
      a. None.
   3. Performance:
      a. None.

B.

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. Exposed Feeders: Type THHN-THWN-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THWN-2, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN-2, single conductors in raceway. Metal-clad cable, Type MC is not allowed.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

H. Class 1 Control Circuits: Type THHN-THWN-2, in raceway.

I. Class 2 Control Circuits: Type THHN-THWN-2, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. 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.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

E. Identify and color-code conductors and cables according to Division 26 Section "Identification 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 and UL 486B.

B. Make splices 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.

D. Provide crimped ferrules for stranded wires at any screw terminal locations.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS

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

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
1. Ground rods.
2. Grounding arrangements and connections for separately derived systems.

C. Field quality-control test reports.

1.3 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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

PART 2 PRODUCTS

2.1 CONDUCTORS

A. Salient Characteristics:
1. Physical:
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) Tinned Conductors: ASTM B 33.
4) Sizes and types of conductors in four subparagraphs below are typical examples. 28-kcmil bonding cable in first subparagraph below is slightly larger than No. 6 AWG.
5) Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
6) Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
7) 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.
8) Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
2. Functional:
a. None.

3. Performance:
   a. None.

2.2 CONNECTORS

A. Salient Characteristics:
1. Physical:
   a. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
2. Functional:
   a. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
   b. Pipe Connectors: Clamp type, sized for pipe.
   c. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
3. Performance:
   a. None.

2.3 GROUNDING ELECTRODES

Salient Characteristics:
1. Physical:
   a. Ground Rods: Copper-clad; 5/8" in diameter by 96 inches in length.
2. Functional:
   a. None.
3. Performance:
   a. None

2.4 GROUNDING BUSBARS

A. Salient Characteristics:
1. Physical:
   a. Grounding Bus: Predrilled rectangular bars of annealed copper, ¼ by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000V.
2. Functional:
   a. None.
3. Performance:
   a. None.

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.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Armored and metal-clad cable runs.

C. 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.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.3 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. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
   1. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
   2. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

D. 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, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, 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.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Ground Rod: Re-use existing otherwise, drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Re-use existing

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements listed below.
   2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rod. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance not less 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.

B. Report measured ground resistances that exceed the following values:
   1. Power and Lighting Equipment or System with Capacity 500 kVA and Less; 10 ohms.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:
1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
1. Steel slotted channel systems. Include Product Data for components.
2. Nonmetallic slotted channel systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section.

PART 2 PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems:
1. Salient Characteristics:
a. Physical:
1) Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
2) Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
3) Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4) Channel Dimensions: Selected for applicable load criteria.
b. Functional:
1) None.
c. Performance:
1) Comply with MFMA-4, factory-fabricated components for field assembly.

B. Nonmetallic Slotted Support Systems:
1. Salient Characteristics:
a. Physical:
1) Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-(14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
b. Functional:
1) Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
2) Fitting and Accessory Materials: Same as channels and angles.
c. Performance:
1) Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports:
1. Salient Characteristics:
a. Physical, Functional and Performance:
1) As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices:
1. Salient Characteristics:
a. Physical:
1) Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
b. Functional:
1) None.
c. Performance:

1) None.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners:
   a. Salient Characteristics:
      1) Physical:
         a) 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) Functional:
         a) None.
      3) Performance:
         a) None.
2. Mechanical-Expansion Anchors:
   a. Salient Characteristics:
      1) Physical:
         a) Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      2) Functional:
         a) None.
      3) Performance:
         a) None.
3. Concrete Inserts:
   a. Salient Characteristics:
      1) Physical:
         a) Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
      2) Functional:
         a) None.
      3) Performance:
         a) None.
4. Clamps for Attachment to Steel Structural Elements:
   a. Salient Characteristics:
      1) Physical:
         a) MSS SP-58, type suitable for attached structural element.
      2) Functional:
         a) None.
      3) Performance:
         a) None.
5. Through Bolts:
   a. Salient Characteristics:
      1) Physical:
         a) Structural type, hex head, and high strength. Comply with ASTM A 325.
      2) Functional:
         a) None.
      3) Performance:
         a) None.

6. Toggle Bolts:
    a. Salient Characteristics:
        1) Physical:
            a) All-steel springhead type.
        2) Functional:
            a) None.
        3) Performance:
            a) None.
7. Hanger Rods:
    a. Salient Characteristics:
        1) Physical:
            a) Threaded steel.
        2) Functional:
            a) None.
        3) Performance:
            a) None.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

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 except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for 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, EMT may be supported by openings through structure members, as permitted in 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 (90 kg).

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 New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Retain first subparagraph below if powder-actuated devices are allowed. Consider deleting if Project contains both lightweight and standard-weight concrete or more than one thickness of concrete slab.
6. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
7. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
8. To Light Steel: Sheet metal screws.
9. 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 reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. 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 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

F. RSC: Rigid steel conduit

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Salient Characteristics:
1. Physical:
a. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1) Fittings for EMT: Steel, set-screw or compression type.
2) Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
b. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.
2. Functional:
a. None.

3. Performance:
    a. Rigid Steel Conduit: ANSI C80.1.
    b. Aluminum Rigid Conduit: ANSI C80.5.
    c. IMC: ANSI C80.6.
    d. PVC-Coated Steel Conduit: PVC-coated Rigid Steel Conduit.
        1) Comply with NEMA RN 1.
        2) Coating Thickness: 0.040 inch (1 mm), minimum.
    e. EMT: ANSI C80.3.
    f. LFMC: Flexible steel conduit with PVC jacket.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Salient Characteristics:
1. Physical:
    a. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated. Type EPC-80-PVC for areas that will be subjected to vehicular travel.
    b. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
2. Functional:
    a. None.
3. Performance:
    a. None.

2.3 SURFACE RACEWAYS

A. Salient Characteristics:
1. Physical:
    a. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by the Contracting Officer.
2. Functional:
    a. None.
3. Performance:
    a. None.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Salient Characteristics:
1. Physical:
    a. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.
    b. Nonmetallic Floor Boxes: Nonadjustable, round.
    c. Cast-Metal Access, Pull, and Junction Boxes: Cast aluminum with gasketed cover.
    d. Cast-Metal Outlet and Device Boxes: Ferrous alloy, Type FD, with gasketed cover.
    e. Hinged-Cover Enclosures: Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
        1) Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
        2) Nonmetallic Enclosures: Plastic.
    f. Cabinets: Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
        1) Hinged door in front cover with flush latch and concealed hinge.
        2) Key latch to match panelboards.
        3) Metal barriers to separate wiring of different systems and voltage.
        4) Accessory feet where required for freestanding equipment.

2. Functional:
   a. None.
3. Performance:
   a. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
   b. Cast-Metal Outlet and Device Boxes: NEMA FB 1.
   c. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
   d. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
   e. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1
   f. Hinged-Cover Enclosures: NEMA 250.
   g. Cabinets: NEMA 250.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Salient Characteristics:
1. Physical:
   a. Color of Frame and Cover: Gray.
   b. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
   c. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
   d. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   e. Cover Legend: Molded lettering, "ELECTRIC." or "TELEPHONE." depending upon the cabling the box is enclosing.
   f. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
   g. Handholes and boxes are to be fiberglass with Polymer-Concrete Fram and Cover. Sheet-molded fiberglass-reinforced polyester-resin enclosure joined to polymer-concrete top ring or frame.
2. Functional:
   a. None.
3. Performance:
   a. Comply with SCTE 77, TIER 15.

PART 3 EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: EMT.
3. Retain subparagraph below if Project includes small amounts of exterior underground wiring, 600 V and less, and Division 26 Section "Underground Ducts and Raceways for Electrical Systems" is not being used.
4. Underground Conduit: For horizontal underground conduit, utilize RNC, Type EPC-80-PVC, direct buried. Underground bends are to utilize PVC Coated Rigid Steel prefabricated sections. Vertical underground conduit (risers) shall be PVC Coated Rigid Steel.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed, Not Subject to Severe Physical Damage: EMT.
   3. Exposed, Subject to Severe Physical Damage: RSC.
   4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   6. Damp or Wet Locations: IMC.
   7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
   8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 3R, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) 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.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) 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. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

G. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   2. RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

H. 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.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

K. Install raceway sealing fittings at suitable, approved, and accessible locations 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 at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

L. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).
   1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
      b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
      c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
      d. Attics: 135 deg F (75 deg C) temperature change.
   2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
   3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

M. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, 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.

N. Set metal floor boxes level and flush with finished floor surface.

O. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

P. Install plastic bushings at conduit terminations prior to pulling wire.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
   1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as indicated in drawings for pipe less than 6 inches (150 mm) in nominal diameter.
   2. Install backfill as indicated in drawings.

3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as indicated in drawings.
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured PVC coated rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom below the frost line, 30” below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC 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 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. 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.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 SLEEVES

A. Salient Characteristics:
1. Physical:
a. Wall Sleeves:
1) Steel Pipe Sleeves: 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 (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
c. PVC-Pipe Sleeves: 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 (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b) For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2. Functional:
   a. None.
3. Performance:
   a. Wall Sleeves:
      1) Steel Pipe Sleeves: ASTM A 53/A 53M
   b. PVC-Pipe Sleeves: ASTM D 1785

2.2 SLEEVE-SEAL SYSTEMS

A. Salient Characteristics:
1. Physical:
   a. Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   b. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   c. Pressure Plates: Carbon steel
   d. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.
2. Functional:
   a. None.
3. Performance:
   a. None.

2.3 SLEEVE-SEAL FITTINGS

A. Salient Characteristics:
1. Physical:
   a. Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD..
2. Functional:
   a. None.
3. Performance:
   a. None.

2.4 GROUT

A. Salient Characteristics:
1. Physical:
   a. Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Functional:
   a. Premixed and factory packaged.
3. Performance:
   a. ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
   b. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

2.5 SILICONE SEALANTS

A. Salient Characteristics:

1. Physical:
    a. Silicone Sealants:
        1) Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
    b. Silicone Foams:
        1) Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
2. Functional:
    a. Silicone Sealants:
        1) Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
3. Performance:
    a. Silicone Sealants:
        1) Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. 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 079200 "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 (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
    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 (50 mm) above finished floor level. Install sleeves during erection of floors.

D. 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.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) 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 waterstop 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 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Identification for raceway and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, 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.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Salient Characteristics:
1. Physical:
a. Color for Printed Legend:
1) Power Circuits: Black letters on an orange field.
2) Legend: Indicate system or service and voltage, if applicable.
b. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
c. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
d. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
e. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.
2. Functional:
a. None.
3. Performance:
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.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Salient Characteristics:
1. Physical:
a. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
b. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
c. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
d. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.
e. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
1) Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Functional:
a. None.
3. Performance:
a. None.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Salient Characteristics:
   1. Physical:
      a. Tape Characteristics:
         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 (0.125 mm).
         3) Foil Core Thickness: 0.35 mil (0.00889 mm).
         4) Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
         5) 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).
      b. Color and Printing:
         1) Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
         2) Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.
         3) Inscriptions for Blue-Colored Tapes: CONTROL CIRCUIT CABLE.
   2. Functional:
      a. Tape:
         1) Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical 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.
   3. Performance:
      a. Color and Printing:
         1) Comply with ANSI Z535.1 through ANSI Z535.5.

2.4 WARNING LABELS AND SIGNS

A. Salient Characteristics:
   1. Physical:
      a. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
      b. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).
      c. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).
   2. Functional:
      a. Warning label and sign shall include, but are not limited to, the following legends:

1) Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2) Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

3. Performance:
   a. Comply with NFPA 70 and 29 CFR 1910.145.

2.5 INSTRUCTION SIGNS

A. Salient Characteristics:
   1. Physical:
      a. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) 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. Functional:
      a. None.
   3. Performance:
      a. None.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Salient Characteristics:
   1. Physical:
      a. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
      b. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
      c. 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 (10 mm).
      d. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).
   2. Functional:
      a. None.
   3. Performance:
      a. None.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Salient Characteristics:
   1. Physical:
      a. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
         1) Minimum Width: 3/16 inch (5 mm).
         2) Tensile Strength: 50 lb (22.6 kg), minimum.

3) Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4) Color: Black, except where used for color-coding.

b. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2. Functional:
   a. None.
3. Performance:
   a. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.

PART 3 EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
   1. Fire Alarm System: Red.
   2. Fire-Suppression Supervisory and Control System: Red and yellow.
   3. Combined Fire Alarm and Security System: Red and blue.
   4. Security System: Blue and yellow.
   5. Mechanical and Electrical Supervisory System: Green and blue.
   6. Telecommunication System: Green and yellow.
   7. Control Wiring: Green and red.

B. Power-Circuit Conductor Identification: For secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

C. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data 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 Operation and Maintenance Manual.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and 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: Adhesive film label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) 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.
   2. Equipment to Be Labeled:
      a. Panelboards, electrical cabinets, and enclosures.
      b. Disconnect switches.
      c. Enclosed circuit breakers.

H. Arc Flash Hazard warning label: Refer to Specification 26 05 73 section 3.5(B) for labeling requirements associated with the Arc Flash Hazard Analysis study.

3.2 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. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded branch-circuit conductors.
   1. Color shall be factory applied.
   2. Colors for 240/120-V Circuits:
      a. Phase A: Black.

b. Phase B: Red.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes Cx process requirements for the following electrical components, systems, assemblies, and equipment:
   1. Electrical equipment connected to Normal power systems, including the following:
      a. Distribution and branch-circuit panelboards.
      b. Luminaires
      c. Lighting Controls
      d. Fire Alarm System
      e. Communication System
      f. Grounding System

B. Related Requirements:
   1. Section 019114 "Total Building Commissioning" for general Cx process requirements and CxA responsibilities.

1.3 DEFINITIONS

A. BoD: Basis-of-Design Document, as defined in Section 019114 "Total Building Commissioning"

B. Cx: Commissioning, as defined in Section 019114 "Total Building Commissioning"

C. CxA: Commissioning Authority, as defined in Section 019114 "Total Building Commissioning"

D. Low Voltage: 600 V and below.

E. Normal Power Systems: A power system that provides primary power to a facility.

F. OPR: Owner's Project Requirements, as defined in Section 019114 "Total Building Commissioning"

G. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.4 INFORMATIONAL SUBMITTALS

A. Construction Checklists: Draft construction checklists will be created by CxA for Contractor review.

B. Construction Checklists: Include the following and comply with requirements in Section 019114 "Total Building Commissioning" for construction checklists:
   1. Panelboards.
   2. Luminaires.
   3. Lighting Controls
   4. Fire Alarm

5. Communications

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electrical systems and components to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Testing Technician Qualifications: Technicians to perform electrical Construction Checklist verification tests, Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:
   1. Journey level or equivalent skill level. Vocational school four-year-program graduate or an Associate's degree in electrical systems, or similar field. Degree may be offset by three years' experience as an apprentice or a journey-level electrician. Generally, required knowledge includes electrical and HVAC&R concepts, building operations, and application and use of tools and instrumentation to measure performance of electrical equipment, assemblies, and systems.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 CONSTRUCTION CHECKLISTS

A. Provided by CxA, completed by contractor.

3.2 CONSTRUCTION CHECKLIST REVIEW

A. Review and provide written comments on draft construction checklists. CxA will create required draft construction checklists and provide them to Contractor.

B. Return draft Construction Checklist review comments within 10 days of receipt.

C. When review comments have been resolved, CxA will provide final construction checklists, marked "Approved for Use, (date)."

D. Use only construction checklists, marked "Approved for Use, (date)."

3.3 GENERAL TESTING REQUIREMENTS

A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved Shop Drawings and submittals.

B. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to Contracting Officer. After deficiencies are resolved, reschedule tests.

3.4 Cx TESTS FOR ELECTRICAL SYSTEMS

A. Verification of Power System Operation:
   1. Prerequisites: Acceptance of results for construction checklists for Division 26 electrical components associated with Normal power system.
   2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
   3. Test Purpose: Verify operation of power system.

4. Test Conditions: Energize components of Normal power system, one at a time. Equipment and Systems to Be Tested: Division 26 electrical equipment.

B. Acceptance Criteria: Operation of equipment according to OPR.

3.5 Cx TESTS FOR LUMINAIRES.

A. Verification of Luminaires:
1. Prerequisites: Acceptance of results for construction checklists for Division 26 Luminaires.
2. Equipment and Systems to Be Tested: Division 26 Luminaires.
3. Test Purpose: Verify operation of Luminaires.
4. Test Conditions: Energize components of Luminaires.

B. Acceptance Criteria: Operation of equipment according to OPR.

3.6 Cx TESTS FOR LIGHTING CONTROLS.

A. Verification of Lighting Controls:
1. Prerequisites: Acceptance of results for construction checklists for Division 26 Lighting Controls.
2. Equipment and Systems to Be Tested: Division 26 Lighting Controls.
3. Test Purpose: Verify operation of Lighting Controls.
4. Test Conditions: Energize components of Lighting Controls.

B. Acceptance Criteria: Operation of equipment according to OPR.

3.7 Cx TESTS FOR FIRE ALARM SYSTEM.

A. Verification of Fire Alarm System:
1. Prerequisites: Acceptance of results for construction checklists for Division 26 Digital Addressable Fire-Alarm System.
2. Equipment and Systems to Be Tested: Division 28 Fire Alarm System.
3. Purpose: Verify operation of Fire Alarm System.
4. Test Conditions: Energize components of Fire Alarm System.

B. Acceptance Criteria: Operation of equipment according to OPR.

3.8 Cx TESTS FOR COMMUNICATIONS.

A. Verification of Communications:
1. Prerequisites: Acceptance of results for construction checklists for Division 27 Communications System.
2. Equipment and Systems to Be Tested: Division 27 Communications System.
3. Purpose: Verify operation of Communications to comply with cabling warranty requirements.
4. Test Conditions: Energize components of Communications System.

B. Acceptance Criteria: Operation of equipment according to OPR.

3.9 Cx TESTS FOR GROUNDING SYSTEM

A. Verification of Grounding and Bonding:
1. Prerequisites: Acceptance of results for construction checklists for Division 26 Grounding and Bonding.
2. Equipment and Systems to Be Tested: Division 26 Grounding and Bonding.

3. Purpose: Verify operation of grounding systems to comply with grounding warranty requirements.
4. Test Conditions: Energize components grounding system.

B. Acceptance Criteria: Operation of equipment according to OPR.

END OF SECTION

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following lighting control devices:
   1. Indoor occupancy sensors.

B. Related Sections include the following:
   1. Division 26 Section "Wiring Devices" for manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

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

B. Shop Drawings: Show installation details for occupancy and light-level sensors.
   1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, and partition assemblies.

PART 2 PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

A. Salient Characteristics:
   1. Physical:
      a. General Description: Wall mounted, 120v units which do not require a separate low voltage power pack.
      b. Sensor Output: Contacts rated to operate the connected relay. Sensor shall be powered from the relay unit.

c. Mounting:
   1) Sensor: Suitable for mounting in any position on a standard outlet box.
   2) Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
d. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
e. Bypass Switch: Override the on function in case of sensor failure.
f. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.
g. Auxiliary Contacts: Where mechanical equipment is indicated for occupancy sensor control, auxiliary contact shall have a minimum horsepower rating suitable for the connected equipment, to be verified with final mechanical shop drawings.
h. Dual-Technology Type: Wall/ceiling mounted; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
   1) Sensitivity Adjustment: Separate for each sensing technology.
   2) Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
   3) Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2. Functional:
   a. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 60 minutes.
3. Performance:
   a. Sensor Output: Comply with UL 773A.

PART 3 EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Install wiring in raceways. Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. 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 Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
   2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to one visit to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Park's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 260943 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes manually operated, digital lighting controls with external signal source relays and control module.

B. Related Sections include the following:

1. Division 26 Section "Lighting Control Devices" for occupancy sensors.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

B. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

C. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.

D. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

1.4 SUBMITTALS

A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.

B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.

1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators,

and other devices to be used. Describe characteristics of network and other data communication lines.

3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.

C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

D. 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.

E. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

F. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of lighting control functions.
2. Coordinate lighting controls with that in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

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

a. Failure of software input/output to execute switching or dimming commands.
b. Failure of modular relays to operate under manual or software commands.
c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: Two years from date of Substantial Completion.
3. Extended Warranty Period for Electrically Held Relays: 10 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Electrically Held Relays: Equal to 25 percent of amount installed for each size indicated, but no fewer than 2 relays.

1.9 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revise licenses for use of the software.

1. Provide 30-day notice to NPS to allow scheduling and access to system and to allow NPS to upgrade computer equipment, if necessary.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.

B. Performance Requirements: Manual switches, an internal timing and control unit, and external sensors or other control signal sources send a signal to a PC-based programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits, or routes variable commands to one or more dimmers, for groups of lighting fixtures or other loads.

2.2 CONTROL MODULE

A. Control Module Description: Comply with UL 916 (CSA C22.2, No. 205); microprocessor-based, solid-state, 365-day timing and control unit. Output circuits shall be switched on or off by internally programmed time signals or by program-controlled analog or digital signals from external sources. Output circuits shall be pilot-duty relays compatible with power switching devices. An integral keypad shall provide local programming and control capability. A key-locked cover and a programmed security access code shall protect keypad use. An integral alphanumeric LCD or LED shall display menu-assisted programming and control.

2.3 POWER DISTRIBUTION COMPONENTS

A. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.

1. Cabinet: Steel with hinged, locking door.

    a. Barriers separate low-voltage and line-voltage components.
    b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
    c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.

2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.

    a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
    b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
    c. Endurance: 50,000 cycles at rated capacity.
    d. Mounting: Provision for easy removal and installation in relay cabinet.

2.4 MANUAL SWITCHES AND PLATES

A. Push-Button Switches: Modular, momentary-contact, low-voltage type.

1. Match color specified in Division 26 Section "Wiring Devices."
2. Integral green LED pilot light to indicate when circuit is on.
3. Internal white LED locator light to illuminate when circuit is off.

B. Manual, Maintained Contact, Full- or Low-Voltage Switch: Comply with Division 26 Section "Wiring Devices."

C. Wall-Box Dimmers: Comply with Division 26 Section "Wiring Devices."

D. Wall Plates: Single and multigang plates as specified in Division 26 Section "Wiring Devices."

E. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 12 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 6a for horizontal copper cable and with Division 27 Section "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install wiring in raceways. Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. 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 terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

F. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Test for circuit continuity.
2. Verify that the control module features are operational.
3. Check operation of local override controls.
4. Test system diagnostics by simulating improper operation of several components selected by Contracting Officer.

3.3 SOFTWARE INSTALLATION

A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Activate luminaires and verify that all lamps are operating at 100 percent.
3. Confirm correct communications wiring and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors and to assist NPS personnel in making program changes to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 260943

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 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 time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

D. 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 panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to NECA 407.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
a. In first subparagraph below, select first option for panelboards with fused switches; select second option for panelboards with circuit breakers.
b. Ambient Temperature: 10 deg F to plus 140 deg F.
c. Altitude: 3,400 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
2. Altitude: 3,400 feet.

1.9 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.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.10 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.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Two spares for each type of panelboard cabinet lock.
   2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Quantity as indicated on electrical drawings.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Salient Characteristics:
   1. Physical:
      a. Enclosures: Flush- and surface-mounted cabinets.
         1) Rated for environmental conditions at installed location
            a) All Locations: NEMA 250, Type 4X.
      b. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
      c. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
      d. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
      e. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
      f. Finishes:
         1) Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
         2) Back Boxes: Galvanized steel.
         3) Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
      g. Phase, Neutral, and Ground Buses:
         1) Material: Hard-drawn copper, 98 percent conductivity.
         2) Equipment Ground Bus: Full capacity separate ground bus for feeder and branch-circuit equipment grounding conductors; bonded to box.
         3) Neutral Bus: Neutral bus rated 100 percent of phase bus and UL listed as suitable for nonlinear loads.
      h. Conductor Connectors: Suitable for use with conductor material and sizes.
         1) Material: Hard-drawn copper, 98 percent conductivity.
         2) Main and Neutral Lugs: Mechanical type.
         3) Ground Lugs and Bus-Configured Terminators: Mechanical type.
         4) Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   2. Functional:

a. Incoming Mains Location: Top and bottom.
b. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
c. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
d. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

3. Performance:
a. Fabricate and test panelboards according to IEEE 344.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Salient Characteristics:
1. Physical:
a. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2. Functional:
a. Mains: Circuit breaker or lugs only.
b. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
c. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

3. Performance:
a. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Salient Characteristics:
1. Physical:
a. 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. Used for all breakers unless otherwise noted.
b. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip). Refer to plans for GFI breaker locations.
c. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
1) Standard frame sizes, trip ratings, and number of poles.
2) Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
3) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
4) Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
5) Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
6) Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.

7) Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2. Functional:
   a. None.
3. Performance:
   a. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

PART 3 EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

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 NECA 407.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
   2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to panelboards.
   5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

E. 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.

F. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

G. Install filler plates in unused spaces.

H. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

J. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate 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 Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "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. Set field-adjustable circuit-breaker trip ranges as indicated.

C. 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: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 13 - ELECTRICITY METERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes equipment for electricity metering by National Park Service, Demand Metering.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual. Include the following:
   1. Electricity-metering equipment.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For electricity-metering equipment to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, store, and handle modular meter center as specified in NECA 400.

PART 2 PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Salient Characteristics:
   1. Physical:
      a. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
      b. Meter Sockets: Comply with requirements of electrical power utility company.
   2. Functional:
      a. None.
   3. Performance:
      a. None.

2.2 EQUIPMENT FOR ELECTRICITY DEMAND METERING

A. Salient Characteristics:
   1. Physical:

a. Kilowatt-Hour/Demand Meter: Electronic single- and three-phase meters, measuring electricity use and demand.

2. Functional:
   a. Basis of design product, E-MON Green Class, or approved equal.
   b. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
   c. Display: Digital liquid crystal, indicating accumulative kilowatt hours, current time and date, current demand, historic peak demand, and time and date of historic peak demand.
   d. Programmable Contact Module: Unit shall have push-button switches and a display for setting the demand level at which an integral set of Form C contacts shall be operated to initiate indicated action.
   e. Enclosure: NEMA 250, Type 1 minimum, with hasp for padlocking or sealing.
   f. Identification: Comply with Division 26 Section "Identification for Electrical Systems."
   g. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
   h. Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for ratings of circuits indicated for this application.
   i. Type: Solid core.
3. Performance:
   a. Meter Accuracy: Nationally recognized testing laboratory certified to comply with ANSI C12.1.
   b. Meet the requirements of EPACT 2005.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install equipment for utility company metering. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install modular meter center according to NECA 400 switchboard installation requirements.

3.2 FIELD QUALITY CONTROL

A. Test electricity-metering installation for proper operation, accuracy, and usability of output data.
   1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
   2. Turn off circuits supplied by metered feeder and secure them in off condition.
   3. Run test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use test load placement and setting that ensures continuous, safe operation.
   4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at test load connection. Record test results.
   5. Repair or replace deficient or malfunctioning metering equipment, or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Toggle switches.

B. Related Sections include the following:
   1. Division 26 Section "Lighting Control Devices" for wall-switch occupancy sensors.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 SUBMITTALS

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

B. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Government-Furnished Equipment: Match plug configurations.
   1. Cord and Plug Sets: Match equipment requirements.

PART 2 PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Salient Characteristics:
   1. Physical:

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.

2. Functional:
   a. None.
3. Performance:
   a. Comply with NFPA 70.
   b. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
      1) Connectors shall comply with UL 2459 and shall be made with stranding building wire.
      2) Devices shall comply with the requirements in this Section.

2.2 STRAIGHT BLADE RECEPTACLES

A. Salient Characteristics:
1. Physical:
   a. Convenience Receptacles, 125 V, 20 A.
2. Functional:
   a. Configuration 5-20R
3. Performance:
   a. Comply with NEMA WD 1, NEMA WD 6, and UL 498.

2.3 GFCI RECEPTACLES

A. Salient Characteristics:
1. Physical:
   a. Straight blade, non-feed-through type.
   b. Duplex GFCI Convenience Receptacles, 125 V, 20 A.
2. Functional:
   a. Include indicator light that is lighted when device is tripped.
   b. Exterior Locations: Provide with in-use cover. Device shall be corrosion resistant, suitable for salt air conditions.
3. Performance:
   a. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A

2.4 SPECIAL EQUIPMENT RECEPTACLES

A. Salient Characteristics:
1. Physical:
   a. Voltage and NEMA configuration as indicated on drawings
2. Functional:
   a. None.
3. Performance:
   a. Comply with NEMA WD 1, NEMA WD 6, and UL 498.

2.5 TOGGLE SWITCHES

A. Salient Characteristics:
1. Physical:
   a. Switches, 120/277 V, 20 A
2. Functional:
   a. None.

3. Performance:
    a. Comply with NEMA WD 1, UL 20, and FS W-S

2.6 WALL PLATES

A. Salient Characteristics:
1. Physical:
    a. Single and combination types to match corresponding wiring devices.
    b. Exhibit Light Switch Cover: Type 1, with continuous-hinge cover with surface mount latch, no window, unless otherwise indicated.
        1) Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
        2) Nonmetallic Enclosures: Plastic.
2. Functional:
    a. Plate-Securing Screws: Metal with head color to match plate finish.
    b. Material for Office, Admin, Exhibit, and Auditorium Spaces: Raw Brass.
    c. Material for all other Finished Spaces: Thermoplastic.
    d. Material for Unfinished Spaces: Galvanized steel.
    e. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."
3. Performance:
    a. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.7 FINISHES

A. Color: Wiring Device outlet colors are to be white for locations with steel or thermoplastic cover plates, and to be almond for all raw brass locations. Confirm with Contracting Officer prior to providing submittals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:
1. Take steps to ensure that devices and their boxes are protected. 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 the 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 wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until just 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. Replace all existing conductors.

D. Device Installation:
   1. Replace all devices that have been in temporary use during construction or that show signs that they 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 (152 mm) in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw. Pressure plate connections are also acceptable. Stab in connections are not allowed.
   6. Use a torque screwdriver when a torque is recommended or required by the 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: 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. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 INSPECTION

A. Contractor will perform inspection of sub-contractor work immediately after work in this section is completed.

B. Contractor will record observations for conformance with ABAAS and SDC Accessibility Standards using the DSC, CQC Accessibility Inspection Report.
   1. Report may be supplemented by sketches, notation, digital images, product literature, red-line contract documents, etc. to illustrate and explain conditions.

C. Coordinate inspections according to updated construction schedules.

D. Submit report to Contracting Officer within 24 hours of commencing inspection.

END OF SECTION

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Molded-case circuit breakers.
   4. Molded-case switches.
   5. Enclosures.

1.3 DEFINITIONS

A. GD: General duty.

B. GFCI: Ground-fault circuit interrupter.

C. HD: Heavy duty.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.4 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, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   3. Short-circuit current rating.
   4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports including the following:
   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.

D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. Include the following items at a minimum:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
   2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 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 (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
   2. Altitude: 8,200 Feet

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.1 FUSIBLE AND NONFUSIBLE SWITCHES

A. Salient Characteristics:
   1. Physical:
      a. Fusible Switch, 600A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
      b. Nonfusible Switch, 600A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
   2. Functional:
      a. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
      b. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
      c. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.
   3. Performance:
      a. None.

2.2 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Salient Characteristics:
   1. Physical:
      a. Molded-Case Circuit Breaker:
         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) GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

b. Molded-Case Switches:

1) Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

c.

2. Functional:

a. Molded-Case Circuit-Breaker:

1) Standard frame sizes, trip ratings, and number of poles.

2) Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.

3) Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

4) Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

b. Molded-Case Switch:

1) Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.

2) Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.

3) Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage. Provide "dummy" trip unit where required for proper operation

3. Performance:

a. Molded-Case Circuit Breaker and Switches:

1) NEMA AB 1, with interrupting capacity to meet available fault currents.

2.3 ENCLOSURES

A. Salient Characteristics:

1. Physical:

a. None.

2. Functional:

a. None.

3. Performance:

a. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1) Outdoor Locations: NEMA 250, Type 3R.

2) Other Wet or Damp Indoor 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

SECTION 26 41 13 – LIGHTNING PROTECTION FOR STRUCTURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes lightning protection for buildings.

1.3 DEFINITIONS

A. LPI: Lightning Protection Institute.

B. NRTL: National recognized testing laboratory.

1.4 SUBMITTALS

A. Product Data: For air terminals and mounting accessories.

B. Shop Drawings: Detail lightning protection system, including air-terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

C. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by an NRTL or LPI.

D. Certification, signed by Contractor, that roof adhesive for air terminals is approved by manufacturers of both the terminal assembly and the single-ply membrane roofing material.

E. Field inspection reports indicating compliance with specified requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an NRTL or who is certified by LPI as a Master Installer/Designer.

B. Listing and Labeling: As defined in NFPA 780, "Definitions" Article.

1.6 COORDINATION

A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

PART 2 PRODUCTS

2.1 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Salient Characteristics:
1. Physical:

a. Roof-Mounting Air Terminals: NFPA Class I, copper, 12” length, 1/2” diameter unless otherwise indicated.
   1) Single-Membrane, Roof-Mounting Air Terminals: Designed for single-membrane roof materials.
b. Stack-Mounting Air Terminals: Solid copper.
c. Ground Rods and Ground Loop Conductors: Comply with Division 26 Section "Grounding and Bonding for Electrical Systems" and with standards referenced in this Section.

2. Functional:
   a. None.
3. Performance:
   a. Comply with UL 96.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.

C. Conceal the following conductors, except as otherwise noted.
   1. System conductors.
   2. Down conductors.
   3. Interior conductors.
   4. Conductors within normal view from exterior locations at grade within 200 feet (60 m) of building.
   5. Notify Contracting Officer at least 48 hours in advance of inspection before concealing lightning protection components.

D. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.

E. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

F. Bond extremities of vertical metal bodies exceeding 60 feet (18 m) in length to lightning protection components.

G. A counterpoise installation based on requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" may be used as a ground loop required by NFPA 780, provided counterpoise conductor meets or exceeds minimum requirements in NFPA 780.
   1. Bond ground terminals to counterpoise conductor.
   2. Bond grounded metal bodies on building within 12 feet (3.6 m) of ground to counterpoise conductor.
   3. Bond grounded metal bodies on building within 12 feet (3.6 m) of roof to counterpoise conductor.

H. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot (18-m) intervals.

3.2 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.3 FIELD QUALITY CONTROL

A. UL Inspection: Provide inspections as required to obtain a UL Master Label for system.

B. Provide an inspection by an inspector certified by LPI to obtain an LPI certification.

END OF SECTION

SECTION 26 43 13 - TRANSIENT VOLTAGE SUPPRESSION (SURGE PROTECTION) FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.3 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.

1.4 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.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 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. Salient Characteristics:
1. Physical:
a. MCOV of the SPD shall be the nominal system voltage.
2. Functional:
a. None.
3. Performance:
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.

2.2 SERVICE ENTRANCE SUPPRESSOR

A. Salient Characteristics:
1. Physical:
a. SPDs with the following features and accessories:
1) Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
2) Indicator light display for protection status.
3) Surge counter.
2. Functional:
a. 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.
b. Protection modes and UL 1449 VPR for grounded wye circuits with 240/120 V, single-phase, three-wire circuits shall not exceed the following:
a) Line to Neutral: 700 V for 240/120 V.
b) Line to Ground: 1200 V for 240/120 V.
c) Line to Line: 1000 V for 240/120 V.
c. SCCR: Equal or exceed 100 kA.
d. Inominal Rating: 20 kA.
3. Performance:
a. SPDs: Comply with UL 1449, Type 1, listed as a Type 1 device, suitable for use in a Type 1 or 2 installation.
b. Comply with UL 1283.

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

2.4 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "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 260519 "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.

END OF SECTION

SECTION 26 51 00 - LIGHTING FIXTURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections include the following:
1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CRI: Color-rendering index.

B. LER: Luminaire efficacy rating.

C. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Driver.
4. Energy-efficiency data.
5. Life, output, and energy-efficiency data for lamps.
6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power wiring.

C. Qualification Data: For agencies providing photometric data for lighting fixtures.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 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.

PART 2 PRODUCTS

2.1 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Salient Characteristics:
1. Physical:
a. Metal Parts: Free of burrs and sharp corners and edges.
b. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
c. 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.
d. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
1) White Surfaces: 85 percent.
2) Specular Surfaces: 83 percent.
3) Diffusing Specular Surfaces: 75 percent.
4) Laminated Silver Metallized Film: 90 percent.
e. Plastic Diffusers and Covers:

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.
2) Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
3) UV stabilized.

f. Glass: Annealed crystal glass, unless otherwise indicated.

2. Functional:
   a. Refer to drawing sheets.
3. Performance:
   a. Refer to drawing sheets.

2.2 EXIT SIGNS

A. Salient Characteristics:
1. Physical:
   a. Internally Lighted Signs:
      1) Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
      2) Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
         a) Revise first subparagraph below to specify different battery. See Evaluations for discussion of battery types. Verify that battery selection is available as UL-listed unit and coordinate with Part 1 "Warranty" Article.
         b) Battery: Sealed, maintenance-free, nickel-cadmium type.
         c) Charger: Fully automatic, solid-state type with sealed transfer relay.
         d) Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
         e) Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
         f) LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
         g) Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.
2. Functional:
   a. Refer to drawing sheets.
3. Performance:
   a. Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
   b. Refer to drawing sheets.

2.3 EMERGENCY LIGHTING UNITS

A. Salient Characteristics:
1. Physical:
   a. Battery: Sealed, maintenance-free, lead-acid type.

b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2. Functional:
   a. Refer to drawing sheets.
3. Performance:
   a. Self-contained units complying with UL 924.
   b. Refer to drawing sheets.

2.4 SOLID STATE LIGHTING FIXTURES

A. Housing, where applicable:
   1. Steel bonderized or equal rust projected, or aluminum, rigid construction. Minimum gauge thickness shall be as follows:
      a. Interior locations: No. 20 gauge steel, no. 16 gauge aluminum.

B. Finish:
   1. Baked enamel finish (except when otherwise specified).
   2. Concealed interior surfaces (this applies to interior hardware, circuit boards, etc.) matte black.
   3. Concealed exterior surfaces: matte black.
   4. Visible surfaces: color and texture as specified below for each fixture type or as selected.
   5. Exterior fixture finish: refer to Lighting Fixture Schedule.

C. Light Emitting Diode (LED) requirements:
   1. Correlated color temperature (CCT) for phosphor - coated white LEDs must have one of the following designated CCT's and fall within the following binning standards:
      a. Outdoor:
         i. 2700K defined as 2725 +/- 145K
         ii. Amber
      b. Indoor:
         iii. 3500K defined as 3465 +/- 245K
         iv. 4000K defined as 3985 +/- 275K

   2. Color spatial uniformity shall be limited to variations in chromaticity for different directions within 0.004 from the weighted average point on the CIE 1976 (u',v') diagram.

3. Color maintenance shall be limited to a maximum change in chromaticity of 0.007 on the CIE 1976 (u',v') diagram over the lifetime of the product.
4. Color rendering index.
   a. Color rendering index to be determined using ANSI C78.377-2008 and applicable IESNA standards.
   b. Laboratory tests must be produced using specific module(s)/array(s) and power supply combination that will be used in production.
   c. Manufacturers must provide a test report from a laboratory accredited by NVLAP or one of its MRA signatories.
5. Lumen depreciation.
   a. Lumen depreciation to be measured using IESNA LM-80-08 standard for IES approved method of measuring lumen maintenance of LED light sources.
   b. Phosphor coated white LED module(s)/array(s) shall deliver at least 70% of initial lumens for a minimum of 35,000 hours when installed in-situ and operated at 100% output and the maximum specified operating temperature.
   c. Colored LED module(s)/array(s) shall deliver at least 50% of initial lumens for a minimum of 35,000 hours when installed in-situ and operated at 100% output and the maximum specified operating temperature.
6. Acceptable LED manufacturers:
   a. CREE
   a. Nichia
   b. Osram Opto Semiconductors
   c. Philips Lumileds

D. Luminaire Efficacy:
1. Luminaire efficiency shall be measured using IESNA LM-79-08 standard for electrical and photometric measurements of solid state lighting products.
2. Manufacturer shall provide published luminaire efficacy, which is defined as luminaire light output divided by luminaire input power measured in a 25 degree Celsius environment. Efficacy shall include power supply, thermal, optical, and fixture losses. Minimum efficacy of 80 lumens per watt.

E. Thermal Management:
1. Solid state light fixture shall not exceed LED manufacturer's maximum junction temperature requirements when operated in-situ at fixture manufacturer's maximum ambient operating temperature and 100% light output.
2. Solid state light fixtures shall be thermally protected using one of more of the following thermal management techniques:
   a. Metal core board
   b. Gap pad
   c. Internal monitoring firmware
3. Solid state lighting fixture housing shall be designed to transfer heat from the LED board to the outside environment.

F. Power Supplies/Drivers:
1. Power supply shall have a power factor of 0.90 or greater for primary application.
2. Power supply input current shall have Total Harmonic Distortion (THD) of less than 20%.
3. Power supply shall have a minimum operating temperature of minus 20 degrees Celsius of below when used in luminaires intended for outdoor applications.

4. Power supply output operating frequency to be equal to or greater than 120Hz.
5. Power supply shall operate with sustained input variations of +/- 10% (voltage and frequency) with no damage to the driver.
6. Power supply shall tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.
7. Power supply output shall be regulated to +/- 5% across published load range.
8. Power supply shall have a Class A sound rating.
9. Power supply outputs shall have current limiting protection.
10. Power supply shall operate LEDs at constant and regulated current levels. LEDs shall not be overdriven beyond the diode manufacturer's specified nominal voltage and current.

G. Solid State Lighting Controls:
1. Control interface to dimmable power supplies shall consist of one of the following:
a. Line Voltage Dimming. Controls to be rated for magnetic or electronic low voltage transformer operation.
b. Low voltage (0-10V) control. Controls to be compatible with either current sink or current source operation.

2. Dimmable LED power supplies shall use pulse width modulation (PWM) to regulate power to LEDs
a. Dimmable power supplies shall have 12-bit or greater resolution to obtain flicker-free operation throughout the dimming range.

H. System Installation:
1. All hardwired connections to solid state lighting fixtures shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
2. All solid state lighting fixtures (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing.
3. Solid state lighting installations shall be UL listed as a low-voltage lighting system including, but not limited to, luminaire, power supply, controller, keypad, and wiring.

I. Warranty: Luminaires, drivers, and controllers for solid state lighting systems shall be covered by a two-year warranty against defects in workmanship or material. Warranty shall include in-warranty service program providing for payment of authorized labor charges incurred in replacement of inoperative in-warranty equipment.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "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 (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) 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 (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. 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 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Suspended Lighting Fixture Support:
   1. Pendants and Rods: Where longer than 48 inches (1200 mm), 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.

C. Adjust aimable lighting fixtures to provide required light intensities.

D. Retrofit power, lighting and controls will impact interior surfaces in public spaces that are highly character defining. If new installations are not concealed it potentially changes the historic appearance and surface anchorage may result in loss of fabric that degrades the quality of the resource. New equipment and materials choices must be concealed or compatible with the historic surface to avoid obtrusiveness. Major alterations should be relegated to least important locations. Careful choices for materials, finishes, fixtures, and service runs can help preserve the character of the property.

END OF SECTION

SECTION 270010 - SUPPLEMENTAL REQUIREMENTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplemental requirements generally applicable to the Work specified in Division 27.
   a. Work specified in Division 27 may be applicable to, or in coordination with, trades other than division 27. It is the contractor's responsibility to coordinate with other trades to define and complete the scope of work.
   b. Information herein shall be considered supplementary, and in addition to, system specific specifications.

B. Related Requirements:

1. Refer to the division 26 specifications for further information regarding:
   a. Abbreviations, acronyms, definitions, and additional coordination drawing submittal requirements.
2. Section 280010 "Supplemental Requirements for Electronic Safety and Security" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
3. Refer to the specifications below:
   a. 270526 – Grounding And Bonding For Communication Systems
   b. 270528 – Pathways For Communication Systems
   c. 270529 – Hangers And Supports For Communication Systems
   d. 270536 – Cable Trays For Communications Systems
   e. 270544 - Sleeves And Sleeve Seals For Communication Pathways And Cabling
   f. 270553 - Identification For Communication Systems
   g. 271116 - Communications Racks, Frames, And Enclosures
   h. 271323 - Communications Optical Fiber Backbone Cabling
   i. 271513 - Communications Copper Horizontal Cabling
   j. 274100 - Audio-Visual Systems

1.2 REFERENCES

A. Abbreviations and Acronyms for Communications:

1. LAN: Local area network.
2. PoE: Power over Ethernet.
3. POTS: Plain old telephone service. See "public switched telephone network."
4. TCP/IP: Transmission control protocol/Internet protocol.
5. WAN: Wide area network.

B. Definitions for Communications:

1. Calling Party Control (CPC): A momentary break in phone line loop current, which is used to signal voicemail and other automated telephone company services that distant party has hung up.
2. Private Branch Exchange (PBX): Analog telephone switch that routes calls internal to a business or organization so a direct external line for each phone is unnecessary.
3. Public Switched Telephone Network (PSTN): Analog telephone technology that uses twisted-pair cables from a telephone-provider central office for the transmission medium. PSTN refers to the telephone network; POTS refers to the individual subscriber line.
4. Remote Office Phone System (ROPS): VoIP system that allows phones for a business or organization located anywhere in the world with internet connectivity to behave similar to phones connected to a PBX.
5. Ringer Equivalence Number (REN): The loading effect of a single traditional telephone ringing circuit. TIA-968 defines REN 1 as an impedance of 7000 Ω at 20 Hz (Type A ringer) or 8000 Ω from 15 Hz to 68 Hz (Type B ringer). The sum of the RENs for all devices on a subscriber line circuit may not exceed the maximum permitted REN for the subscriber line.
6. Voice over Internet Protocol (VoIP): Digital telephone packet technology that uses the internet for its transmission medium.

1.3 COORDINATION

A. The Technology drawings and specifications provide the scope and requirements of construction applicable to multiple trades and systems. These systems are inclusive of, but not limited to, structured cabling, low voltage, audio-visual, and other such systems. Each system requires the coordination of multiple contracting trades and disciplines. It is the responsibility of each contractor to review all technology scope and to coordinate with other disciplines.

B. Contractor shall coordinate with all other trades prior to construction, at minimum, contractor shall coordinate with the general, electrical, security, and other low voltage contractors. It is the contractor's responsibility to ensure all other contractor trades are aware and knowledgeable of the system requirements and associated responsibilities as defined in these construction documents.

C. Contractor shall always maintain a working set of the construction documents in field (These may be printed or virtual). These documents shall always represent the latest information as well as capture all changes to final constructed solution(s). Any cost associated with an unaccepted installation, and subsequent reinstallation, due to the wrong documentation reference is the sole responsibility of the contractor and shall not be a cost transferred to the contracting officer. At a minimum, the working set of construction documents shall include:
   1. The latest version of construction documents
   2. All changes associates with change orders, RFIs, Addenda, email, and/or other such documentation
   3. All field coordinated changes and/or changes to be captured in as-built drawings.

D. For any and all discrepancies, contractor shall provide written notification to contracting officer and general contractor prior to commencement of work and procurement of material.

E. Interruption of Existing Telephone, Internet, CATV, Cellular, or other such Service: Do not interrupt service to facilities occupied by end user or others unless permitted under the following conditions:

1. Notify Contracting Officer no fewer than 20 business days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Contracting Officer's written permission.

F. Multi-disciplinary coordination requirements: Ensure that all trades and integrators who are impacted or dependent on the Division 27 scope of work (either via scheduling, constructability, support, or other such means) are contacted and informed of coordination items relevant to their scope of work at least 10 days prior to commencement of work. Furthermore, ensure all trades and integrators whose work has a similar effect on the Division 27 scope of work are contacted for information regarding items relevant to the scope of work at least 10 days prior to work commencement.

1.4 PREINSTALLATION MEETINGS

A. Communications Preconstruction Conference: Schedule conference with General Contractor and the Contracting Officer not later than 10 business days after notice to proceed. Agenda topics include, but are not limited to, the following:

1. Installation schedule for communications systems.
2. Installation schedule for all systems effecting, or effected by, the communications systems scope of work.
3. Value analysis proposals and requests for substitution of communications equipment.
4. Utility service coordination, outages, inspections, and/or activation.
5. Sustainability activities.
6. Submission of action submittals specified in Division 27.
7. Submission of information submittals specified in Division 27.
8. Submission of closeout submittals specified in Division 27.
9. Orders placed for major equipment.
10. Arrival of major equipment on-site.
11. Preinstallation meetings specified in Division 27.
12. System startup, testing, and commissioning activities for communications equipment.
13. System startup, testing, and commissioning activities for Work specified in other divisions that depends on Work specified in Division 27.
14. Requests for special inspections.
15. Requests for inspections by authorities having jurisdiction.

1.5 ACTION SUBMITTALS

A. Submission of action submittals shall be in accordance with Division 01 specifications. Refer to each specification section for submittal requirements specific to each scope of work.

B. The items listed below outline the multiple categories of action submittals, and the associated items comprising each category, that may be included in a system's specification. Refer to each division 27 specification for the system specific submittal requirements.
1. Product Data
   a. Manufacturer and Part number
      1) Shall be highlighted to indicate version of equipment to be utilized when multiple models/variations of product are present on documentation.

2. Shop Drawings
    a. Contractor shall provide Site Plans, Overall plans, Floor plans, Ceiling plans, One-line Diagrams, Wiring Diagrams, and/or Elevations views as needed to indicate system specific fabrication, installation, layout, connectivity, and coordination.
    b. Cabling Plan for backbone cabling indicating the origination point, termination point, and general path of cable including the pathways utilized along path.
3. Identification Schedule
    a. An electronic copy of the system specific labeling schedule including, at minimum, an itemized list of the component(s) to be labeled, the associated label per component, and component information such as manufacturer, part number, and installed location.
    b. Scaled details drawings indicating components to be labeled and location of label on components.

1.6 INFORMATIONAL SUBMITTALS

A. Submission of information submittals shall be in accordance with Division 01 specifications. Refer to each specification section for submittal requirements specific to each scope of work.

B. Information submittals shall be submitted to General Contractor at monthly intervals unless otherwise noted/directed by General Contractor.

C. At each issuance, a combined submittal shall be submitted that includes the information submittals from all the division 27 specifications referenced herein.
    1. Where multiple specification sections indicate the same or similar recorded item, it is acceptable for the contractor to submit a combined submittal to address multiple specification sections.
        a. For example, Field Quality Control Reports can be combined to encompass multiple specification sections. It must be noted on report which sections are included in report.

D. The items listed below outline the multiple categories of information submittals, and the associated items comprising each category, that may be included in a system's specification. Refer to each division 27 specification for the system specific submittal requirements.
    1. Coordination Drawings
        a. Drawings indicating specific coordination items between the division 27 scope of work components with elements from architectural, structural, and other trades.
    2. Installer Qualification Data
        a. Certification information of each title as specified.
    3. Field Quality Control Reports
        a. Reports that include the following:
            1) Adherence and/or adjustments to installation schedule
            2) Adherence and/or adjustments to procurement schedule
            3) System Start-up, Testing, Commissioning and Turn-Over schedules
            4) System outages and downtime
            5) Major Equipment order placing and arrival schedules
            6) Waste-management and work site cleanliness adherence
            7) Testing and Verification Results
    4. Factory Test Reports

a. Manufacturer generated test reports validating the products viability prior to being shipped.

5. System Testing Plans
   a. A scheduled plan to execute the testing requirements of a specific product in accordance with manufacturer requirements, industry recommendations, and specification requirements.
   b. Plan shall include testing procedures, testing equipment, pass/fail thresholds per test, testing parameters of equipment and test, and the proposed schedule for testing plan.
6. Certificates
   a. Seismic-Load Performance Certificates: Provide special certification as indicated in Paragraph 13.2.2 "Special Certification Requirements for Designated Seismic Systems" of ASCE/SEI 7-16 for designated seismic-load systems identified on Drawings or in the Specifications.
      1) Include the following information:
         a) Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
         b) Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
         c) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
         d) Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
         e) Provide equipment manufacturer's written certification for each designated active electrical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction.
         f) Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by qualified structural professional engineer.
   b. Wind-Load Performance Certificates: Provide special certification for designated wind-load systems and components identified on Drawings or in the Specifications.
      1) Include the following information:
         a) Provide equipment manufacturer's written certification for each designated system and component, stating that it will remain in place and operable following the design wind event and comply with requirements of authorities having jurisdiction.
         b) Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

1.7 CLOSEOUT SUBMITTALS

A. Submission of closeout submittals shall be in accordance with Division 01 specifications. Refer to each specification section for submittal requirements specific to each scope of work.

B. A combined submittal shall be submitted to the Contracting Officer that includes the closeout submittals from all the division 27 specifications referenced herein.
   1. Where multiple specification sections indicate the same or similar recorded item, it is acceptable for the contractor to submit a combined submittal to address multiple specification sections.
      a. For example, Record Documentation can be combined to encompass multiple specification sections. It must be noted on document which sections are included in document.

C. The items listed below outline the multiple categories of closeout submittals, and the associated items comprising each category, that may be included in a system's specification. Refer to each division 27 specification for the system specific submittal requirements.
   1. Record Documentation:
      a. Including the installed location of equipment and components.
      b. Including the major routes of backbone, utility, and grounding cables.
   2. Operation and Maintenance Data:
      a. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device listed below:
      b. Manufacturer's operating specifications.
      c. User's guides.
      d. Schedule of maintenance material items recommended to be stored at Project site.
      e. Detailed instructions covering operation under both normal and abnormal conditions.
      f. Instructions for setting field-adjustable components.
      g. Manufacturer's instructions for testing, adjusting, and maintaining component/equipment.
   3. Warranty Information
      a. Manufacturer's and Contractor's Warranty Documents
      b. Maintenance Contracts and Service Agreements
   4. Software and Firmware Operational Documentation: Provide software and firmware operational documentation, including the following:
      a. Software operating and upgrade manuals.
      b. Names, versions, and website addresses for locations of installed software.
      c. Device address list.
      d. Printout of software application and graphic screens.
      e. Testing and adjusting of panic and emergency power features.
      f. Provide the program Software Backup username and password for approved online or cloud solution.
      g. Provide to Contracting Officer the upgrades and unrestricted licenses for installed and backup software, including operating systems and programming tools required for operation and maintenance.
   5. Identification Schedule
      a. The finalized version of the identification schedule updated to include label changes from in-field/coordinated changes.
      b. A single identification schedule encompassing all associated specification sections shall be submitted.
   6. Extra Materials
      a. Furnish to Contracting Officer extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   7. Field Test and Inspection Reports

a. Preform testing per system specification and submit associated report.
b. All test reports shall be combined and submitted as a single file and combined report.

1.8 QUALIFICATIONS

A. Communications Design Professional: Design professional possessing active qualifications specified in Section 014000 "Quality Requirements" and the following:

1. Expertise in design of communications infrastructure and distribution equipment.
2. BICSI Registered Communications Distribution Designer (RCDD) certification.

B. Communications Cable Installer: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" and the following:

1. Training and manufacturer certification to install, splice, and terminate communications cabling.
2. Installation Supervisor: BICSI Technician (TECH) certification.
3. Copper Installers: 30 percent of on-site employees possess BICSI Copper Installer 2 (INSTC) certification. Remaining employees possess BICSI Installer 1 (INST1) certification.
4. Fiber Installers: 30 percent of on-site employees possess BICSI Optical Fiber Installer 2 (INSTF) certification. Remaining employees possess BICSI Installer 1 (INST1) certification.

C. Communications Testing Agency: Entity possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

1. On-site communications testing supervisor must have BICSI Technician (TECH)] certification and documented training, and be experienced with testing communications equipment in accordance with BICSI and ANSI/TIA testing standards.

1.9 FIELD CONDITIONS

A. Modeling, analysis, product selection, installation, and quality control for work specified in Division 27 must comply with requirements specified in Section 260011 "Facility Performance Requirements for Electrical."

PART 2 - PRODUCTS

2.1 COMMUNICATIONS EQUIPMENT

A. Products shown within the associated division 27 specifications, and/or within associated drawings/schedules, shall be considered as basis of design, unless specifically noted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Immediately upon initial (1st day) arrival to site, contractor shall coordinate with General Contractor for all site and project specific information. Contractor shall adhere to all General Contractor requirements throughout duration of project.

2. Prior to commencement of work, contractor shall reference and/or inspect the following conditions:
   a. All safety and security protocols specific to site construction.
   b. The most current version of construction documents as specified in section 1.3.C herein.
   c. The most updated/recent version of project and installation schedule(s).
   d. All coordinated work previously completed and coordinated work that is uncompleted but scheduled for prior completion.
   e. Current construction conditions affecting scope of work.

3. For any and all questions, concerns, coordination, or other project specific information, especially those affecting schedule, quality of work, or system acceptance, contractor shall inform General Contractor in as timely a manner as possible.

B. Preinstallation Testing:

1. It is the contractor's responsibility to ensure that all material and equipment is tested for acceptance pursuant to the manufacturer's specifications and parameters prior to installation.

2. All material and equipment shall be tested for acceptance immediately upon being received by contractor.
   a. If material and/or equipment is received off-site, material and/or equipment shall be retested and confirmed to be acceptable upon arrival on-site.

3. Any material and/or equipment that fails testing procedure and is unacceptable for installation shall be noted and communicated to manufacturer. Dependent upon scope and breadth of failures, contractor shall coordinate required replacement material and maintain installation schedule. If failures affect the installation schedule and/or project schedule, contractor shall inform the General Contractor.

3.2 PREPARATION

A. Protection of In-Place Conditions:

1. Contractor shall always maintain a neat and orderly workspace while on site. The workspace shall not interfere with, or in any other form, disallow other trades to complete their scope of work or maintain proper schedule of work.

2. All tools, material, equipment, trash, etc., shall be maintained to be always neat and orderly while on site.

3. All material and equipment that has been installed shall be protected in place. It is the contractor's responsibility to ensure all installed equipment is protected in place through means of protective coverings, enclosed/restricted spaces, and coordination with other trades. The items of note include, but are not limited to:
   a. Capping/Taping the open ends of unused conduit and open backboxes while protecting pull string.
   b. Covering of all active equipment and termination components to ensure any openings, ports, or other such component orifices are protected from elements such as water, dust, and construction debris and/or material.
   c. Isolation of telecommunication rooms and equipment from general construction whenever possible to minimize water, dust, and construction debris and/or material.
   d. Protection of active equipment from tampering, especially pre-configured or recently configured.
   e. Proper bonding and grounding of all equipment immediately upon installation.

3.3 INSTALLATION OF COMMUNICATIONS WORK

A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' instructions, contractors shall complete scope of work in a neat and workmanlike manner and comply with NFPA 70, NECA NEIS 1, and BICSI N1 for installation of work specified in Division 27. Consult Contracting Officer for resolution of conflicting requirements.

B. For all work specified in Division 27, contractor shall provide a complete and functional (turnkey) system. Coordination with General Contractor, Contracting Officer, and other trades may be required. Reference the Responsibility Matrix on Technology sheets for information per each system.

3.4 SYSTEM STARTUP

A. Commissioning Activities:

1. Contractor shall reference and adhere to manufacturer's startup/activation requirements for commissioning.

2. Commissioning effort shall ensure that system is complete and operational prior to final testing, system turnover and substantial completion.

3.5 FIELD QUALITY CONTROL

A. Administrant for Communications Equipment, Systems, and Material Tests and Inspections:
   1. Contractor shall administer and perform tests and inspections.

   2. Contractor may utilize assistance of factory-authorized service representative, or a third-party certified testing authority, at no cost to Contracting Officer.

3.6 CLEANING

A. Waste Management:

1. Proper disposal and on-site management of all waste material, packaging, and other such extra items not scheduled for install is required. It is the contractor's responsibility to ensure all waste management procedures and protocols are observed and practiced with regards to any and all waste accumulated.

2. Prior to initial (1st day) arrival on site, contractor shall coordinate with General Contractor for current site conditions, rules, regulations, and requirements regarding the accumulation and disposal of waste.

3. The requirements below are in addition to General Contractor defined site requirements, not in lieu of, and shall not supersede any site requirements. Any discrepancy between the below and the site requirements shall be communicated to General Contractor for further clarification.
   a. All trash or waste accumulated shall be properly disposed of at the end of each day.
   b. Any material deemed hazardous must be disposed of immediately. Disposal of material shall be communicated to, and coordinated with, General Contractor.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration:

1. Contractor shall coordinate with Contracting Officer and General Contractor to schedule time and attendance for a contractor provided demonstration of the operability of the following systems and equipment:
   a. Telecommunication Equipment Room
   b. Structured Cabling System (Horizontal and Backbone) and Infrastructure
   c. AV system

2. It is acceptable for contractor to engage sub-contractors, manufacturer representatives, and/or third parties, to conduct demonstration. Any engagement of such shall be at no cost to Contracting Officer.

3. At Contracting Officer's request, Contractor shall record demonstration(s) or allow Contracting Officer to record demonstration(s). Any contractor provided recording shall be at no extra cost to Contracting Officer.

B. Training:

1. Train end-user's maintenance personnel on any system and/or equipment defined herein. Training shall be administered by contractor(s) and shall include at least 1 hour of training per section on how to adjust, operate, update, and maintain the system(s) below:
   a. Section 271116 "Communications Rack, Frames, and Enclosures"
   b. Section 271323 "Communications Optical Fiber Backbone Cabling"
   c. Section 271513 "Communications Copper Horizontal Cabling"
   d. Section 274100 "Audio-Visual Systems"

At Contracting Officer's request, Contractor shall record training session(s) or allow Contracting Officer to record session(s). Any contractor provided recording shall be at no extra cost to Contracting Officer.

END OF SECTION 270010

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
   1. In addition to information listed herein, contractor shall reference the below standards:
      a. ANSI/TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises.
      b. ANSI/NECA/BICSI 607 - BICSI Standard for Telecommunication Grounding and Bonding, Planning and Installation Methods for Commercial Building
      c. NFPA 70 (NEC)

1.2 SUMMARY

A. Section Includes:

   1. Selection and installation of communications busbars.
   2. Selection and installation of communications bonding conductors.

1.3 DEFINITIONS

A. BBC: Backbone bonding conductor, for connecting multiple SBBs serving the same floor.

B. PBB: Primary bonding busbar, located in main distribution frame room, ideally near electrical service entrance.

C. RBB: Rack bonding busbar, located in equipment cabinets and racks.

D. SBB: Secondary bonding busbar, located in intermediate distribution frame rooms.

E. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.

F. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device at electrical service entrance.

G. TEBC: Telecommunications equipment bonding conductor, for connecting RBBs to SBBs or PBB.

H. UBC: Unit bonding conductor, for connecting individual communications equipment to RBBs or SBBs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. The following products shall be included:
      a. Grounding Busbars
      b. Conductors
      c. Connectors

B. Shop Drawings

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings

B. Installer Qualification Data
   1. Refer to Division 26 specifications and requirements for electrical contractor installation requirements and qualification requirements.
   2. Qualifications per specification 270010 “Supplemental Requirements for Communications”.
   3. RCDD certification for Installer, installation supervisor, and field inspector.
   4. Manufacturer certification indicating completion of manufacturer specific training and/or accreditation for the installation of products submitted.
      a. Manufacturer’s Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:
         1) Installing wire connector on conductor.
         2) Recommended torque values.

C. Field Quality Control Reports

1.6 CLOSEOUT SUBMITTALS

A. Record Documentation: Project record documents in accordance with Section 017839 "Project Record Documents" must include locations of PBB and SBBs, and routing of TBC, TBBs, and BBCs.

B. Operation and Maintenance Data.

C. Field Test and Inspection Report.

PART 2 - PRODUCTS

2.1 GROUNDING BUSBARS

A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Must be UL listed and have a hole pattern configuration in line with recommendations of ANSI/BICSI and ANSI/TIA 607 standards.

C. Must be made of copper, or copper alloy having a minimum of 95% conductivity as specified by the International Annealed Copper Standard (IACS).

D. PBB:

1. Dimensions: 1/4 inch thick by 4 inch high by 20 inch wide (6.3 mm thick by 100 mm high by 500 mm wide)
2. Stand-Off Distance: 4 inch (100 mm)

2.2 CONDUCTORS

A. Comply with UL 486A-486B.

B. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.

C. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

2.3 CONNECTORS

A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

C. Busbar Connectors: Cast silicon bronze, solderless compression-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.

2.4 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of TBC connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of TBC only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF COMMUNICATIONS BONDING CONDUCTORS

A. Unless otherwise indicated in this Section or on Drawings, provide products specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Communications Busbar Connections:

1. Unless otherwise specified, contractor shall refer to information below for sizing of grounding conductor cables:
   a. For any application(s) where the conductor length does not exceed 100 feet (30.5m), a minimum of 6AWG conductor is acceptable.
   b. For any application(s) where the conductor length is greater than 100 feet (30.5m):
      1) Determine the size of the grounding electrode conductor (GEC).
      2) Increase the size of the bonding conductor by one trade size for every 100 feet (30.5m) of length.

C. Cable Tray Connections:

1. Cable Tray Equipment Grounding Conductor: 6 AWG.
2. Cable Tray Bonding Jumper: If not supplied by cable manufacturer, provide bonding jumper not smaller than 6 AWG and not longer than 12 inch (300 mm). If jumper is wire, it must be terminated with lug having at least one hole and a standard-length barrel for single crimp. If jumper is flexible braid, it must be terminated with two-hole ferrule. Attach with bonding screw or connector provided by cable tray manufacturer.

D. Underground Connections: Not smaller than 2 AWG. Provide welded connectors, except bolted connectors may be used in handholes or manholes and as otherwise indicated on Drawings.

3.3 INSTALLATION OF BONDING FOR COMMUNICATIONS

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Bonding of Communications: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with BICSI N3.
2. Consult Contracting Officer for resolution of conflicting requirements.

C. Special Techniques:

1. Busbars:

a. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 18 inch (450 mm) above finished floor unless otherwise indicated.
b. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

2. Conductors:

a. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
b. Assemble wire connector to conductor, complying with manufacturer's published instructions and as follows:

1) Use crimping tool and die specific to connector.
2) Pretwist conductor.
3) Apply antioxidant compound to bolted and compression connections.

c. Install in straightest and shortest route between origination and termination point, and no longer than required. Bend radius must not be smaller than 10 times diameter of conductor. No single bend may exceed 90 degrees.
d. Install without splices.
e. Support conductors at not more than 36 inch (900 mm) intervals.
f. Outside telecommunications rooms, install conductors in metric designator 21 (trade size 3/4) PVC-80 conduit until conduit enters telecommunications room. Install bonding conductors in EMT-A or EMT-SS when routed through plenum. Do not install bonding conductors in EMT-S unless otherwise indicated on Drawings.

1) If bonding conductor must be installed in EMT-S or other ferrous metallic raceway, bond conductor to raceway using grounding bushing that complies with Section 270528 "Pathways for Communications Systems," and bond both ends of raceway to SBB.

3. Provide TBC and terminate ends to PBB and intersystem bonding termination device at electrical service entrance in accordance with Section 250.94, "Bonding for Communication Systems," of NFPA 70.

4. Busbar Interconnections: Bond SBBs to PBB with TBBs. If more than one TBB is installed, bond TBBs together. Install BBCs where required by TIA-607.
5. Structural Steel: Where structural steel of steel frame building is readily accessible within room or space, bond each SBB and PBB to vertical steel of building frame.
6. Communications Enclosures: Bond metallic enclosures of telecommunications equipment with UBCs to nearest SBB or PBB.
7. Equipment Racks: Bond metallic components of enclosures to RBB using UBCs. Provide top-mounted RBB if not provided by enclosure or rack manufacturer. Bond RBB to SBB with TEBC. Power connection must comply with NFPA 70; equipment grounding conductor in power cord of cord- and plug-connected equipment must be considered supplemental to bonding requirements in this Section.
8. Shielded Cable: Bond shield of shielded cable to SBB in communications rooms and spaces. Comply with TIA-568.1 and TIA-568.2 when grounding shielded balanced twisted-pair cables.
9. Primary Protector: Bond to PBB with insulated bonding conductor.
10. Electrical Power Panelboards: Where electrical panelboards for communications equipment are located in same room or space, bond each ground bar of panelboard to SBB.
11. Cable Trays: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
12. Conduits/Sleeves: Bond all conduit and/or sleeve pathways to nearest SBB or PBB.
13. Ladder Racks/Runways: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
14. Access Floors: Bond metal parts of access floors to SBB.

3.4 IDENTIFICATION

A. Comply with Section 270553 "Identification for Communications Systems."

B. Labels must be preprinted or computer-printed type.

1. Label PBB(s) with "ts-PBB," where "ts" is telecommunications space identifier for location of PBB.
2. Label SBB(s) with "ts-SBB," where "ts" is telecommunications space identifier for location of SBB.
3. Label TBC, TBBs, and BBCs at attachment points with legend: "WARNING! COMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.5 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Prior to acceptance testing, contractor shall preform initial testing and inspection checks to ensure system is in proper order. All insufficiencies or failures in system should be discovered and mitigated prior to acceptance testing procedure.
2. Coordinate with Contracting Officer and the authority having jurisdiction (AHJ) prior to system acceptance testing for any witness requirements.

B. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench according to manufacturer's published instructions.
2. Test bonding connections of system using AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing PBB or SBB, using process recommended by BICSI N1. Conduct tests with facility in operation.

   a. Measure resistance between PBB and electrical service intersystem termination point. Maximum acceptable value is 100 mΩ.

      1) If measured resistance from electrical service equipment to ground exceeds 1 Ω, notify Contracting Officer and include recommendations to reduce resistance to ground.

   b. Measure resistance between SBBs and PBB. Maximum acceptable value is 100 mΩ.

3. Test for ground loop currents using digital clamp-on ammeter, with full scale not more than 10 A, displaying current in increments of 0.01 A at accuracy of plus or minus 2.0 percent.

   a. With grounding infrastructure completed and communications system electronics operating, measure current in bonding conductors connected to PBB and to SBBs. Maximum acceptable AC current level is 1.00 A.

C. Nonconforming Work:

1. Communications bonding will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Collect, assemble, and submit test and inspection reports.

3.6 PROTECTION

A. After installation, protect busbars and conductors from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Contracting Officer.

END OF SECTION 270526

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

C. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Innerduct pathways
4. Surface Metal Raceways
5. Surface Nonmetallic Raceways
6. Boxes, enclosures, and cabinets.
7. Polymer-concrete handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid conduit.

C. IMC: Intermediate metal conduit.

D. RTRC: Reinforced thermosetting resin conduit.

E. EMT: Electrical Metallic Tubing.

F. FMC: Flexible Metallic Conduit

1.4 ACTION SUBMITTALS

A. Product data:

1. The following products shall be included:
    a. Surface pathways
    b. Boxes, enclosures, and cabinets.
    c. Underground handholes and boxes.

B. Shop Drawings:
1. Pathway layout, showing route and components to scale, with relationship between the pathway and adjacent structural, electrical, and mechanical elements. Include the following:

    a. Coordination with structure, other architectural elements, and other trade elements such as lighting, plumbing, and HVAC elements.
    b. Structural connection points and connection components including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
    c. Vertical and horizontal offsets and transitions.
    d. Vertical elevation of pathway above the floor or bottom of ceiling structure.
    e. Coordination with access panels.
    f. Underground ducts, piping, and structures in location of underground enclosures and handholes.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings

B. Field Quality Control Reports

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Pathways, fittings, and supports shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the equipment will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 METAL CONDUITS AND FITTINGS

A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
2. Comply with TIA-569-D.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated **GRC**.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. FMC: Aluminum

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
2. Fittings for EMT:

a. Material: **Steel**
b. Type: **compression**

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), 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.

2.3 NONMETALLIC CONDUITS AND FITTINGS

A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.

B. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Comply with TIA-569-D.

C. RNC: **Type EPC-40-PVC** & **Type EPC-80-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 651A.

F. RTRC: Comply with UL 2515A and NEMA TC 14.

G. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.

H. Solvents and Adhesives: As recommended by, and in respect to, each manufacturer listed above.

2.4 INNERDUCT PATHWAYS

A. Description: Comply with UL 2024; flexible-type pathway, able to be installed into existing conduit or routed independently in plenum environment, and approved for plenum and general-use (dependent on specific product) installation unless otherwise indicated.

B. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with TIA-569-D.

2.5 SURFACE METAL RACEWAYS:

A. Galvanized steel with snap-on covers. Prime coating (ready for field painting) and painted to match surrounding color. Coordinate with contracting officer prior to color application.

2.6 SURFACE NONMETALLIC RACEWAYS:

A. Two-piece construction, manufactured of rigid PVC with texture and color selected by Contracting Officer.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Description: Enclosures for communications.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-D.
2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
4. Device Box Dimensions: **4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)** at minimum
   a. Refer to drawing notes, details, and other such information for the use of any other size/type of device box (commonly referred to as backbox also)
5. Gangable boxes are **prohibited**.

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, **aluminum**, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: **sheet metal**
2. Type: **Semi-adjustable**
3. Shape: Rectangular.
4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes:

1. Any use of nonmetallic floor boxes is prohibited without prior approval by Contracting Officer, unless otherwise noted.

G. Conduit Bodies: A pull box that is manufactured to facilitate a change in the direction of the pathway at 90-degree increments, while also adhering to ANSI/TIA 568 and BICSI standards for cabling and pathway bend radius requirements. It is acceptable to use this device to optimize pathway routing near or at a penetration only.
1. For all locations where a conduit body may be installed, contractor shall submit the location and specification of device to be used to the Contracting Officer prior to procurment for approval.
2. Device shall have lid and gasket to protect cabling from exposure to elements and other such debris.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250 (Type indicated below) with continuous-hinge cover with flush latch unless otherwise indicated. Shall be manufactured of steel, finished inside and out with manufacturer's standard enamel.
1. The following NEMA 250 enclosure types shall be utilized for each scenario at a minimum, it is the contractor’s responsibility to increase the enclosure type rating as required for each installation.
   a. Interior to Telecommunication Room - **Type 2 at minimum**
   b. Interior to building, outside of Telecommunication Room - **Type 12 at minimum**
   c. Exterior Environment - **Type 4 at minimum**
   d. Any environment where corrosion, moisture, chemical, or other such hazardous or deteriorating substances may come in direct contact - **Type 4x at minimum**

K. Cabinets:

1. NEMA 250 (Type indicated below) galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   a. The following NEMA 250 cabinet types shall be utilized for each scenario at a minimum, it is the contractor’s responsibility to increase the cabinet type rating as required for each installation.
      1) Interior to Telecommunication Room - **Type 2 at minimum**
      2) Interior to building, outside of Telecommunication Room - **Type 12 at minimum**
      3) Exterior Environment - **Type 4 at minimum**

4) Any environment where corrosion, moisture, chemical, or other such hazardous or deteriorating substances may come in direct contact - **Type 4x at minimum**

2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 POLYMER-CONCRETE HANDHOLES

A. Description: Molded of sand and aggregate; bound together with polymer resin; and reinforced with steel, fiberglass, or a combination of the two.

B. General Requirements for Polymer Concrete Handholes:

1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
3. Comply with TIA-569-D.

C. Configuration: Designed for flush burial with **open** bottom unless otherwise indicated.

D. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.

1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
2. Cover Legend: Molded lettering, [**"COMMUNICATIONS"**].
   a. Coordinate with Contracting Officer prior to procurement of cover to ensure labeling/lettering is acceptable. Contractor shall provide alternate labeling/lettering per Contracting Officer's request.
3. Cover Rating: Tier 15 rating unless otherwise noted

E. Handholes
1. Refer to drawings and schedules for more information.
2. Installed handhole size and installation parameters shall be in accordance with BICSI standards, existing and new conditions, and future growth.

F. Source quality control for underground enclosures:
1. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
   a. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. All visible pathways, such as exposed conduit, exterior conduit, or any other such pathway that is visible, shall be painted to match the surrounding color/material. Color chosen shall be coordinated with the contracting officer for approval prior to procurement and application.

B. All pathway routing that is exposed/visible shall be routed in such a way as to minimize its visibility and visible disruption to the building/environment.

C. All surface mounted/visible/exposed pathway routing shall be coordinated with the contracting officer prior to installation.

D. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: **GRC**
2. Concealed Conduit, Aboveground: **GRC**
3. Underground Conduit, direct buried in non-traffic area: **Type EPC-40-PVC**
4. Underground Conduit, direct buried in traffic area: **Type EPC-80-PVC**
5. Underground Conduit, concrete encased in traffic area: **Type EPC-80-PVC**
6. Boxes and Enclosures, Aboveground: NEMA 250, Type 4 and/or Type 4X as previously indicated.

E. Indoors: Apply pathway 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. Exposed and Subject to Severe Physical Damage: **GRC**. Pathway locations include the following:
   a. Loading dock
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units
4. Concealed in Ceilings and Interior Walls and Partitions: **EMT**
5. Damp, Wet, and/or Caustic Locations (Natatorium, high humidity areas, chemical storage, etc.): **GRC**
   a. This does not include submerged areas and/or pathways.
6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: **EMT**
7. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: **EMT**
8. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: **EMT**
9. Boxes and Enclosures: NEMA 250, Type 2 and/or Type 12.
   a. Type 4X, stainless steel units in institutional and commercial kitchens and damp or wet locations.

F. Minimum Pathway Size: 1-inch (25-mm) trade size for copper and aluminum cables, and 1 inch (25 mm) for optical-fiber cables.

G. Pathway Fittings: Compatible with pathways 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 **compression**, steel fittings. Comply with NEMA FB 2.10.
4. All conduit fittings that facilitate a change in pathway direction (such as a 90-degree bend) shall be:
   a. For conduits with an internal diameter of 2 inches or less, a sweeping bend with a bend radius greater than 6 times the pathway diameter, or
   b. For conduits with an internal diameter greater than 2 inches, a sweeping bend with a bend radius greater than 10 times the pathway diameter, or

H. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

I. Install surface pathways only where indicated on Drawings.

J. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F (49 deg C)**.

K. Pathways indicated on the T-sheets shall be dedicated for use by the associated systems only. No other trade may route through, utilize, or otherwise be attached to these pathways. In addition, refer to specification 271313 and/or 271513 for the separation requirements of pathway when an EMI source is present.

3.2 INSTALLATION

A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA/BICSI 568.
3. TIA-569-D.
4. NECA 101
5. NECA 102.
6. NECA 105.
7. NECA 111.

B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.

E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.

F. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

G. Complete pathway installation before starting conductor installation.

H. Arrange stub-ups so curved portions of bends are not visible above finished slab.

I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.

J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches (300 mm) of enclosures to which attached.

L. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
3. Arrange pathways to keep a minimum of **1 inch (25 mm)** of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Contracting Officer for each specific location.

M. Stub-ups to Above Recessed Ceilings:

1. Use EMT for pathways, unless otherwise noted
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

Q. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.

R. 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.

S. Cut conduit perpendicular to the length. For conduits of 2-inch (50-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

T. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.

U. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

V. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 1-Inch (25-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

W. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, 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 pathway-sealing fittings according to NFPA 70.

X. Install devices to seal pathway 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 pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

Y. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

Z. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC **and EMT** that is located where environmental temperature change may exceed 100 deg F (55 deg C), and that has straight-run length that exceeds 100 feet (30 m).

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations: **125 deg F (70 deg C)** temperature change.
    b. Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F (70 deg C)** temperature change.
    c. Attics: **135 deg F (75 deg C)** 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 (0.06 mm per meter of length of straight run per deg C) 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 (0.0115 mm per meter of length of straight run per deg C) 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.

AA. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches (150 mm) of slack.
4. The lowest point of the cables shall be no less than 6 inches (150 mm) adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
5. Space hooks no more than 5 feet (1.5 m) and no less than 2 feet (0.6 m) o.c., with distances between hooks alternating so not to allow electro-magnetic induction formation from consistent spacing.
6. Provide a hook at each change in direction.

BB. 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.

CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

DD. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

EE. 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.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

GG. Set metal floor boxes level and flush with finished floor surface.

HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe of less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up throughout length of elbow.
   a. Material of elbow shall be consistent with the pathway installed.
5. Underground Warning Tape: Comply with requirements in Section 270553 "Identification for Communications Systems."
6. Coordinate with civil, structural, and any other trades with underground routing; coordinate with Contracting Officer for trenching locations and project specific requirements.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes with bottom below frost line, at least 48 inches below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or 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 270528

SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

C. Section 260536 "Cable Trays for Electrical Systems" for cable trays and accessories serving electrical systems.

1.2 SUMMARY

A. Section Includes:

1. Ladder Runway and Ladder Rack Cable Tray.
2. Cable tray accessories.
3. Warning signs.

1.3 ACTION SUBMITTALS

A. Product Data:
1. The following products shall be included:
a. Ladder Runway and Ladder Rack Cable Tray
b. Cable tray accessories

B. Shop Drawings:
1. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
a. Coordination with structure, other architectural elements, and other trade elements such as lighting, plumbing, and HVAC elements.
b. Structural connection points and connection components including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
c. Vertical and horizontal offsets and transitions.
d. Clearances for access above and to sides of cable trays.
e. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
f. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings

B. Field Quality Control Reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray installed outdoors.

1. Temperature Change: **120 deg F (67 deg C) ambient temperature.**

2.2 GENERAL REQUIREMENTS FOR CABLE TRAYS

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

1. Source Limitations: Obtain cable trays and components from single manufacturer.

B. Sizes and Configurations: See the equipment schedule on drawings for specific requirements for types, materials, sizes, and configurations.

C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:

1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.3 LADDER RUNWAY AND LADDER RACK CABLE TRAY

A. Description:

1. Configuration: Two longitudinal side rails with transverse rungs swaged or welded to side rails, complying with NEMA VE 1.
2. Width: **12 inches (300 mm)**, unless otherwise indicated on Drawings.
3. Straight Section Lengths: **10 feet (3.0 m)**, except where shorter lengths are required to facilitate tray assembly.
4. Rung Spacing: **9 inches (225 mm)** on center.
5. Minimum Cable-Bearing Surface for Rungs: 7/8-inch (22-mm) width with radius edges.
6. No portion of the rungs shall protrude below the bottom plane of side rails.
7. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.
8. Class Designation: Comply with NEMA VE 1, **Class 12A**.
9. Splicing Assemblies: Bolted type using serrated flange locknuts.
10. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

B. Materials and Finishes:

1. Aluminum:

   a. Materials: Alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and **Alloy 5052-H32** according to ANSI H35.1/H 35.1M for fabricated parts.
   b. Hardware: **Chromium-zinc-plated steel, ASTM F1136**

2. Finish shall be powder coated in black, unless otherwise noted.

2.4 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Barrier Strips: Same materials and finishes as for cable tray.

C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.5 WARNING SIGNS

A. Comply with requirements for identification in Section 270553 "Identification for Communications Systems."

B. Lettering: **1-1/2-inch- (40-mm-)** high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."

2.6 SOURCE QUALITY CONTROL

A. Testing: Test and inspect cable trays according to **NEMA VE 1**.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

A. Install cable trays according to **NEMA VE 2**.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.

F. Fasten cable tray supports to building structure **and install seismic restraints**.

G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb (90 kg). Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems.

H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

J. Locate and install supports according to **NEMA VE 2**. Do not install more than one cable tray splice between supports.

K. For Ladder Runway connected to equipment, ladder runway shall be supported independent of connections to equipment. Do not carry weight of ladder runway on equipment enclosure.

L. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in **NEMA VE 2**. Space connectors and set gaps according to applicable standard.

M. Make changes in direction and elevation using manufacturer's recommended fittings. For any transitions that are vertical to a new pathway or cable tray, a cable tray dropout or other similar fitting type shall be utilized.

N. Make cable tray connections using manufacturer's recommended fittings.

O. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."

P. Install cable trays with enough workspace to permit access for installing cables.

Q. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems."

B. Cable trays shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. Cable trays with single-conductor power conductors shall be bonded together with a grounding conductor run in the tray along with the power conductors and bonded to the tray at 72-inch (1800-mm) intervals. The grounding conductor shall be sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors," and Article 392, "Cable Trays."

D. When using powder-coat painted cable tray as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

E. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.3 CABLE INSTALLATION

A. No cable other than network/voice cabling for designated division 27 systems shall utilize the cable tray for communication systems, unless specifically noted. Coordinate with other trades to ensure separate routing methods are utilized for other system cabling.

1. All cabling routed on, through, or via cable tray shall be coordinated with division 27 trade partner to minimize cable burns, kinks, and cable tray capacity/loading.
2. It is acceptable to provide and install bridal rings attached to cable tray for dedicated use by a division 27 system. Installation of bridal rings shall not conflict with cable tray clearances, with architectural elements, or with other trade’s devices/equipment.

B. Install cables only when each cable tray run has been completed and inspected.

C. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

D. Fasten cables on vertical runs to cable trays every 18 inches (450 mm).

E. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches (1800 mm).

F. Tie MI cables down every 36 inches (900 mm) where required to provide a 2-hour fire rating and every 72 inches (1800 mm) elsewhere.

G. In existing construction, remove inactive or dead cables from cable trays.

3.4 CONNECTIONS

A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.

B. Connect pathways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.

3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 270536

SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 SUMMARY

A. Section Includes:

1. Manufactured Sleeve Seal Systems.
2. Conduit or Field Fabricated sleeves.
3. Sealants and Devices

1.3 ACTION SUBMITTALS

A. Product data:
1. The following products shall be included:
   a. Manufactured Sleeve Seal Systems
   b. Conduit or Field Fabricated sleeves
   c. Sealant and Devices

1.4 INFORMATION SUBMITTALS

A. Coordination Drawings
1. Indicating all penetration locations and penetrating component.
2. Details indicating each penetration type, associated components, and associated structural coordination.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data

PART 2 - PRODUCTS

2.1 MANUFACTURED SLEEVE SEAL SYSTEM

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable. Shall be an engineered, re-enterable cable pathway that is specifically manufactured for facilitating a floor, ceiling, or wall penetration. The device shall match or exceed the fire-rating of the penetrated material, at minimum.

1. Sealing Elements: Self-sealing intumescent material

B. Pathway shall be able to be retrofitted to existing cable and penetration and shall be able to be removed from existing cabling, without cutting or splicing existing cables.

C. It is acceptable to utilize grommet type sleeves (typically allowing a single cable or small cable bundle through penetration), round type sleeves, and square type sleeves. Number of cables per rated penetration shall be in accordance with manufacturer.

2.2 CONDUIT OR FIELD FABRICATED SLEEVES

A. Pipe Sleeves, PVC:

1. Description: ASTM D1785, Schedule 40

B. Sheet Metal Sleeves, Galvanized Steel, Round:

1. Description: Galvanized-steel sheet; thickness not less than 0.0239-inch (0.6-mm); round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.3 SEALANTS AND DEVICES

A. Description: Products and material that have been tested for specific fire resistance, smoke, or acoustical rated construction, conforming to penetrating item type, filling annular space between cable and pathway, and filling the space between pathway and penetration.

1. Sealants - Single component latex formulations that, upon cure, do not re-emulsify during exposure to moisture.
2. Putty - Intumescent, non-hardening, water-resistant putties containing no solvents, inorganic fibers or silicone compounds.
3. Pillows - Re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES, SEALANTS, AND DEVICES THROUGH NON-FIRE-RATED BARRIERS

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 space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
b. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pathway or cable, unless sleeve seal system is to be installed **or seismic criteria require different clearance**.
4. Install sleeves for wall penetrations. 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 6 **inches (50 mm)** above finished floor level. Install sleeves during erection of floors.

C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for wall assemblies.

D. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using **steel** pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Underground, Exterior-Wall and Floor Penetrations:

1. For new construction, install **steel** pipe sleeves with integral waterstops. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve seal system. Install sleeve during construction of floor or wall.
2. For existing wall, install steel pipe sleeves through core drill penetration. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF SLEEVES, SEALANTS, AND DEVICES THROUGH RATED BARRIERS

A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.

B. Install conduits and cable with no crossings within the sleeve.

C. Fill opening around conduits and cables with sealant without leaving voids.

D. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 270544

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 SUMMARY

A. Section Includes:

1. Labels
2. Underground-line warning tape.
3. Cable straps
4. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product data:
1. The following products shall be included:
   a. Labels
   b. Underground-line warning Tape

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70 and TIA 606-B.

B. Comply with ANSI Z535.4 for safety signs and labels.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
c. As required by authorities having jurisdiction.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground 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 degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, and ANSI Z535.4.
2. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL-FIBER CABLE"

C. Tag, Detectable:

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, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Width: 3 inches (75 mm).
3. Overall Thickness: 5 mils (0.125 mm).
4. Foil Core Thickness: 0.35 mil (0.00889 mm).
5. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
6. Tensile according to ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

2.5 CABLE STRAP

A. Plenum-Rated Velcro Ties/Straps
   1. Hook & Loop Strap, Cinch, and Tape style are acceptable.
   2. Minimum Width: 3/4 inch (19.1 mm).
   3. RoHS Compliant
   4. Temperature Range: 0 to plus 220 deg F (Minus 18 to plus 104 deg C).
   5. Color: Black.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain 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 PREPARATION

A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
3. Provide label 6 inches (150 mm) from cable end.

I. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

J. Underground-Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

K. Cable Straps: General purpose, except as listed below:

1. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.

1. System legends shall be as follows:

a. Network/Voice
b. Audiovisual
c. Security
1) For Surveillance, Access Control, and/or Intrusion

D. Faceplates/Surface Mount Box:
1. Label individual faceplate with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise

when entering room from primary egress, composed of the following, in the format shown:
a. [Cable Origination Room #] : [Outlet #]

2. Label individual ports with self-adhesive labels. Place label above each port. Each port label shall be composed of the following, in the format shown:
a. [Outlet Port #]

E. Equipment Room Labeling:

1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels. Each shall be labeled sequentially, beginning with the device closest to the wall.
a. [Rack #]

2. Patch Panels: Label each individual patch panel in room sequentially, starting at the top of rack and working down, with self-adhesive labels. Patch panel numbering shall restart at one at each rack. Each patch panel label shall be composed of the following, in the format shown:
a. [Patch Panel #]

3. Patch Panel Port: Label each port with a self-adhesive label, place label directly above port in designated area. Each port shall be composed of the following, in the format shown:
a. [Cable Termination Room #] : [Outlet #] : [Outlet Port #]

F. Backbone Cables:
1. Label each cable within 6 inches of strand/conductor breakout with a vinyl-wraparound label indicating the location of the far or other end of the backbone cable. Each label shall be composed of the following, in the format shown:
a. [Room Number of other end of cable] : [Patching Device] : [Patching Device #]
b. Patching Device Legend:
1) Fiber Patch Panel
2) Copper Patch Panel
3) 110-Block
4) OTHER

G. Horizontal Cables: Label each cable within 6 inches of termination with a vinyl-wraparound label. Label shall match the port label as referenced above.

1. For cables terminated at patch panel:
a. Refer to label specified at Patch Panel Port
2. For cables terminated at faceplate/surface mount box:
a. Refer to label specified at faceplate/surface mount box

H. Locations of Underground Lines: Underground-line warning tape for copper, coaxial, hybrid copper/fiber, and optical-fiber cable.

I. Instructional Signs: Self-adhesive labels.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Laminated-acrylic or melamine-plastic sign

1. Apply to exterior of door, cover, or other access.

END OF SECTION 270553

SECTION 271116 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

C. Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground pathways.

1.2 SUMMARY

A. Section Includes:

1. Backboards.
2. Equipment Racks.
3. Power Distribution Unit (PDU)
4. Grounding.
5. Labeling.

1.3 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. LAN: Local area network.

D. RCDD: Registered communications distribution designer.

E. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

F. TGB: Telecommunications grounding bus bar.

G. TMGB: Telecommunications main grounding bus bar.

1.4 ACTION SUBMITTALS

A. Product data:
   1. The following products shall be included:
      a. Equipment Racks.
      b. Power Distribution Unit (PDU)
      c. Grounding.

B. Shop Drawings:
   1. Telecommunications Room/Space layout.
   2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
   4. Grounding: Indicate location of PBB/SBB and its mounting detail showing standoff insulators and wall-mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings

B. Installer Qualification Data:
   1. Qualifications per specification 270010 “Supplemental Requirements for Communications”.
   2. RCDD certification for Installer, installation supervisor, and field inspector.
   3. Manufacturer certification indicating completion of manufacturer specific training and/or accreditation for the installation of products submitted.

C. Field Quality Control Reports

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data.

B. Warranty Documentation.

C. Identification Schedule.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

   1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
   2. Installation Supervision: Installation shall be under direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
   3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."

B. UL listed.

C. RoHS compliant.

D. Compliant with requirements of the Payment Card Industry Data Security Standard.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).
1. Plywood that is not fire-retardant treated may be utilized under the following condition:
a. Non-treated plywood is painted with a minimum of 2-coats of intumescent paint to ensure a 2-hour fire-rating of painted plywood.

B. Backboard Paint: Plywood shall be painted white, unless otherwise noted. Contractor shall coordinate with Contracting Officer prior to painting for final color and paint type determination.
1. For fire-retardant treated plywood, ensure that the fire-retardant label remain visible after all paint is applied and plywood is installed.

C. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

2.3 EQUIPMENT RACKS

A. Description: Two- and four- post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA standards. Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
1. For equipment details and specific information, refer to equipment schedules on drawings.
2. The below information is applicable at a minimum, unless otherwise noted:
a. Height: As indicated on Drawings
b. Width: Compatible with 19 inch EIA standard
c. Depth: A minimum of 2 foot (24 inches) in usable depth
d. Material: Extruded Aluminum
e. Finish: Baked -Polyester Powder Coated
f. Color: Refer to schedules.

B. Floor-Mounted Racks:

1. A floor mounted rack able to be secured to floor without required mounting to adjacent wall.
   a. Base shall have a minimum of four mounting holes for permanent attachment to floor.
2. Shall have provisions for Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and grounding attachment.
   a. Refer to schedules on drawings for more information
3. Top shall have provisions for attaching to cable tray or ceiling.
4. Self-leveling.

C. Cable Management:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each, unless otherwise noted.

2.4 POWER DISTRIBUTION UNIT (PDU)

A. Power Strips: Comply with UL 1363.

B. Description: Rack mounted, vertical and/or horizontal power distribution unit(s) (PDU) dedicated to the supply and routing of power from local uninterruptable power supply (UPS) and/or power outlet. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. A minimum of twelve (12) 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles. A minimum of six (6) receptacles shall be mounted on front and on back. Refer to schedules for basis of design.
2. LED indicator lights for power and protection status.
3. LED indicator lights for reverse polarity and open outlet ground.
4. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
5. Cord connected with 15-foot (4.5-m) line cord.
6. Rocker-type on-off switch, illuminated when in on position.

2.5 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Telecommunication Grounding Bars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-B. Predrilling shall be with holes for use with lugs specified in this Section.

1. Wall Mount Telecommunications Primary Busbar (PBB): Refer to specification 270526 and drawing schedules.

2. Wall Mount Telecommunications Secondary Busbar (SBB): Refer to specification 270526 drawing schedules.
3. Cabinet-Mounted TGB: Terminal block, with stainless-steel or copper-plated hardware for attachment to cabinet.
4. Rack-Mounted Horizontal TGB: Designed for mounting in 19 inch (482.6 mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
5. Rack-Mounted Vertical TGB: 36 inches (914.4 mm) long, with stainless-steel or copper-plated hardware for attachment to rack.

2.6 LABELING

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES / EQUIPMENT ROOMS

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
   1. Coordinate with Contracting Officer as required.
   2. If direction for service provider differs from construction drawings, contact the Contracting Officer for coordination.

B. Coordinate all underground and/or wall penetrations with other trades. Refer to drawings, schedules, matrices, and related specifications for pathway and cabling requirements.

C. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground and/or buried pathways.

D. Coordinate

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout of communications equipment spaces.

C. Comply with BICSI ITSIMM for installation of communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. For vertical routed cabling, secure cabling at intervals required to be in accordance with manufactures limitations on tension and compression.

F. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.

1. Meet jointly with system providers, equipment suppliers, and Contracting Officer to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

G. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

H. Coordinate layout of ladder runway and ladder rack with HVAC components to ensure air flow is not restricted by pathway and/or cable utilizing the pathway.

I. Coordinate layout of ladder runway and ladder rack with penetrations to ensure installation heights and cable bend radii are acceptable.

J. Backboards:

1. Install from 6 inches (150 mm) to 8 feet 6 inches (2588 mm) above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.
2. Paint all sides of backboard with two coats of paint leaving fire rating stamp visible.
3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

3.3 GROUNDING

A. Comply with NECA/BICSI 607.

B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.

C. Locate PBB/SBB to minimize length of bonding conductors. Fasten to wall, allowing proper clearance behind PBB/SBB for standoff. Connect with a minimum No. 4 AWG grounding electrode conductor from PBB/SBB to suitable electrical building ground. Connect rack TGB to near PBB/SBB.

1. Where shielded or armored cabling are utilized, bond the shielding and/or armor to patch panel. Ensure patch panel is properly bonded to rack or rack TGB and in turn, the in-room PBB/SBB.

D. All conduit, cable tray, ladder rack, ladder runway, sleeves and other such metallic routing equipment shall be grounded properly. Pathway within the telecommunication room shall be bonded directly to local PBB/SBB.

3.4 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 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.5 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual," "Firestopping Practices" Ch.

3.6 IDENTIFICATION

A. Coordinate system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Section 270553 "Identification for Communications Systems."

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Labels shall be machine printed. Type shall be 3/16 inch (5 mm).

END OF SECTION 271116

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 SUMMARY

A. Section Includes:

1. Type OFNR optical fiber cable.
2. Type OFCR optical fiber cable.
3. Type OFNP optical fiber cable.
4. Type OFCP optical fiber cable.
5. Types OFN and OFNG optical fiber cable.
6. Types OFC and OFCG optical fiber cable.
7. Optical fiber cable connecting hardware, patch panels, and cross-connects.

1.3 DEFINITIONS

A. Conductive Cable: Cable containing non-current-carrying electrically-conductive members such as metallic strength members and metallic vapor barriers.

B. Cross-Connect: A facility enabling termination of cable elements and their interconnection or cross-connection.

C. Type OFCP: Conductive cable for use in plenums, ducts, and other spaces used for environmental air.

D. Type OFCR: Conductive cable for use as riser in vertical shafts or from floor to floor.

E. Type OFNP: Nonconductive cable for use in plenums, ducts, and other spaces used for environmental air.

F. Type OFNR: Nonconductive cable for use as riser in vertical shafts or from floor to floor.

G. Types OFC and OFCG: Conductive cable for general purpose use.

H. Types OFN and OFNG: Nonconductive cable for general purpose use.

1.4 ACTION SUBMITTALS

A. Product data:
   1. The following products shall be included:
      a. Optical Fiber Cable
      b. Optical Fiber Cable connecting hardware, patch panels, and cross-connects

B. Shop Drawings:
   1. Cabling Plan

C. Identification Schedule

1.5 INFORMATIONAL SUBMITTALS

A. Installer Qualification Data:
   1. Qualifications per specification 270010 “Supplemental Requirements for Communications”.
   2. RCDD certification for Installer, installation supervisor, and field inspector.
   3. Manufacturer certification indicating completion of manufacturer specific training and/or accreditation for the installation of products submitted.

B. Field Quality Control Reports

C. Factory Test Reports.

D. Optical fiber cable testing plan.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data.

B. Warranty Documentation.

C. Identification Schedule.

D. Extra Material:
   1. Patch-Panel Units: One of each type.
   2. Jacks/Connectors: 10 of each type.

E. Field test and inspection reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet-work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Test cables upon receipt at Project site.

1. Test optical fiber cable while on reels. Use optical time domain reflectometer to verify cable length and locate cable defects, splices, and connector, including loss value of each. Retain test data and include record in maintenance data.

PART 2 - PRODUCTS

2.1 OPTICAL FIBER CABLE

A. Cable Type

1. OFNR: This category covers jacketed optical fiber cable for use as risers in vertical runs in shaft or between floors within buildings in accordance with Article 770 of NFPA 70 containing no electrically conductive materials.
2. OFCR: This category covers jacketed optical fiber cable for use as risers in vertical runs in shaft or between floors within buildings in accordance with Article 770 of NFPA 70 containing noncurrent-carrying electrically conductive materials.
3. OFNP: This category covers jacketed optical fiber cable for use in vertical runs in plenums, ducts, or other spaces used for environmental air within buildings in accordance with Article 770 of NFPA 70 containing no electrically conductive materials.
4. OFCP: This category covers jacketed optical fiber cable for use in vertical runs in plenums, ducts, or other spaces used for environmental air within buildings in accordance with Article 770 of NFPA 70 containing noncurrent-carrying electrically conductive materials.
5. OFN and OFNG: This category covers jacketed optical fiber cable for general use within buildings in accordance with Article 770 of NFPA 70 containing no electrically conductive materials.
6. OFC and OFCG: This category covers jacketed optical fiber cable for general use within buildings in accordance with Article 770 of NFPA 70 containing noncurrent-carrying electrically conductive materials.

B. Performance Criteria:

1. Regulatory Requirements: 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. Listing Criteria: UL CCN QAYK; including UL 1651.
3. General Characteristics:

   a. Performance: TIA-568.3.
   b. Inside Plant Mechanical Properties: ICEA S-83-596.
   c. Inside-Outside Plant Mechanical Properties: ICEA S-104-696.
   d. Jacket:

      1) Cable cordage jacket, fiber, unit, and group color in accordance with TIA-598.
      2) Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inch (1 m).

C. OS2 Single-Mode Optical Fiber Cable:

1. Source Limitations: Obtain products from single manufacturer.

2. Options:

   a. Configuration: ISP/OSP, Loose tube, optical fiber cable; refer to schedule on drawing for strand count and other information.
   b. Maximum Attenuation: 0.5 dB/km at 1310 nm wavelength; 0.5 dB/km at 1550 nm wavelength.
   c. Jacket Color: Refer to schedule on drawings.

3. Additional Characteristics for OS2 Single-mode Fiber Optic Cabling:

   a. Construction: TIA-492CAAA; 9 µm core diameter, 125 µm cladding diameter with low water peak.
   b. Minimum Overfilled Modal Bandwidth-Length Product: 500 MHz-km at 850 nm wavelength; 500 MHz-km at 1300 nm wavelength.

2.2 OPTICAL FIBER CABLE HARDWARE

A. Performance Criteria:

1. Fiber Optic Connector Intermateability Standard (FOCIS) specifications of TIA-604 series.
2. TIA-568.3.

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in lengths and colors as specified in schedules on drawings.

D. Connector Type: Type LC complying with TIA-604-10 connectors.

E. Jacks and Jack Assemblies:

1. Female; quick-connect, simplex and/or duplex; fixed telecommunications connector designed for termination of single optical fiber cable.
2. Insertion loss not more than 0.75 dB.
3. Marked to indicate transmission performance.
4. Designed to snap-in to patch panel or faceplate.

2.3 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.4 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate backbone cabling with protectors and demarcation point provided by communications service provider.

3.2 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Optical fiber backbone cabling system must provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters may not be used as part of backbone cabling.

C. Comply with BICSI N1, NECA NEIS 1, and NECA NEIS 301.

D. Backbone cabling system must comply with transmission standards in TIA-568.1.

E. Telecommunications Pathways and Spaces: Comply with TIA-569.

F. Wiring Methods:

1. In Raceway: Install cables in raceways and cable trays for the entire route of cable outside of equipment rooms, telecommunication rooms, or other such rooms housing networking equipment and terminations, unless otherwise noted.
   a. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

2. In Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

G. Optical Fiber Cabling Installation:

1. Comply with TIA-568.1 and TIA-568.3.
2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."

3. Terminate all cables; no cable may contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inch (760 mm) and not more than 6 inch (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps may not be used for heating.
9. In communications equipment room, provide 10 ft (3 m) long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
    a. No fiber cable may be left unterminated (or dark). Ensure all fiber installed are terminated properly, it is the contractors responsibility to review construction documents and ensure all cabling termination points are made available.

H. Group connecting hardware for cables into separate logical fields.

I. Splicing
1. Splicing existing or new fiber optic cabling is not acceptable except for splicing onto pigtail type cable assemblies at fiber termination points. New cable shall be provided and installed to ensure no splicing along fiber path is utilized. For instances where fiber termination onto a pigtail cable assembly is accepted:
    a. All such connections shall be fusion spliced.
    b. All fusion splices shall have a maximum loss of .3 dB.

3.3 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with requirements in Section 270544 “Sleeves and Sleeve Seals for Communications Pathways and Cabling.”

C. Comply with TIA-569, Annex A, "Firestopping."

D. Comply with BICSI ITSIMM, "Firestopping" Chapter.

3.4 GROUNDING

A. Install grounding in accordance with BICSI ITSIMM, "Grounding (Earthing), Bonding, and Electrical Protection" Chapter.

B. Comply with TIA-607 and NECA/BICSI-607.

C. Refer to 270526 “Grounding and Bonding for Communications Systems.”

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

B. Cable Schedule: Install in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish electronic copy of final comprehensive schedules for Project.

C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

D. Cable and Wire Identification:

1. Label each cable within 4 inch (100 mm) of each termination and tap, where it is accessible in cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 ft (4.5 m).
4. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use different color for jacks and plugs of each service.

3.6 FIELD QUALITY CONTROL

A. Field tests and inspections must be witnessed by the Contracting Officer or the Contracting Officer’s chosen representative. The authority having jurisdiction (AHJ) shall be included at their discretion, coordinate with Contracting Officer for scheduling and attendees requirements.

B. Tests and Inspections:

1. Perform manufacturer’s recommended test and inspections.
2. Visually inspect optical fiber jacket materials for qualified electrical testing laboratory certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568.1.

3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. For each fiber installed, perform a link-loss budget calculation that will be compared with measured results.
5. Optical Fiber Cable Tests:

    a. All test performed on Optical Fiber cabling that uses a laser or light-emitting diode (LED) in a test set are to be carried out with a safety precaution in accordance with ANSI Z136.2.
    b. Test instruments must meet or exceed applicable requirements in TIA-568.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    c. Both Tier 1 and Tier 2 testing shall be applied to each fiber strand as defined in TIA-568.3-D.
        1) Encircled Flux (EF) testing shall be utilized when testing multimode fiber optic cable.
    d. Link End-to-End Attenuation Tests:
        1) Multimode fiber optic cable link measurements: Test at 850 or 1300 nm in one direction in accordance with TIA-526-14, Method B, One Reference Jumper.
        2) Single-mode fiber optic cable link measurements: Test at 1310 or 1550 nm
        3) Attenuation test results must be less than those calculated in accordance with equation in TIA-568.1.
    e. All test reports shall be combined into a single document and provided to the Contracting Officer at completion of testing.

C. Nonconforming Work:

1. Cables will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective cables and retest.

D. Collect, assemble, and submit test and inspection reports.

1. Data for each measurement must be documented.
2. Data for field quality-control report submittals must be printed in summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from instrument to computer, saved as text files, and printed and submitted.

END OF SECTION 271323

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 SUMMARY

A. Section Includes:

1. Category 6a twisted pair cable.
2. Twisted pair cable hardware, including panels and jacks.

1.3 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.

D. F/FTP: Overall foil screened cable with foil screened twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. LAN: Local area network.

H. Jack: Also commonly called an "outlet," it is the fixed, female connector.

I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

J. RCDD: Registered Communications Distribution Designer.

K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

M. S/FTP: Overall braid screened cable with foil screened twisted pair.

N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

O. UTP: Unscreened (unshielded) twisted pair.

1.4 ACTION SUBMITTALS

A. Product data:

1. The following products shall be included:
   a. Each type of Category Cabling
   b. Twisted pair cabling hardware

B. Shop Drawings:
1. Reviewed and stamped by RCDD.
2. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:
   a. Telecommunications cable termination locations.
   b. Typical telecommunications details.
   c. Patch Panel Configuration with racks and cable labels.
   d. Telecommunication room locations and cable origination locations.

C. Identification Schedule

1.5 INFORMATIONAL SUBMITTALS

A. Installer Qualification Data:
1. Qualifications per specification 270010 “Supplemental Requirements for Communications”.
2. RCDD certification for Installer, installation supervisor, and field inspector.
3. Manufacturer certification indicating completion of manufacturer specific training and/or accreditation for the installation of products submitted.

B. Field Quality Control Reports

C. Factory Test Reports.

D. Twisted Pair Cable Testing Plan.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data

B. Warranty Documentation

C. Identification Schedule

D. Extra Material

1. Connecting Blocks: One of each type.
2. Cover Plates: Five of each type.
3. Jacks: Ten of each type.
4. Patch-Panel Units: One of each type.

E. Field test and inspection reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet-work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Test cables upon receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field-testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

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. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

E. Grounding: Comply with TIA-607-B.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated:

   a. Type CMP complying with UL 1685.

2. Communications, Non-Plenum Rated:

   a. Type CMR complying with UL 1666.

B. RoHS compliant.

C. It is a requirement that all equipment and components within a channel (patch cable to patch cable), inclusive of, but not limited to, cabling, jacks, plugs, faceplates, patch panels, patch cables, etc., shall be of a single manufacturer. All installation, testing, and warranty requirements shall be in-line with the chosen manufacturer's requirements.

2.3 CATEGORY 6a TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500 MHz.

B. Standard: Comply with TIA-568-C.2 for Category 6a cables.

C. Conductors: 100-ohm, 23 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP).

E. Cable Rating: Plenum.

F. Jacket: Refer to schedules.

2.4 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6a.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

C. Manufacturer Limitations: Obtain twisted pair cable hardware from single manufacturer that is from same manufacturer of structured cabling. The structured cabling solution shall be an end-

to-end solution from a single manufacturer, pursuant to, and in line with, the specific manufacturers product solution warranty.

D. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
3. Number of Jacks per Field: One for each four-pair cable indicated at minimum. Refer to rack elevation and schedules.
4. A minimum of one patch panel shall be dedicated for analog voice communication applications. It shall be connected to the wall mounted 110-block via a 25-pair CAT5E cable. Horizontal cabling scheduled for analog voice use shall be patched from horizontal patch panel to the voice dedicated patch panel.

E. Patch Cords: Factory-made, four-pair cables in lengths as specified in drawing schedules; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.

F. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or cover plate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

G. Cover Plate:

1. Two, Four, and/or Six port, vertical single gang cover plates designed to mount to single gang wall boxes.
2. Plastic Cover Plate: High-impact plastic. Coordinate color with Section 260533 "Raceway and Boxes for Electrical Systems."
3. Metal Cover Plate: Stainless steel, complying with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."
4. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

a. Flush mounting jacks, positioning the cord at a 45-degree angle.

H. Legend:

1. Machine printed, in the field, using adhesive-tape label.

2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. Horizontal cabling shall contain no more that one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
2. Bridged taps and splices shall not be installed in the horizontal cabling.
3. Splitters shall not be installed as part of the optical fiber cabling.

B. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect, when cabling leaves the communications equipment room.

3.2 SELECTION OF COMMUNICATIONS COPPER HORIZONTAL CABLING

A. All cable selection shall be as specified in section 2 and on the construction drawings. Final cable selection shall be approved through submittal process.

B. CMP (Plenum rated) Cabling: Plenum cabling shall be provided and installed in all Inside Plant (ISP) applications.
1. It is acceptable to utilize CMR (Riser rated) cabling interior to the telecommunications space when specified and/or with Contracting Officer’s approval.
2. It is at the contractor’s risk to utilize any non-CMP cabling for ISP applications.
3. It is acceptable to use ISP/OSP plenum rated cable within the building.

C. Where cabling leaves the footprint of the building and utilized underground pathway, exterior pathway, and/or is exposed to the exterior environment, OSP or ISP/OSP rated cabling shall be utilized.

3.3 WIRING METHODS

A. Routing:
1. Unless otherwise and specifically indicated, cables shall be installed into, and route through raceways and/or cable trays as indicated below. Cables shall route via:

a. Conduit(s) in all cases from telecom room to outlet/device. Cable shall not be routed freely or exposed in any way outside of the telecom room, unless specifically noted.

B. Wiring within Enclosures, cabinets, consoles and other such non-architectural equipment.

1. Cable shall route freely without raceway unless equipment provides raceway. Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.4 INSTALLATION OF PATHWAYS

A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 271116 "Communications Racks, Frames, and Enclosures."

B. Comply with Section 270528 "Pathways for Communications Systems."

C. Comply with Section 270529 "Hangers and Supports for Communications Systems."

D. Comply with Section 270536 "Cable Trays for Communications Systems."

E. Drawings indicate general arrangement of pathways and fittings.

3.5 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. MUTOA shall not be used as a cross-connect point.
7. Consolidation points may be used only for making a direct connection to equipment outlets:

   a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
   b. Locate consolidation points for twisted-pair cables at least 49 feet (15 m) from communications equipment room.

8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
12. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
13. Install a 10-foot- (3-m-) long service loop on each end of cable. One loop shall be located in communication room and one shall be located in accessible ceiling near cable termination. Refer to drawing details for more information.
14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

D. Group connecting hardware for cables into separate logical fields.

E. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.6 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with requirements in Section 270544 “Sleeves and Sleeve Seals for Communications Pathways and Cabling”.

C. Comply with TIA-569-D, Annex A, "Firestopping."

D. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.7 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

C. Comply with TIA-607-B and NECA/BICSI-607.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.8 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

    1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels per indication on drawing schedules and rack elevations.

B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

3.9 FIELD QUALITY CONTROL

A. Field tests and inspections must be witnessed by the Contracting Officer, coordinate with the Contracting Officer for scheduling and attendees requirements.

B. Tests and Inspections:

1. Perform manufacturer's recommended test and inspections.
2. Factory test cables on reels according to TIA-568-C.1.
3. Factory test twisted pair cables according to TIA-568-C.2.
4. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
5. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
6. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. The following testing procedures shall be applied:
        1) Continuity
        2) Insertion Loss
        3) NEXT
        4) Return Loss
    c. All test reports shall be combined into a single document and provided to the Contracting Officer at completion of testing.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Nonconforming Work:

1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. Collect, assemble, and submit test and inspection reports.

END OF SECTION 271513

SECTION 27 41 00 - AUDIO VIDEO SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The term “provide” used throughout this specification and drawings shall mean “furnish, install, test, and certify”.

B. Extent of Audio Video Systems infrastructure work is indicated by DIVISION 26 electrical and other specification sections, drawings and schedules and is hereby defined to include, but not by way of limitation, the provisions of:

1. Raceway systems including but not limited to conduits, cable trays, sleeves, surface raceways, pull-boxes, junction boxes, back-boxes, etc. as required and specified in this section and/or select DIVISION 26 sections.
2. Power distribution within equipment racks including programable power sequencing of AC circuits.

C. Extent of Audio Video Systems Infrastructure as indicated by DIVISION 27 “Communications” and those associated specification sections that address Ethernet and IT requirements shall include but not be limited to:

1. Patch cords, jumper cables, and cross-connect cables to interconnect wiring terminals as well as electronic equipment.
2. Network connectivity: a channel is defined as the connection from one active device to another, including any patch cords and equipment cords and shall not exceed 100 meters total length.
3. Testing of all IT category type cable infrastructure and grounding systems as noted by specification, drawings, and applicable industry standards.

D. General requirements also include but are not limited to:

1. AV Head-end Room hardware and component fit-out including rack enclosures, cable tray, backboard, and raceways for terminating cable and installation of electronic equipment.
2. Grounding and bonding of all metallic hardware components back to the nearest grounding bus, i.e. AV grounding bar including (AVGB) or similar, but not limited to equipment racks, cabinets, cable trays, ladder rack, metallic cable sheaths, wall mounted wiring terminals, conduits, sleeves, metallic ductwork, and frames..
3. The use of Velcro type cable ties is required; the use of plastic zip ties shall not be permitted. No exceptions.
4. Fire stopping as required. Contractor shall provide fire stopping for all low-voltage openings (including empty low voltage raceway) once cable installation is complete or to use products such as EZ-Path or similar.
5. Seismic bracing of all equipment racks, ladder-type or wire basket cable trays, ceiling recessed equipment such as loudspeakers, plenum boxes etcetera as required by code and by local governing jurisdiction.
6. Preparation and submission of product data, shop drawings, testing reports, as-built drawings, and cabling documentation as required in this specification.

7. Construction and Installation warranties.
8. Manufacturer components, channel and solutions warranties.
9. Installation and testing of all system and components shall be documented.
10. Onsite administrative and user training.

1.2 REFERENCES

A. Audiovisual and Integrated Experience Association (AVIXA):

1. ANSI / INFOCOMM 2M – Standard Guide for Audiovisual Design and Coordination Processes
2. ANSI / INFOCOMM 10 – Audiovisual Systems Performance Verification
3. ANSI / INFOCOMM A102.01 – Audio Coverage Uniformity in Listener Areas
4. AVIXA F502.01 – Rack Building for Audiovisual Systems
5. AVIXA F502.02 – Rack Design for Audiovisual Systems
6. INFOCOMM F501.01 – Cable Labeling for Audiovisual Systems

B. Building Industry Consulting Service International (BISCI):

1. ANSI / BICSI 001 – Information and Communication Technology Systems Design and Implementation Best Practices for Educational Institutions and Facilities
2. ANSI / BICSI N1 – Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure
3. ANSI / BICSI N3 – Planning and Installation Methods for the Bonding and Grounding of Telecommunication and ICT Systems and Infrastructure

C. Code of Federal Regulations (CFR):

1. 29 CFR 1910.268 – Occupation Safety and Health Standards (OSHA) – Telecommunications
2. 36 CFR 1191 – Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

D. Electronic Components Industry Association (ECIA):

1. ECIA EIA/ECA 310-E – Cabinets, Racks, Panels, and Associated Equipment

E. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code
2. NFPA 72 – National Fire Alarm and Signaling Code
   a. (muting of sound systems during a life safety event)
3. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems

F. Telecommunications Industry Association (TIA):

1. TIA-568.0 – Generic Telecommunications Cabling for Customer Premises
2. TIA-568.1 – Commercial Building Telecommunications Infrastructure Standard
3. TIA-568.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards

4. TIA-568.3 – Optical Fiber Cabling Components Standard
5. TIA-568.4 – Broadband Coaxial Cabling and Components Standard
6. TIA-569 – Telecommunications Pathways and Spaces
7. TIA-606 – Administration Standard for Telecommunications Infrastructure
8. TIA-607 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
9. TIA-862 – Structured Cabling Infrastructure Standard for Intelligent Building Systems
10. TIA-1152 – Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

G. Underwriters Laboratories (UL):

1. UL 263 – Fire Tests of Building Construction and Materials
2. UL 1480 – Speakers for Fire Alarm and Signaling Systems, Including Accessories
3. UL 2043 – Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handing Spaces
4. UL 62368-1 – Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements

H. International Code Council (ICC):

1. IBC – International Building Code

I. National Electrical Manufacturer's Association (NEMA)

J. Society of Motion Picture and Television Engineers (SMPTE)

1.3 DEFINITIONS

A. The terms "AV Contractor", "AVC", and "Contractor" shall refer to the Audio-Video Systems Contractor who has been awarded the contract for this scope and who has responsibility for the performance of the work specified in this specification.

B. The term "EC" shall refer to the electrical contractor.

C. The term "GC" shall refer to the general contractor.

D. The term "SCC" shall refer to the structured cabling contractor.

E. The term "specified elsewhere" shall refer to the material and work which is related to this contract and for which the Contractor is not responsible except as otherwise detailed herein. Some of all of these items may be included in the overall electrical contract.

F. The terms "not in contract" and "NIC" shall refer to work or equipment that is not in the contractor covered in this specification.

G. The terms "Contracting Officer furnished equipment" and "OFE" shall refer to equipment which shall be provided by the Contracting Officer or user to the Contractor. The Contractor shall be responsible for installing the equipment at the project site in good functional order as detailed herein. Where the equipment is existing or is used, the AV Contractor shall verify the

operation and functionality of these devices prior to installation. Any deficiencies shall be brought to the Contracting Officer's attention immediately via written documentation.

H. The terms "provided by others" and "PBO" shall refer to work or equipment that is provided by another trade, party, or team not directly responsible for the Audio-Video Systems but that interfaces with this scope of work.

I. The term "complete" shall refer to equipment and systems that shall be provided with all necessary accessories to complete a turn-key solution (i.e., "equipment racks" shall include doors, locks, side panels, covers, blank and vented panels, thermal regulation system, cooling fans, cable management, AC power distribution, UPS and power sequencing, and et cetera.). If the Contractor is unclear about a particular piece of equipment, system accessories, or design intent, then it is the sole responsibility of the Contractor to immediately contact the Contracting Officer via the RFI process for clarification prior to the bid submittal.

J. The term "furnish" shall indicate the responsibility to ship or deliver the item to the job site for receipt, staging and installation by others.

K. The term "install" or "installation" shall indicate the responsibility of receiving the item at the job site, providing adequate storage, unpacking or uncrating the item, physically securing the item or otherwise making ready the item for its intended use by following the instruction and approved methods of the manufacturer and those contained herein.

L. The term "provide" shall refer to the responsibility to both furnish, install, test and certify equipment.

M. The term "shall" is mandatory; the term "will" is informative; the term "should" is advisory.

1.4 SCOPE OF WORK

A. The work as described herein shall be furnished and installed by one (1) firm alone, hereafter referred to as the AV Contractor or AVC, for undivided responsibility. The AV Contractor shall provide all equipment, cabling and audio / video / control signals for the AV Systems described herein.

B. The work shall be provided complete, and the systems shall be fully operational as shown on the Audio-Video System drawings. It is expected that the AVC shall be accountable for a functional system Turn-key solution regardless of the packages selected by the Contracting Officer and that any deficiencies or added expenses created by the Contracting Officers' selections be brought to the Contracting Officers attention before acceptance of the contract.

C. The AV Contractor shall provide equipment and materials, whether specifically mentioned herein or not, to ensure a complete and operating system. Equipment and materials designated as Provided by Others (PBO), Not in Contract (NIC), and/or Contracting Officer Furnished Equipment (OFE) are specifically exempted from this requirement.

D. The AVC shall provide all software programming required to provide fully operational systems.

E. The specifications and drawings shall be read and used together. System features which are mentioned in one document are not necessarily shown in the other. In case of conflict between

the drawings and specifications, request clarification via the pre-bid RFI process. These pre-bid RFI's are due one (1) week before the bids are due. All pre-bid RFI responses shall be distributed to each Bidder.

F. The AVC shall coordinate with the Contracting Officer and/or their network staff et cetera to fully understand their network protocols and the security feature set they utilize so that the AV Network shall be installed and remain secure to outside cyberthreats at all times.

1.5 SYSTEM DESCRIPTIONS AND FUNCTIONS

A. General: Provide audio video systems that promote an enjoyable and educational experience for the guests and staff during events and while visiting facility. The AV systems must be easy to use, set up and maintained by the facility's technical support staff.

B. AV Systems are anticipated for the following areas:

1. Auditorium Room 103
2. Conference Room 120

C. Auditorium general audio video system requirements:

1. Audio Systems:
   a. Provide full frequency quality Dolby 7.2 surround sound reinforcement with locations as shown on the drawings.
   b. Full frequency loudspeakers
      1) Front and rear speakers are recessed surface mount units
   c. Subwoofers & Surround Loudspeakers are ceiling recessed units
   d. A networked digital signal distribution format called Dante shall be used.
   e. Wireless microphone System with headset and handheld microphones
   f. Ceiling microphone array for presentations that do not require a wireless microphone
   g. Provide a digital signal processor (DSP) system that shall utilize the Dante signal protocol as a signal distribution solution.
   h. Provide a Dolby surround sound processor
   i. Bluetooth receiver for bring your own devices (BYOD)
   j. Assistive Listening System
      1) This system shall utilize the facility WIFI system provided by the Telecom Contractor.
      2) It is required per the federal ADA code

2. Video System
   a. Provide large 10,000 lumen professional grade WUXGA (UHD capable) resolution video projection system.
   b. Video flat panel monitors shall be sized based on room size and occupancy.
   c. Provide local active HDMI & USB-C wall plates connectivity rated at 4k resolution.
   d. Pan Tilt Zoom (PTZ) camera system.
   e. Video / audio network internet streaming

3. Control System:

a. The AV systems will be operated by the low voltage control system using local wall mounted fixed touch panels. The control system shall operate:
   1) AV systems on / off. These can be scheduled events.
   2) System presets including PTZ camera presets and adjustments
   3) Audio and video source selection
   4) Audio and video zone distribution selection
   5) CATV channel selection where required
   6) System audio volume up / down
   7) Audio and or video mute
   8) Automatic sound systems mute during a fire alarm / life safety "event". The FA contractor to provide a dry contact closure & relays or similar signals to the control system CPU located in head-end rack. Cabling etcetera for this functionality shall be provided by the FA Contractor.
   9) Each touch panel can be password protection enabled if desired by the Contracting Officer.
b. Note: this is not a complete list of all the functionality the project requires. AVC to coordinate with the team during the shop drawing process. AVC shall coordinate a meeting with the Contracting Officer to discuss touch panel control requirements, GUI layout etcetera.
c. Note: the control system can utilize global scheduling presets such as auto system of/ off based on time of date etcetera. AVC to coordinate the system requirements with the Contracting Officer during the shop drawing process.

4. Ethernet Network Requirements (dedicated): AVC shall closely coordinate with the Contracting Officers IT staff with all AV systems network requirements including but not limited to:
   a. Gbps Ethernet backbone including active managed PoE (and or PoE+) switches which are Contracting Officer provided.
   b. VLAN / dedicated AV Subnet etcetera
   c. Patch-bay and patch cabling
   d. Cable plant certification (if applicable)
   e. Ethernet switch / PoE (+) requirements
   f. Gbps typical for most applications, i.e. control and audio applications
   g. Gbps for 4k & 8k video applications

5. Equipment rack
   a. Provide sequenced power distribution with the racks utilizing vertical power management.
   b. Automatic thermal protection system
   c. AVC shall provide blank plates to fill in any open areas in the front of the rack. This is to encourage convection airflow inside the rack.
   d. Provide a UPS, rack mounted for use with the control CPU and digital signal processors (DSP) etcetera, but not anticipated for audio power amplifiers.
   e. For pricing purposes, include a new rack at the facility.
      1) Upon site investigation and review of existing rack, if the existing rack can be reused and adhere to the requirements herein, the existing rack shall be reused and a credit shall be provided to the contracting officer.

D. Conference Room general system requirements:

1. Audio Systems: Provide a Video Sound Bar (VSB) that will be mounted below the professional grade flat panel monitor
2. Microphone array will be internal to the VSB.
3. PTZ camera is integral to the VSB
4. HDMI and USB-C laptop connectivity will be provided.
5. Control System a 10.0" touch panel will be provided for system ease of use.

1.6 AV CONTRACTOR'S GENERAL RESPONSIBILITIES

A. The Contractor shall be responsible for delivering a complete and fully functional turnkey system to the Contracting Officer. The Contractor shall provide equipment and materials, whether specifically mentioned herein or not, to ensure a complete and operating system. The "Not in Contract" (NIC), "Provided by Others" (PBO) and "Contracting Officer Furnished Equipment" (OFE) designated equipment and materials are specifically exempted from this requirement.

B. AV systems, infrastructure, raceway and equipment are sensitive to environmental conditions including but not limited to temperature, dirt, dust, and water. The AV contractor shall ensure the storage and installation of all AV Systems components are sequenced and scheduled accordingly to prevent any damage, loss of performance, and warranty void of such systems. All miss-installed components shall be replaced with new parts and re-installed at the AV Contractor's expense.

C. It is expected that the Contractor shall be accountable for a functional system regardless of the packages selected by the Contracting Officer and that any deficiencies or added expenses created by the Contracting Officers' selections be brought to the Contracting Officers attention before acceptance of the contract.

D. AV Ethernet Network Security: The AV Contractor shall extensively coordinate with the Contracting Officer and /or their network staff etcetera to fully understand their network protocols and the security feature set they utilize so that the AV Network shall be installed and remain secure to outside cyberthreats at all times.

1.7 RELATED WORK BY OTHER TRADE CONTRACTORS

A. General Contractor (Contractor): It is the responsibility of the GC to furnish and install all steel not shown on the Structural drawings but required for the Audio-Video equipment rigging and support. Additionally, the GC shall provide plywood backing to support video flat panel monitors, video walls, etcetera.

B. Electrical: It is the responsibility of the EC to furnish and install the work described in the Electrical documentation as well as all electrical infrastructure for AV systems. All high-voltage work shall be done by the EC only.
   1. It is anticipated that the AV equipment rack grounding bar shall be provided and installed by the EC / Tele-Data Contractors. See drawing detail sheets for additional information.

C. Tele-data: It is the responsibility of the Tele-Data / IT Contractor to furnish and install network data drops (including those designated as Dante signal types) and wireless LAN access point equipment that shall be utilized by the AV Systems and one-line diagrams. AVC shall closely coordinate their requirements with the Tele-Data Contractor.

D. Fire Alarm / Life Safety: The AVC shall coordinate the requirement of a contact closure & relay devices from the Fire Alarm Panel to the AV Systems low voltage control CPU. It is required so that the AV System shall mute during an "event". All cabling etcetera from the FA panel to the AV head-end is by the FA Contractor.

1.8 SUBMITTALS

A. Long Lead-Time Items: Prior to submittal of Shop Documentation, and within one (1) month of contract award, the AVC shall submit a list of anticipated long lead-time items (i.e., items with a lead time of eight (8) weeks or longer) for early approval. It is expected that all items listed in this submittal be furnished immediately upon approval.

B. Shop Documentation: The Shop drawing and data sheet submittals shall be submitted together, as one (1) package. The Shop Documentation submittal shall include the following items to be submitted simultaneously, no exceptions.

1. Bill of Materials: A complete list with quantities of equipment to be provided for the systems, including that required for items which are to be fabricated by the AV Contractor (i.e., a bill of materials). Products shall be listed in the same order as found herein. No exceptions.
2. Product Data: A complete set of manufacturer's equipment specifications with detailed technical information describing and illustrating all components and materials to be used in the installation of the AV systems. This would include those items listed by the manufacturer and model number herein and any other components needed to provide complete functional systems. Highlight in YELLOW what devices and accessories are to be installed, No exceptions.
3. Cabling Schedule: A complete materials list containing cable type, cable marker identifier, connector type, and origin and destination location for each cable.
4. Wireless Microphone Frequency Coordination:
   a. Provide on-site scan of UHF radio spectrum, from 470-608 MHz, using a calibrated spectrum analyzer (i.e., RF Venue). Show the noise floor in dBm with a horizontal line.
   b. Using the scanned spectrum as well as the digital television (DTV) station database information available from the microphone system manufacturer's website, determine the specific frequency bands best suited for the project, to minimize intermodulation distortion and channel conflicts, and maximize channel count. Include the specific frequency band for each component on the shop drawings (below).
   c. Submit proposed frequencies for each channel of wireless microphones within the proposed frequency band, taking into account second- and third-order harmonics to prevent intermodulation distortion, and avoiding DTV stations. Indicate and include any additional sources of RF in the space, such as in-ear monitors (IEMs), wireless intercom headsets, etcetera. Provide at least 1 spare frequency for every 4 channels of wireless microphones.
   d. After installation, during the testing phase, perform "real-world" frequency coordination, using "war gaming" techniques. Verify in sequence that there is no RF signal on each microphone receiver when its transmitter is turned off.
5. Shop Drawings: The shop drawings shall be submitted after the award of contract and be of a scale suitable for use for fabrication. AV Contractor shall make the following shop drawings submittals:

a. A one-line signal flow block diagram showing exactly the manner in which the AV Contractor proposes to install the system. Show all switches, modifications to equipment, relay and control circuits. Show all equipment/apparatus items which are required for realization of the functions described herein.
b. AC Power sequencing one-line that will be used in larger applications. Assume each power amplifier shall have its own circuit. This must be coordinated with the EC.
c. Detail diagrams of items which are to be fabricated by the AV Contractor and/or which the AVC intends to fabricate or has fabricated, including, but not limited to, the custom panels and receptacle plates. They shall show materials, finishes, panel/control markings, and complete dimensions when applicable.
d. Detailed diagrams showing equipment rack layouts.
e. Detailed diagrams showing loudspeaker mounting details with all hardware identified by manufacturer and model number.
f. A signal loss diagram for the coaxial distribution of video signals with calculations to verify that the signal strength at each endpoint is within industry specifications.
g. Any wireless microphone or monitor system shall indicate its proposed frequency band (such as G50 or J50A) on the one-line signal flow interconnect diagram.
h. Important Note: Submit sight-line calculations regarding FDA 3640 with elevations drawings of each location where a laser projector is to be installed and how its light path does not provide a hazard to human sight. AVC shall coordinate with projector manufacturer regarding this important issue.
i. AVC shall maintain on-site a hardcopy of their shop drawings detailing the latest as-built conditions.

C. Control & DSP System Shop Submittal:
1. GUI layouts that demonstrate page flips and system operation.
2. Domain Manager GUI layout and routing maps

D. Written field updates, including photos etcetera (once the site installation begins) shall be required every two (2) weeks.

E. Closeout Documents: Prior to Final Acceptance, AV Contractor shall submit the following:

1. Test reports, as specified herein. These documents are required twenty-one (21) calendar days before the anticipated final acceptance testing, else the appointment shall be rescheduled.
2. Updated control system and DSP source code and executable files, with all tunings and adjustments incorporated.
   a. It Shall be noted that all programming code, executables etcetera shall be provided to (and owned) by the Contracting Officership in perpetuity.
3. Updated frequency coordination, including specific “real world” frequency selection, showing no intermodulation distortion or channel conflicts.
4. Complete and accurate Final As-Built Drawings prior to final acceptance testing.
5. O & M manuals / documentation, programmable software files and executables as specified herein.
6. Written warranty, as specified herein, to take effect after the Final Acceptance Testing has occurred and any punch list-items have been completed.

1.9 QUALITY ASSURANCE

A. Manufacturer's Qualifications: All electronic products shall be designed and marketed by the manufacturer for application in professional sound amplifying, reproduction and recording systems.

B. AV Contractor's Qualifications: AVC shall meet all the requirements of the AV Contractor Qualification Statement, as described herein.

1. The AV Contractor shall have on their full-time payroll at least on staff engineer having five (5) years minimum experience as an audio design engineer. In place of a qualified staff engineer, the AV Contractor may retain a consulting engineer to direct the project. Prior to bid acceptance, the qualifications of the consulting engineer shall be submitted for the approval of the Contracting Officer.
   a. The staff or consulting engineer shall:
   b. Provide all technical liaison between the AV Contractor and the Contracting Officer.
   c. Represent the AV Contractor at meetings and conferences and be present at the job site for final inspection.
   d. Be responsible for the supervision of all technical and engineering work required to execute the contract and approve and sign the shop drawings.
2. The senior AVC project staff presented in the AV Contractor Qualification Statement shall remain on the project (at a minimum) in a supervisory role until the completion of all AV-related work.

C. Minimum Performance Requirements: To meet the minimum performance requirements, the AV Contractor shall be responsible for:

1. Installing Assistive Listening System components in conformance with ADAAG (including 216.10 and 706) code requirements, as required by law for indoor / outdoor spaces.
2. Each component's conformance with the manufacturer's published specifications and other requirements as stated herein.
3. Detailed checking of each item of equipment provided, each portion of the installation, and of the complete installation to find and remedy any defects therein.
4. Setting the system gain structure, including initial adjustment of digital signal processing, and amplifier gain controls, and, under the direction of the Contracting Officer, making the final adjustment of these items and, if so directed, re-aiming loudspeakers, resetting loudspeaker levels and providing additional equalization and DSP programming, as necessary.

D. Final Acceptance: Final Acceptance will be contingent upon issuance by the Contracting Officer of a letter of acceptance stating that the work has been completed and is in accordance with the contract documents. This is when the warranty period shall begin and not at "Substantial Completion".

1.10 DELIVERY, STORAGE, AND HANDLING

A. The AV Contractor shall ensure the storage and installation of all AV Systems components are sequenced and scheduled accordingly to prevent any damage, loss of performance, and warranty void of such systems.

B. All incorrectly installed components shall be replaced with new parts and re-installed at the AV Contractor's expense.

1.11 WARRANTY

A. Provide a written warranty, signed by the AV Contractor, due when the AVC issues the As-Built Documentation. Warranty period shall equal the requirements described the DIVISION 00 sections.

B. Include the following provisions:
   1. Warranty all equipment and the installation to be free of faulty workmanship.
   2. Warranty all components, including solid state devices, to be free of defects.
   3. Paint and exterior finishes, fuses and lamps are excluded from above warranty, except when damage or failure results from defective materials or workmanship covered by the warranty.

C. If, within the warranty period of the installation or within a longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents or provided by a manufacturer, any of the work or equipment is found to be defective or not in accordance with the Contract Documents, the AV Contractor shall correct it promptly including all parts and labor after receipt of notice from the Contracting Officer to do so unless the Contracting Officer has previously given the AV Contractor a written acceptance of such condition. This obligation shall survive termination of the contract. The Contracting Officer shall give such notice promptly after discovery of the condition. Such notice shall be provided by Contracting Officer representatives, to be identified, either verbally or in writing.

D. Nothing contained in the Contract Documents shall be construed to establish a shorter period of limitation with respect to any other obligation which the AV Contractor might have under the Contract Documents or any manufacturer's warranty. The establishment of the time period noted above, after the date of Final Acceptance or such longer period of time as may be prescribed by law or by the terms of any warranty required by the Contract Documents, relates only to the specific obligation of the Contractor to correct the work or equipment, and has no relationship to the time within which their obligation to comply with the Contract Documents may be sought to be enforces, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to their obligations other than specifically to correct the work or equipment.

E. The Contracting Officer reserves the right to expand or add to the system during the warranty period using firm(s) other than the AV Contractor for such expansion without affecting the Contractor's responsibilities, provided that the expansion is done by a firm which is an authorized dealer or agent for the equipment of system being expanded.

F. Structured Cable:

   1. The manufacturer shall provide a warranty with a minimum term of twenty-five (25) years for structured cabling and all communications cable infrastructure components. This warranty shall cover all components including cables, jacks, patch panels, and wiring panels, etc. to maintain the specified performance, physical criteria, and applications assurance.

2. Any such components, link, or channel shall be replaced by the manufacturer at no cost to Contracting Officer during this period.
3. The Contractor and Manufacturer shall submit all information and documentation on Warranty

G. Service Warranty:
1. Replace defective materials and repair faulty workmanship within 72 hours of discovery at no cost to the Contracting Officer during the period of the Warranty.
2. If during the warranty period, system operation is not fully restored, or a working temporary solution is not deemed acceptable by the Contracting Officer, within four (4) business days, the Contracting Officer reserves the right to require the Contractor to provide on-site manufacturer's service technicians at no additional cost.
3. At no additional charge, provide maintenance service for a period of one (1) year after the Contracting Officer's Final Acceptance of installation. This service shall consist of at least one (1) visit six (6) months and one (1) visit eleven (11) months after Final Acceptance for regular maintenance responsibilities, checking equipment and systems operations / functionality, and rigging safety. The AVC shall make all necessary adjustments in a timely manner.
4. If, during the warranty period, any component is out of service for more than four (4) days due to unavailability of parts or service, supply and install an identical new component. If an identical component is not available, temporarily substitute equivalent equipment, but only with the written approval of the Contracting Officer.

PART 2 - PRODUCTS

2.1 DEVICE QUANTITIES

A. Every attempt has been made to provide an accurate and detailed equipment schedule. However, when a discrepancy is found, the quantities found on the one-lines shall take precedence over the equipment schedule specified herein. AVC shall issue a pre-bid RFI requesting clarification no later than five (5) working days prior to the bid due date. Responses shall be provided to all bidders prior to the bid due date.

2.2 EQUIPMENT PERFORMANCE SPECIFICATIONS

A. For all items which are identified by part number and manufacturer, performance specifications which are published in the most recent manufacturer's data sheets available at the time of bidding this contract shall be applicable to the present work as though fully written out herein.
B. For those items which are not identified by part number and manufacturer, the AV Contractor may select items which conform to the functional and/or technical specifications. For all such items, the AV Contractor shall submit for approval all technical data which is available from the supplier or manufacturer.
C. All terminated and bulk cable types shall be submitted in the shop documentation prior to purchase and installation.

2.3 EQUIPMENT SCHEDULE:

A. The following schedule provides devices that meet the functional criteria for the **"Basis of Design"** for this project.

B. Products and devices submitted for consideration must meet the **"equal or better"** criteria to be considered viable for this project.

Tag	Description	Manufacturer	Model Number	Notes
	Audio Equipment			
S1	Ceiling loudspeaker, large format w/ tile bridge and enclosure, complete	Atlas	FAP63T	70.7 volt / Tap @ 32 W
S2	**Directional Recessed ceiling loudspeaker**	**Bose**	**EdgeMax EM180**	Left. Center, & Right and rear surround sound loudspeakers
S3	Ceiling subwoofer, large format, w/ tile bridge and enclosure, complete	Sonance	PS-C83RWT	Color coordinated with contracting officer
	Digital Signal Processor, w/ modules & Dante, complete	QSC	CORE 110f-v2	Quantities as required; all licenses included
	Surround sound digital audio processor	Extron	SSP 200	
	Amplifier, 300W x 8 channels, w/ Dante	Crown	CDi 8|300DA	
MC1	Microphone array, complete	Shure	MXA920	Ceiling Mounted
	Wireless microphone system w/ Dante UHF system, batteries, Battery charger. Etcetera, complete	Shure	ULXD4D-GV	Combination system w/ hand held and head set microphones, submit broadcast frequency ranges in Shop Document Submittal
WM1	Wireless Antenna, remote	Shure	UA864US	
	RF bandpass filter	RF Venue	BPF custom	NOTE: AVC to select the best band-pass filter for RF microphone frequency to be installed
BT1	Bluetooth receiver	Symetrix	x|O Bluetooth	Color coordinated with contracting officer.
	ALS system, Wi-Fi based, with Dante, w/ earbuds, neck loops, rechargeable batteries, chargers, placard etcetera, complete	Listen Tech	ListenAURA	All quantiles shall be based on ADA code requirements. Receiver quantities based on occupancy

Tag	Description	Manufacturer	Model Number	Notes
	Video Equipment			
AV1	HDMI Encoder	Crestron	DM-NVX-E20-2G-x-T	
	HDBT Encoder	Crestron	DM-NVX-E760	
AV2	USB-C to HDBT Tx	Crestron	HD-TXU-4KZ-111-2G-W	
	HDMI Decoder, w. Dante	Crestron	DM-NVX--363	
FP98	Flat panel Monitor, 98"D	Sharp	E988	
FP86	Flat panel Monitor, 86"D	Sharp	E868	
FP75	Flat panel Monitor, 75"D	Sharp	E758	
	Digital signage player w/ 64G micro SD card	Brightsign	XT114	or similar
PS1	Recessed motorized tab-tensioned projection screen wl LVC, wall switch, etcetera, complete	Draper	Access V	1.9:1 Aspect ratio 60" x 114" (Matte White)
PJ1	Video projector, WUXGA (/ UHD), 10,000 lumens, w/ lens etcetera, complete	Sharp NEC	NP-PA-1004UL-W-41	
PTZ1	HD PTZ Camera	Vaddio	RoboSHOT 30 HDBT	
VSB	Conference AV system w/ touch panel control, complete	Cisco	Room Bar	Conference Room 120
	4k Blu-ray player w/ RS-232 Control	**Tascam**	**BD-MP4K**	
	Network & Control System			
	Control System CPU, complete	Crestron	CP4N	
TP10	Touch Panel, 10.0", fixed, complete	Crestron	TSW 1070-B-S	
	Ethernet PoE+ switch, AV Dedicated	Netgear	4250 series	AV Network, Quantities as required
USB	**USB-C Extender**	**C2G**	**Superbooster® 1-Port USB**	**Data only**

Tag	Description	Manufacturer	Model Number	Notes
	Hardware / Miscellaneous			
	Flat panel wall mount, tilting, large	Chief	LTM1U	
	Large Flat Panel Mobile AV Cart	Legrand	PFCUB	
	Flat panel wall mount, tilting, large	Chief	XTM1U	98.0" UNIT
BB1	Flat panel back box	Chief	PAC 526	AVC provided EC installed
PJ1	Projector mount	Chief	RPS series	
PB1	Ceiling plenum box	Chief	CMA473	
	Ceiling plenum box mount	Chief	CMA440	
	Equipment Rack, wall mount w/ locking doors & panels, fans, thermal sensor system, blank panels etcetera, complete	Middle Atlantic	BGR-45SA-32	
	AV equipment rack AC power sequencer & power distribution and management	Middle Atlantic	MPR Series	AVC shall submit power sequencing one-line in Shop Drawings
	UPS, rack mounted	APC	SMT1500RM2UNC	
	Cabling, bulk & pre-terminated	Custom	Custom	See Part 2.05 below for additional info on approved cabling
	CAT6A / RJ45 Patch Bay	Belden	Custom	Contractor provided and installed, CAT6A shielded or better
	END			

2.4 WIRING AND CONDUCTORS

A. General Notes:

1. Any specific cable AWG gauge detailed in the drawing package supersedes this document. These cable types are cited to illustrate the type and quality of cable required. Plenum cable must be utilized as required. Unless otherwise noted, cables from other reputable manufacturers will be considered acceptable only if data sheets are submitted and approved by the Contracting Officer prior to installation. The AV Contractor must

verify cable lengths and confirm the suitability of the cables listed above but may change based on field conditions. Where signal loss is beyond anticipated norms, the AVC shall coordinate with manufacturers and the Contracting Officer to select a cable that will meet or exceed the requirements. No exceptions.

2. Cables running in plenum areas without conduit shall be plenum rated cable and match the specified cable below. It is the responsibility of the bidder to inspect the electrical drawings and verify in what spaces plenum cable shall be used. No claims for additional monies, based on the use of plenum cable, will be allowed.
3. All cables (except video and pulse cables which must be cut to an electrical length) shall be cut to the length dictated by the run. No splices shall be permitted in any pull boxes without prior permission of the Contracting Officer. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length based on the bend radius of the cable etcetera.

2.5 FABRICATED MATERIALS

A. Designation / Engraving

1. All equipment controls, receptacles and all indicators shall have, unless otherwise noted, Lamacoid / Phenolic, permanently engraved, or silk-screened fully descriptive identification labels. The resolution of silk-screened labels shall not be less than 90,000 dots/sq. in.
2. The word “engraved” shall mean that the identification shall be engraved into the indicated panel, plate or control surface.
3. All engraving shall be with 5/32-inch high characters, unless otherwise noted, and shall be filled with engraver’s enamel of a contrasting color.

B. Receptacle Plates:

1. Receptacles shall be screwed, bolted or flush-riveted to the plate.
2. Plates shall be marked to indicate function and circuit of the receptacle, for example: MICROPHONE, USB-C VIDEO, USB-C DATA etcetera. Each receptacle shall have a discrete and unique identifier, for example: MIC 1, MIC 2, etc. All identifiers shown on the Contract drawings are for reference only.
3. All wall plates shall be powder coated rather than having an adonized finish.
4. Color and finish of blank panels and custom assembly panels shall match adjacent equipment panels to the extent possible. The finish of wall mounted receptacle panels shall be coordinated with the Contracting Officer.

C. Terminals and Terminations:

1. Microphone cables shall not be spliced or otherwise interrupted from termination to termination. All cables shall have visible adhesive identifying markers on each end.
2. Wiring in terminal cabinets shall be tied and clamped neatly to backboards or cable-forms.
3. Terminals shall, unless otherwise specified, be one of the following types:
   a. Wire-wrap type terminal block.
   b. Barrier strips with screw terminals.
4. Each terminal strip shall have a legibly marked identification strip.

D. Structural Assemblies:
   1. Provide holes required for securing other components or assemblies to structural steel framing and for passage of other components through steel framing members as shown on final shop drawings. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning.
   2. In fabricating mounting brackets and other steel components requiring bends, the radii of the bends shall not be less than three times the thickness of the steel being bent.
   3. All bolts and nuts used in the fabrication of mounting hardware shall be Grade 5 or better, i.e. rated five (5) times the anticipated load.
      a. Surface Mount Equipment Color:
      b. Surface mounted AV Equipment, Wherever possible AVC shall coordinate the color of that device, i.e. touch panels, loudspeakers, projectors etcetera with the Contracting Officer prior to purchase.

2.6 TESTING EQUIPMENT FOR SYSTEMS PERFORMANCE VERIFICATION

A. The AV Contractor shall furnish and utilize the following test equipment for their own use during their initial tests and adjustments and, if necessary, during Final Acceptance testing of the system by the Contracting Officer. Equipment listed in this article is not intended to be provided to the Contracting Officer or Project site.

   1. Data Cable Analyzer: Hardware and software requirements include but are not limited to:
      a. Level III accuracy in accordance with ANSI/TIA-1152
      b. Permanent Link Adapters: RJ45 Adapter must meet requirements for NEXT, FEXT and Return Loss in accordance with ANSI/TIA-568-C.2 Annex C. Twisted pair Category 6A, 7 or 7A cords are not permitted as their performance degrades with use and can cause false Return Loss failures.
      c. Results Storage: Must be capable of storing and reporting results
   2. 250 MHz Dual Trace Oscilloscope: With external video trigger capabilities
   3. Audio Analyzer: Hardware and software requirements include but are not limited to:
      a. Class 1 device which shall be calibrated in the field. Shall meet ANSI S1.4 specifications for Type I sound level meters.
      b. 1/12-octave real time FFT spectrum analyzer, with a minimum of six (6) curve integration averaging
      c. 1/12-octave band filter set meeting ANSI S1.11 specifications
      d. Audio signal test measurement set
      e. SPL functionality including dBA and dBC weighted scale functionality
      f. STI-PA software or discrete device where intelligibility is required as part of the project scope
   4. Audio Signal Generator: Continuously variable from 20.0 Hz to 20.0 kHz within +1.00 dB with less than 0.50 percent THD. Include the ability to produce Pink and White noise, sine wave (variable frequency) and sweep generator, with variable output: -60.0 dB-V to +4.00 dBm
   5. Distortion Analyzer: Tunable 1/12-octave band wave analyzer allowing readings down to 1.00 percent of the fundamental for measuring THD, hum amplitude and noise spectrum shape

B. All field test instruments shall be within the calibration period recommended by the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION PRACTICES

A. General:

1. The AV Contractor shall coordinate with EC on conduit/junction box locations for audio equipment and routing of audio, control, and power cables/conduits from terminals, poke-thru /floor and pull boxes, wall plates, stub-ups etcetera to system equipment racks. This shall be done prior to the installation of drywall, ceilings etcetera.
2. Installation shall include the delivery, unloading, setting in place, fastening to walls, floors, ceilings, counters, or other structures where required, interconnecting wiring of the system components, equipment alignment and adjustment, and all other work whether or not expressly required herein which is necessary to result in complete operational systems.
3. The contractor shall construct AV equipment racks and sub-assemblies, including all equipment to be installed therein off-site. All wiring work, labeling of wiring, cable dressing, hardware supports, and connection panels, cable wiring documentation, socket installation, ventilation and power supply regulation and filtering component installation shall be performed in AV Contractor's own premises.
4. The Contractor shall not deliver equipment in original packaging to the site for installation. All such equipment will be unpacked and checked thoroughly in AV Contractor's premises. The contractor shall test such equipment as it is received to ensure that it conforms to the manufacturer’s specifications. On no account shall the Contracting Officer be liable for any delays of completion of the installed system due to defective equipment being received by Contractor.
5. Keep the job adequately staffed at all times. Designate a field supervisor to be present on the job site and in responsible charge during all phases of installation and check out. Maintain the same supervisor throughout the execution of the work unless circumstances beyond the control of the AV Contractor intervene. Install the system in cooperation with other trades in order to achieve coordinated progress and satisfactory final results. Watch for conflicts with work of other trades on the job. Execute without claim for extra payment, moderate moves or changes as are necessary to accommodate other equipment or preserve symmetry and pleasing appearance.
6. In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors. Any issue regarding a visual aesthetic shall be brought to the attention of the GC and Contracting Officer immediately so that all parties can coordinate and provide an adequate solution in a timely manner.
7. For the purposes of coordination with Contracting Officer s specified furniture, the AV Contractor will ensure that such equipment or mounting hardware is compatible with and suitable for installation in that furniture. It shall be the AV Contractor's responsibility to ensure they coordinate with the furniture and / or millwork contractor and that parties shall exchange and follow their Shop Drawings to ensure that dimensions and structural supports are adequate for the AV equipment installation. It is the AV Contractor's responsibility that the request and delivery of such critical coordination information is satisfactorily executed and in as much as the Contractor has control over the delivery of such information, the AV Contractor shall deliver it as requested by the Contracting Officer.
8. The equipment specified herein must be capable of operation in environments of normal humidity, dust and temperature. AV Contractor should avoid installing equipment where

extreme environmental conditions can occur and shall be responsible for protection of equipment and related wiring from such conditions.

9. The AV Contractor shall take precautions to prevent electromagnetic and electrostatic hum. Install the equipment to provide safe operation. Provide ventilation as required to maintain equipment within the manufacturer's specified temperature limits.
10. The AV Contractor shall do all cutting and patching necessary for proper installation of the system and shall repair any damage done by themselves or their workmen. Any required penetration of slabs or CMU walls shall be made by a cutting method rather than by a concussive method.
11. All installation practices shall be in accordance with, but not limited to, the general design and construction requirements of the Contracting Officer, and these specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of the Contracting Officer. Before commencing work, the Contractor shall familiarize all project team members with all of these requirements.
12. If, in the opinion of the AV Contractor, an installation practice is desired or required, which is contrary to these specifications or drawings, a written request for modification shall be made to the Contracting Officer. Modifications shall not commence without written approval.
13. During the installation, and up to the date of issuance of the Final Acceptance Memorandum, the AV Contractor shall be under obligation to protect their finished and unfinished work against damage and loss. In the event of such damage or loss, they shall replace or repair such work at no cost to the Contracting Officer.

B. Security:

1. Provide a project security program to:

   a. Protect Work, stored products, and construction equipment from theft and vandalism.
   b. Protect Contracting Officer's operations at site from theft, vandalism or damage from AV Contractor's work or employees.
   c. Maintain security program throughout construction period, until Contracting Officer occupancy or Contracting Officer acceptance precludes the need for AV Contractor security.

C. Coordination:

1. All work shall be reviewed and coordinated with the GC prior to commencing work.
2. The AV Contractor shall coordinate all AV equipment connections, panels and control locations with the Contracting Officer prior to installation.
3. Coordinate installation with Structural, Electrical, Mechanical, Plumbing, Fire Protection, and other trades to eliminate disruption and/or conflict with other systems.
4. Sequence installation of the AV Systems and infrastructure with other work to minimize possibility of damage and soiling during remainder of construction.

3.2 GENERAL INSTALLATION PROCEDURES

A. Locate all apparatuses requiring adjustments, cleaning or similar attention so that they will be accessible.

B. All boxes, equipment, wall plates, loudspeakers, antennae, cabling etcetera shall be secured plumb and square.

C. All supporting structures and enclosures supplied by the AV Contractor, not having a standard factory paint finish, shall be painted. Paint specifications and color shall be supplied by the Contracting Officer.

D. Clearly, logically and permanently mark switches, connectors, jacks, relays, receptacles, cables and cable terminations.

E. Etch, engrave, silk screen or apply in a similar permanent manner all legends and markings on all custom panels and receptacle plates. Embossed tape, press type, etc., are not acceptable.

F. Provide all cables necessary for interconnection of permanently mounted equipment. Use terminations required to achieve full function of equipment as specified herein.

G. Exercise care in wiring, to avoid damage to the cables and to the equipment. Make all joints and connections with rosin-core solder or with mechanical connectors approved for Class I wiring. Execute all wiring in strict adherence to standard broadcast and BICSI procedures. AVC shall adhere to the cable manufacturers' recommended cable bend radius, no exceptions.

H. Run lines in separate metallic conduits for line level circuits (up to +30.0 dBm), loudspeaker circuits (above +30.0 dBm) and power circuits. Non-metallic or PVC conduits for AV system wiring are not acceptable. Confirm with EC that all metallic raceways have been properly bonded. Use only cables which are insulated from the conduit and from each other for the entire conduit length.

I. All shielded audio cable shall be bonded at both ends. Do not ground audio cable shields only at the source end. Preserve continuity of microphone shields at both connecting points. Connect all audio grounds in this system to a common point.

J. All equipment shall be firmly secured in place unless the equipment has been documented to be portable in nature, either within this Specification or as shown in the Construction Documents.

K. All fastenings and supports shall be adequate to support their loads with a safety factor of five (5) times the load weight or as required by ESTA , whichever is greater. Wind shear must be taken into account when installing all outdoor pole mounted devices.

L. All loudspeakers shall be installed according to the manufacturer's instructions. All loudspeakers shall be installed with a secondary seismic safety harness assembly in addition to the specified loudspeaker mount. No exceptions.

M. It is the responsibility of the AVC to test all loudspeakers and/or loudspeaker line arrays for sound pressure levels to verify that the full frequency spectrum coverage area is uniform throughout the listening area. AVC shall reposition and or adjust aiming angles as necessary until uniform full frequency coverage is reached per the specification. This work shall be done as part of this contract and no additional funds shall be provided to the AVC to accomplish this requirement. No exceptions.

3.3 BONDING

A. The Contractor shall be responsible for correcting any signal grounding problems within the AV System (excluding Division 26 grounds) including but not limited to electromagnetic / electrostatic hums, ground loops anomalies, and distortions.

B. A bonding buss bar shall be installed at each equipment rack location. The copper buss bar shall be sized to accommodate all connections plus future expansion. See drawing details for additional information.

1. In locations where multiple AV equipment racks exist, they shall be grounded to each other as well as grounding to the AV Grounding Bar (AVGB).

C. Ground all components according to the following methods:

1. Equipment having a power cord without a grounding conductor connected to chassis: Furnish and install 14 AWG grounding conductor from the component's metallic chassis to grounding buss bar within rack.
2. Equipment having a power cord with a grounding conductor connected to chassis: Do not install an additional grounding conductor.

D. Shielded audio signal cables shall have the shields terminated at both ends. No exceptions.

E. All video and data shielded cables shall have the shielded conductors terminated on both ends.

3.4 LAN & ETHERNET NETWORK REQUIREMENTS FOR AV SYSTEMS

A. The Contractor shall coordinate with the Contracting Officer regarding the Ethernet switch requirements and system topography necessary for the AV Systems:

1. 1 G Ethernet switches for audio systems
2. 10 Gbps Ethernet switches for media servers (including audio and video recording media servers).
3. IP Address quantity for AV System
4. Wireless access points for dedicated AV Systems.

3.5 PATCH PANEL ASSIGNMENTS

A. The Contractor shall provide patch panels that shall be the same category as the cable being passed through them and match the more stringent category rating if multiple cable types are terminated there. The AVC shall provide shielded terminations that also match the category of the most stringent cable type.

B. All patch panels shall be wired so that the signal "sources" (outputs from) appear on the upper row of a row pair; and all "loads" (inputs to) appear on the lower row of a row pair.

C. All audio and video patch panel designation strips shall utilize alphanumeric identifications and descriptive information. The jack position in each horizontal row shall be numbered sequentially from left to right. The horizontal jack rows shall be lettered sequentially from top to bottom. The alphanumeric identification of each jack shall be included on the shop

documentation functional block drawings, as well as on reproductions of these drawings, which shall be mounted in an appropriate location near the patch bays.

3.6 EQUIPMENT RACK INSTALLATION

A. Supply completely assembled and fully shop-tested racks with all internal wiring completed as required to provide a complete system, to the extent that such items are not provided by others.

B. All power cables, low voltage control cables, and high level cables shall be run on the right side of an equipment rack as viewed from the rear. All other cables shall be run on the left side of an equipment as viewed from the rear.

C. When dressing the equipment rack, cable ties shall be placed at appropriate intervals of approximately six (6) inches for vertical bundles, four (4) inches for horizontal bundles. No cable ties shall cause the cable to exceed the manufacturer's recommended bend radius or deform the cable.

D. All vertical cable bundles internal to AV system equipment racks shall be attached to the rack frame utilizing a cable management system.

E. Use only Velcro-type cable straps to mount and bundle all cables. The use of plastic wire ties is prohibited. No exceptions.

F. All equipment racks shall by fully dressed out and cabled shall not protrude from the back of the rack.

G. All cable entry shall be through the tops of equipment racks or through entrance holes in the base of the rack. No cable shall enter racks through front, rear, or side panel openings.

H. Millwork installed or pivoting racks shall be provided with a sufficient amount of dressed cabling or harness to allow free and untethered travel of the rack from the permanent locking position to the extended "service" position.

3.7 CABLE INSTALLATION

A. All cables for this project must conform to the latest version of NFPA 70 as well as local code requirements.

B. Where existing cabling is to be abandoned, it shall be completely removed as directed in the NFPA 70 / NFPA 72. No exceptions.

C. All cables, regardless of length, shall be marked with permanent wrap-around number letter cable markers at both ends. There shall be no unmarked cables at any place in the system. Wire labels done by hand in the field must be replaced with computer-generated labels for legibility. Marking codes used on cables shall match the codes / labels shown on the AVC shop drawings and on run sheets.

D. CAT6A / 4k cable runs shall not exceed the most current BICSI telecommunications cabling standards, i.e. 100 meters inclusive of all cross-connects, patches etcetera. When the distances

are longer, the AVC must coordinate with the cable manufacturer to verify performance is still within the acceptable range of performance for this scope of work. No exceptions.

E. Internal and inter-rack cabling shall be neatly strapped, dressed, labeled, and adequately supported without pinching the cable bundle.

F. Use only Velcro-type cable straps to mount and bundle all cables. The use of plastic wire ties is prohibited. No exceptions.

G. Terminal blocks, boards, strips, or connectors shall be furnished for all cables that interface with racks, cabinets, consoles, or equipment modules. The use of "wire nuts" to terminate or connect cabling is strictly prohibited.

H. All cables and bundles shall be grouped according to the signals being carried. In order to reduce signal intermodulation distortion, separate groups shall be formed for the following cables:

1. Power loudspeaker cables
2. Low voltage system cables
3. Video cables / Category cables
4. Audio cables carrying signal levels less than -20.0 dBm
5. Audio cables carrying signal levels between -20.0 dBm and +20.0 dBm
6. Audio cables carrying signal levels greater than +20.0 dBm

I. All cables shall be continuous lengths without splices. All system wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No bare wire terminations shall be allowed, unless specified on the drawings. No exceptions. Heat-shrink tubing shall be used to insulate the ground or drain wire.

J. All solder connections shall be made with rosin-core solder using temperature-controlled solder stations. No cold or cracked solder joints are acceptable. Any connections, which do not appear to be clean and shiny, or which show signs of cracking, shall be re-soldered by the AV Contractor before Final Acceptance testing of the system.

K. Mechanical connections using insulations, crimp-type connectors shall be bonded to the connector by soldering the wire to the metal part of the connector.

L. Connections made with screw actuated pressure type terminal strips shall be made by stripping approximately 1/4-inch of insulation from the stranded connector. The un-tinned wire shall be inserted into the terminal and tightened.

M. All wire bundles are to be neat and combed free of cable crossovers.

N. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer.

O. All wire markers / labels shall face a common direction.

P. All cables shall have proper connector housing.

Q. All cables located in the ceiling areas, excluding corridors, where conduit as not been provided for are to be J-hooked and kept separate from data cables with crossovers at ninety (90) degrees. Large conduit sleeves shall be required for all inaccessible ceiling areas or hard lid ceilings.

R. All cable passing through penetrations in fire rated walls must be fire blocked after cable installation by the AV Contractor.

3.8 CLEAN UP AND REPAIR

A. During the installation, the Contractor shall be expected to maintain a clean and safe working environment.

B. Upon completion of the work the Contractor shall remove all their refuse and rubbish from and about the premises and shall leave the relevant areas and equipment clean and in an operational state. The Contractor shall be responsible for repairing any damage caused to the premises by the AV Contractor's installation activities, at no cost to the Contracting Officer.

3.9 PROTECTION

A. Protect installed products until completion of the project.

B. Touch-up, repair or replace damaged products before substantial completion.

3.10 AV CONTRACTOR SYSTEM CHECKOUT CHECKLIST

A. General:

1. Before Final Acceptance tests are scheduled, the Contractor shall perform a complete system checkout. The Contractor shall furnish all required test equipment and shall perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification.
2. For any audio or video system tests performed which yield results indicating failure to meet the performance requirements of this specification, the Contractor shall be held responsible for all costs related to adjustments and aiming of components required to rectify the failed conditions.
3. Maintain onsite documentation of all field related changes / as-builts etcetera as well as performance tests for reference by the Contracting Officer during the site surveys and Final Acceptance testing.
4. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer’s published specifications. Establish and note normal settings for all device controls and record these settings in the Operation and Maintenance (O & M) Manual.
5. Check all low voltage control system functions and presets, from all controlling devices to all controlled devices, for proper operation.

B. General Audio System Tests:

1. General Inspection and Adjustment: Measure and subsequentially document that all individual components are performing in accordance with each manufacturer’s published

specifications. Specifically, examine frequency response, audible harmonic distortion, and signal-to-noise (S/N) ratio. Replace any components found to be defective.

2. Freedom from Parasitic Oscillation and Radiofrequency (RF) Pickup: Check to ensure that the system is free from spurious oscillation and radio-frequency pickup, both in the absence of any audio input signal and also when the system is driven to full output from 20.0 Hz to 20.0 kHz. Utilize a dual trace oscilloscope as specified.
3. Loudspeaker Phasing: Perform phasing checks of loudspeaker lines by means of a DC source at one end of each line and a voltmeter at the other end. Phase all loudspeaker lines identically with respect to color coding.
4. Freedom from Buzzes, Rattles and Objectionable Distortion: Apply a slow sine wave sweep from 20.0 Hz to 20.0 kHz at a level 6.00 dB below rated power amplifier output voltage. Listen carefully for buzzes, rattles, and objectionable distortion. Correct any causes of these defects, unless the cause is clearly outside the sound amplification system equipment and installation, in which case, the cause shall be brough to the attention of the Contracting Officer.
5. Gain Control Settings: Establish tentative normal settings for all gain controls. All gain controls on rack-mounted equipment shall be adjusted for optimum S/N ratio and signal balance. Settings may require further adjustment by the AV Contractor as a result of testing by the Contracting Officer. After final gain and attenuator settings have been established, mark all control settings with an adhesive indicator dot or arrow on the amplifiers.
6. Freedom from Switching Transient Noise: Operate all AC power sequencing equipment while listening for clicks and pops in the system outputs. Eliminate any found.
7. Initial Listening Test: Listen to normal program material to be sure that there are no remaining defects.

C. Loudspeaker Equalization Tests – 70.7 Volt Distributed Systems

1. Perform all tests and adjustments required to obtain specified performance. Tests and adjustments shall be performed when all ceiling tiles, acoustical treatment panels, sound screens, furnishings, etcetera are in their final position and ready for personnel. HVAC and lighting shall be operating at normal conditions.
2. Measure the ambient sound level in 1/12-octave bands with all HVAC systems and lights on. Record data as 1/3-octave band readings. Also measure and record the ambient sound level as a single wideband C-weighted (dBC) reading.
3. Individually test each loudspeaker circuit or zone extensively for uniform sound pressure levels (SPL) and adjust the system as necessary.
4. With the pink noise (or sweep generator) off and power amplifier on, and with all amplifier attenuation controls set at an 80.0% rotation (or +80.0 dB where applicable) in all areas, the system hum and noise must be inaudible. Any mechanical rattles or audio distortion must be corrected at this time.
5. Apply the pink noise or sweep generator signal to system and adjust for a working level for the equalization of the system of at least +20.0 dB above the ambient sound level. Staff must use ear protection.
6. Check for uniformity of coverage utilizing a 32-band, 1/12-octave Class 1 spectrum analyzer. The level in all areas must not deviate more than +/- 2.00 dBC. Correct any out of tolerance deviations before proceeding to the next zone / loudspeaker circuit.
7. Document all findings. Provide the Contracting Officer “Before” and “After” spreadsheet and resultant frequency response curves and graphical test results for a representative

quantity of each speaker type or zone. Note microphone test locations on floor-plan drawings.

D. Loudspeaker Equalization Tests – Low Impedance Loudspeaker Systems

1. Perform all tests and adjustments required to obtain specified performance. Tests and adjustments shall be performed when all ceiling tiles, acoustical treatment panels, sound screens, furnishings, etcetera are in their final position and ready for personnel. HVAC and lighting shall be operating at normal conditions.
2. Measure the ambient sound level in 1/12-octave bands with all HVAC systems and lights on. Record data as 1/3-octave band readings. Also measure and record the ambient sound level as a single wideband C-weighted (dB-C) reading.
3. The DSP shall utilize the loudspeaker manufacturer's Finite Impulse Response (FIR) files as an initial starting point for equalization.
4. Using an AC impedance meter or bridge, measure all loudspeaker circuit's impedance at 1.00 kHz while disconnected from the amplifier output and note the data. This will assure that the speaker circuits are free of faults and will not overload the amplifier.
5. With the pink noise (or sweep generator) off and power amplifier on, and with all amplifier attenuation controls set at an 80.0% rotation (or +80.0 dB where applicable) in all areas, the system hum and noise must be inaudible. Any mechanical rattles or audio distortion must be corrected at this time.
6. Perform time domain alignment of full frequency loudspeaker and separated subwoofer units. It is recommended that the AVC coordinate with the loudspeaker manufacturer regarding this complex procedure.

    a. Utilize and record an impulse response sweep for both the full frequency loudspeakers and the subwoofers separately.
    b. Time align the full frequency loudspeaker's 1st peak with that on the subwoofer's 1st peak.
    c. Verify time alignment by testing various locations in the space and document microphone locations on floor-plan drawings that correspond to testing results.
    d. Consider using AFMG SysTime V1.3.7 (or newer) as an alignment software tool, or similar.
    e. It is understood that not all locations can be perfectly aligned but the AVC shall adjust the system for the best overall performance with the space under test.

7. Apply the pink noise or sweep generator signal to system and adjust for a working level for the equalization of the system of at least +20.0 dB above the ambient sound level. Hearing protection must be provided for all individuals present.
8. Check for uniformity of coverage utilizing a 32-band, 1/12-octave Class 1 spectrum analyzer. The level in all areas must not deviate more than +/- 2.00 dBC. Correct any out of tolerance deviations before proceeding.
9. System Ring-Out (Feedback Reduction): Once the sound system has been equalized to obtain a flat response, each microphone input (hardwired & wireless) shall ring out using the following procedure or similar. Hearing protection must be provided for all individuals present:

    a. Attach oscilloscope to the output of the sound system.
    b. Turn on one (1) microphone.
    c. Raise system volume until feedback begins.

d. Use the oscilloscope to find the largest peak.
e. Add a very narrow parametric filter to “notch” out that frequency on the corresponding microphone channel.
f. Repeat feedback procedure to eliminate several feedback frequencies. When using wireless microphones, be sure to walk about the space to excite other potential feedback frequencies.
g. Once feedback has been essentially eliminated from the microphone, (in software) add a compression module or block with moderate compression ratio, attack and release settings. When the microphone is used the effect shall not be noticeable.
h. Verify that the compression algorithm has not altered the feedback suppression in place.
i. Test remaining microphone input(s) using the same general procedure.

10. Document all findings. Provide the Contracting Officer “Before” and “After” spreadsheet and resultant frequency response curves and graphical test results for all low impedance full frequency range loudspeakers, sub-woofers and loudspeaker clusters, array devices etcetera.

E. Acoustical Tests

1. Make all necessary adjustments to ensure proper operation of the system. Tests and adjustments shall be performed when all ceiling tiles, acoustical treatment panels, sound screens, furnishings, etcetera are in their final position and ready for personnel. HVAC and lighting shall be operating at normal conditions.
2. The overall space average acoustical frequency response within each area served shall be within the limits given by the Contracting Officer within this specification. Test signals shall be broadband “pink” noise applied to any system input. Measurements shall be made using 1/12-octave band filters centered on ANSI preferred frequencies. Sweep tests can also be utilized.
3. Throughout the coverage area of the system, amplified sound levels shall not vary more than +/- 3.00 dB as measured using an octave band of “pink” noise centered at 4.00 kHz as the test signal.
4. Measurements of system performance shall be made using a calibrated ANSI S1.4, Type I sound level meter set for “slow” meter damping and flat response. The microphone shall be positioned 4.00 feet above the floor within the area served by the system. The system gain shall be set to provide octave band levels at least 10.0 dB above background noise levels in any octave band at the measuring locations for these tests.
5. Low Impedance Systems: Measurements shall be taken in a grid fashion at twenty (20) foot intervals in all directions. Provide a floor-plan map to add clarity that may be used during Final Acceptance Testing by the Contracting Officer.
6. Volt Systems: Measurements shall be taken on axis as well as at the point of overlapping speaker coverage.
7. Upon completion of above tests and any necessary adjustments, submit two (2) copies of a written report presenting test results in graphical format with units clearly marked, including numerical values in a table where necessary, for review by the Contracting Officer prior to Final Acceptance Testing, final tuning and demonstration. With this report, submit written certification that the installation conforms to the requirements stated herein, is complete in all respects, and is ready for inspection, testing and final tuning.

F. Balanced Twisted Pair Cable Testing (CAT6A or newer):

1. All outlets, cables, patch panels, and associated components shall be fully assembled and labeled prior to testing. Any testing performed on incomplete systems shall be redone upon completion of work.
2. Testing shall be performed on each cabling segment. Sampling is not acceptable
3. Testing of horizontal cabling shall not be performed on test equipment with marginal pass/fail notification disabled. If the tester is capable of indicating tests that pass with a measured value closer to the limit than the guaranteed accuracy of the tester, the test result shall be marked (typically as “Pass” or “Fail”).
4. Marginal pass results will not be accepted. The contractor shall correct issues and retest at no expense to the Contracting Officer.

G. General Video Systems Tests:

1. Check to determine that all projectors, projector bases, carts, tables, and mirrors are rigid and vibration-less in operation.
2. Test and record all optical projection images for average light level, light fall-off, image alignment, and size to comply with the manufacturer’s performance standards and specification drawings.

H. HDBT Distributed Video System Tests:

1. AVC shall test every possible routing of sources, matrix switching cross-points and end point sinks etcetera and document the results for future reference. This procedure shall take place after the initial category cable point-to-point testing.
2. The Contractor shall provide to the Contracting Officer a copy of the following test results in electronic format in order to verify the AV video equipment has been installed and configured correctly:

    a. The number of HDCP KDVs Keys supported by each source.
    b. The video timing, HDCP use and audio format of each source when operating.
    c. The video timings and supported audio formats for each connected sink.
    d. The video timings and supported audio formats presented in the EDID to each source. The preferred video timing shall be indicated.
    e. The length of cable used on all shielded twisted pair cable used for AV distribution.
    f. The data rate supported by each twisted pair cable used for AV distribution per table below:

3.11	Video Format	3.12	Data Frame Rate (Gbps)
3.13	4320p (8k / 60 fps) + HDR1	3.14	80.19
3.15	4320p (8k / 60 fps)	3.16	64.15
3.17	2160p (4k / 60 fps) + HDR1	3.18	20.05
3.19	2160p (4k / 60 fps)	3.20	17.82
3.21	UHD 3840 x 2160 (60 fps)	3.22	11.9
3.23	1080p + HDR1	3.24	5.57
3.25	1080p (60 fps)	3.26	4.46
3.27	1600 x 1200	3.28	4.86
3.29	1920 x 1200	3.30	4.62
3.31	1080p	3.32	4.44

3.33	1360 x 768	3.34	2.54
3.35	720p / 1080i	3.36	2.22

a. Notes:
   1) HDR is defined as 10-bit color (Dolby Vision is optimized at 12-bit color. Not used here.)
   2) Chromas Subsampling used for this table was 4:4:4

2. Check that the image is correctly displayed on the video monitors and/or the video projector. Image must completely fill the imaging area and be "square" without the use of any type of "key-stoning" on video projection systems. No exceptions.
3. Test each input using crosshatch signal, checkerboard signal, Moiré and "H" pattern signals, color balance and greyscale / contrast etcetera at the scan rates indicated in items above.
4. Repeat tests at each connection location.

B. Blu-ray / Universal Format Player Tests:

1. Insert the pre-recorded 4k disc into the deck and check operation of the control panel's transport controls as well as picture image quality. Also check that the audio signal is head from the left and right speakers, where applicable.
2. Check that the transport controls are logically presented on the touch screen GUI
3. Check that the audio and video signals are recorded and can be played back on the picture monitor(s) and/or the video projector and the left, right and surround loudspeakers etcetera, where applicable.

C. Network Distributed Video System Tests:

1. AVC shall test every possible routing of sources and end point sinks etcetera and document the results for future preference. This procedure shall take place after the initial category cable point-to-point testing as detailed above.

D. Video Coaxial Distributed Digital Cable System Tests:

1. AVC shall test and verify all gain losses as documented in the Shop Drawing submittals. Any endpoint that requires additional gain or attenuation shall be in compliance with the signal strength the sink device requires.

E. Bluetooth Device Tests:

1. Document which Bluetooth Standard Profiles are being used in the project: A2DP, HFP, HSP etcetera.
2. Document the release version of Bluetooth being used, i.e. 5.2 or newer.
3. Provide a discrete name for all Bluetooth receivers via manufacturer's software.
4. Verify each receiver's ability to perform pairing.
5. Document connectivity range to verify it is within manufacturer's specifications.
6. Document names, test results, and software package used.

F. Assistive Listening System (ALS) Tests:

1. Verify that the entire scope area to be covered by the ALS provides clear audible sound with no discernable distortion.

3.37 DEMONSTRATION AND FINAL ACCEPTANCE TESTING

A. General:

1. Final Acceptance Testing shall not be performed until the AV Contractor's system checkout has been completed, documented, and results submitted to the Contracting Officer for approval.
2. Upon approval of the AVC test reports by the Contracting Officer, and at a time established by the Contracting Officer, demonstrate the operation of each major component of the system and the completed installation. Typically ten (10) working days after the AVC test documentation / As-Built Drawings have been submitted for approval.

B. Site Testing: To be conducted in the presence of the Contracting Officer and shall consist of the following:

1. Final As-Built Drawings, run sheets, O & M Manuals, submitted test results, and other required documents, as detailed in the Construction Documents shall be on hand. One (1) complete set of these documents shall be delivered to the Contracting Officer at this time (one complete set shall have been delivered to the Contracting Officer prior to the scheduling of Final Acceptance Testing in PDF format).
2. A physical inventory will be taken of all equipment on site and will be compared to equipment lists in the contract documents.
3. The AVC shall demonstrate the operation of all system equipment installed.
4. Both subjective and objective tests shall be required by the Contracting Officer to determine compliance with the specifications. The AVC shall be responsible for providing test equipment for this exercise. Therefore, be prepared to repeat and verify test results previously submitted to the Contracting Officer. It is anticipated that final loudspeaker tuning / equalization adjustments shall be made at the direction of the Contracting Officer.

C. After demonstration, assist as required in the following acceptance tests:

1. Listening tests: These tests may include speech intelligibility survey and subjective aural evaluations by observers at various positions under various operating conditions, using live speech and/or recorded music material.
2. Equipment tests: Any measurements of frequency response, distortion, noise or other characteristics and any operational tests deemed necessary may be performed on any item or group of items to determine conformity with these requirements.

D. Control System Operation: AVC shall coordinate with the Contracting Officer to review the operation of the AV system prior to and during installation. During the second training session, the Contracting Officer can request additional changes and updates to the GUI and system functionality if they so choose without additional cost to the project.

E. If the need for adjustment or modification becomes fully evident during demonstration and testing, continue working until the installation operates fully in accordance with the requirement of this specification.

F. In the event significant adjustments are required during the Final Acceptance Testing phase, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the Contracting Officer.

3.38 DOCUMENTATION

A. Project Record: The AV Contractor shall supply one (1) clean full-size print of the system drawings which show all changes which were made during fabrication and installation to the Contracting Officer.

B. Maintenance Information:

1. The AV Contractor shall provide technical information for all electronic apparatuses, including but not limited to schematic diagrams and parts lists, manufacturer's installation instructions, operating instructions, and technical specifications.
2. The AV Contractor submittal shall include all shop drawings prepared and used by the AVC, as well as those which were not required to be submitted for approval. This shall include, but not be limited to, wiring diagrams, schedules for identification of building wiring and installation details useful to a maintenance technician.

C. Operation and Maintenance (O & M) Manuals:

1. Provide one (1) hard copy of an instruction manual to the Contracting Officer containing the following:

a. Table of Contents
b. Bill of Materials
c. Instructions for operating the system in all modes of operation and for fulfilling all functional requirements.
d. List of settings and adjustments for semi-fixes controls.
e. Manufacturer's sheets of specifications, operating instructions, and service information arranged alphabetically by manufacturer and then by model number.
f. Detailed wiring diagrams and the simplified one-line diagram.
g. All system and device software files, executable, GUI etcetera.

D. Quick Reference Guides:

1. AVC to provide the Contracting Officer with two (2) laminated "Quick-Reference Guides" detailing the operation of each standalone AV system.
2. This shall include both touch-panel layouts and general system "how-to" quick-referenced.
3. This guide should be no longer than two (2) pages where both sides of a standard letter sized sheet are used.

3.39 TRAINING AND INSTRUCTION

A. A minimum of sixteen (16) hours of training shall be provided by the AV Contractor, at a time mutually agreed upon between the Contracting Officer and AV Contractor.

1. Eight (8) hours prior to Final Acceptance Testing.
2. Eight (8) hours one (1) month following the initial training. This will allow the Contracting Officer to acquaint themselves with the system so that they can provide follow up questions as to the systems operation.

B. During the training, the participants shall be given opportunities for “hands-on” experience with operating the controls. There shall be visual and audible demonstrations using the systems themselves as aids. Personnel for instruction and training for the AV systems shall be designated by the Contracting Officer.

C. In the event the AVC does not have qualified instructors on staff for projects with sophisticated or complex equipment, the Contractor will provide a manufacturer’s representative for such instruction at no additional cost to the Contracting Officer.

D. Training will be video recorded by the AVC on a DVD / Blu-ray disc or flash drive as designated by the Contracting Officer. AVC will supply the equipment necessary to record the training sessions. The AV Contractor shall provide two (2) electronic copies to the Contracting Officer and one (1) full-size set of documentation.

END OF SECTION 27 41 00

SECTION 28 00 01 - ELECTRONIC SAFETY BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in this Section applies to Division 28, Electronic Safety work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Contracting Officer's use of electronic safety systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, and Contracting Officer/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly, and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installing, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability, or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Contracting Officer for consideration, in accordance with Division 01, General Requirements, and approved by the Contracting Officer prior to submitting bids for substituted items.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities having jurisdiction, including local fire marshal, insurance underwriter, Contracting Officer, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section apply to Division 28, Electronic Safety Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
   a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
   b. Drawings
   c. Addenda
   d. Contracting Officer/Contractor Agreement

e. Codes, Standards, Public Ordinances and Permits

C. Contents of Division 26, Electrical apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 28, Electronic Safety Sections, and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements, and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. International Code Council:
   a. International Building Code (IBC)
   b. International Fire Code (IFC)
   c. International Existing Building Code (IEBC)

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABAAS - Architectural Barriers Act Accessibility Standards
2. ANSI - American National Standards Institute
3. ASCE - American Society of Civil Engineers
4. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
5. ASHRAE Guideline 0, the Commissioning Process
6. ASME - American Society of Mechanical Engineers
7. ASTM - ASTM International
8. CFR - Code of Federal Regulations
9. EPA - Environmental Protection Agency
10. ETL - Electrical Testing Laboratories
11. FM - FM Global
12. ISO - International Organization for Standardization
13. NEC - National Electric Code
14. NEMA - National Electrical Manufacturers Association
15. NFPA - National Fire Protection Association
16. OSHA - Occupational Safety and Health Administration
17. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association
18. UL - Underwriters Laboratories Inc.

D. See Division 28, Electronic Safety individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

D. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Contracting Officer on all transmissions/submissions.

E. Product Data: Provide manufacturer's descriptive literature for products specified in Division 28, Electronic Safety Sections.

F. Identify/mark each submittal in detail. Note what difference, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.

1. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
2. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished, or provided. Reference individual Division 28, Electronic Safety specification Sections for specific items required in product data submittal outside of these requirements.
3. See Division 28, Electronic Safety individual Sections for additional submittal requirements outside of these requirements.

G. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items. Incomplete submittal documentation will be returned to without review. Contractor must arrange for, and bear costs of, the reviewing entity's additional reviews.

H. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Contracting Officer's comments. Identify Contracting Officer's comments and provide an individual response to each of the Contracting Officer's comments. Cloud changes in the submittals and further identify changes which are in response to Contracting Officer's comments.

I. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

J. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 28, Electronic Safety Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety submittals.

K. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

L. Substitutions and Variation from Basis of Design:

1. The Basis of Design designated product where provided in the specifications or on the drawings, establishes the parameters used for space planning coordination with other disciplines.
2. If substitutions from the basis of design and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor are required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be submitted to Contracting Officer for approval prior to purchase, delivery, or installation.
3. Where manufacturer equipment or model numbers are indicated with no exceptions, substitutions will be rejected.

M. Shop Drawings:

1. Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 28, Electronic Safety specification Sections for additional requirements for shop drawings outside of these requirements.
2. Provide Shop Drawings indicating access panel locations, size, and elevation for approval prior to installation.

N. Samples: Provide samples when requested by individual Sections.

O. Resubmission Requirements:

1. Make any corrections or change in submittals when required by Contracting Officer's review comments. Provide submittals as specified. The Contracting Officer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
2. Resubmit for review until review indicates no exception taken or "make corrections noted."
3. When submitting drawings for Contracting Officer's re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

P. Operation and Maintenance (O&M) Manuals:

1. Reference individual Division 28, Electronic Safety Specification Sections for additional requirements for operations and maintenance manuals.
2. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
   a. Include copy of approved submittal data along with submittal review letters received from Contracting Officer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
   b. Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, and quantities relevant to each piece of equipment.
   c. Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.
   d. Include Warranty per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 28, Electronic Safety Sections.
   e. Include product certificates of warranties and guarantees.
   f. Include copy of start-up and test reports specific to each piece of equipment.
   g. Include commissioning reports.
   h. Incomplete submittal documentation will be returned to without review. Contractor must arrange for, and bear costs of, the reviewing entity’s additional reviews.

3. Thoroughly instruct the Park Staff as directed by the Contracting Officer in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 28 00 01, Electronic Safety Basic Requirements Article titled "Demonstration."
4. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

Q. Record Drawings:

1. Maintain at site at least one set of drawings for recording “as-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements and location of concealed items. Include items changed by addenda, field orders, supplemental instructions, and constructed conditions.
2. Record Drawings are to include equipment locations, calculations, and schedules that accurately reflect "as constructed or installed" for project.
3. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.
4. See Division 28, Electronic Safety individual Sections for additional items to include in Record Drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (e.g., cable tray, panels, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Contracting Officer in writing before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 28, Electronic Safety Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements, and the General Conditions. Confirm requirements in all Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacture, including but not limited to panels, devices and equipment unless otherwise specified in individual Division 28, Electronic Safety Sections.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products listed in manufacturer's printed catalog data and are to be UL, ETL, or FM listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of Colorado, and Federal regulations relating to hazardous materials.
2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Contracting Officer.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 28, Electronic Safety Sections.

B. Install equipment having components requiring access (i.e., devices, equipment, electrical boxes, panels, etc.) so that they may be serviced, reset, replaced, or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles, or crawlspaces which would impede, or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Contracting Officer prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents.
2. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections, and the following:
   a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
   b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
   c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection.
2. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around conduit, raceway, and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Plenums: In plenums, provide plenum rated materials that meet the requirements to be installed in plenums.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 28 Electronic Safety Sections.

B. Earthquake resistant designs for Electronic Safety (Division 28) systems and equipment to conform to regulations of jurisdiction having authority.

C. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

D. Provide means to prohibit excessive motion of safety equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, individual Division 28, Electronic Safety Sections.

B. Notify Contracting Officer in writing at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground conduit and wire installation prior to backfilling.
2. Prior to covering walls when electronic safety systems installation is started.
3. Prior to ceiling cover/installation.
4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CUTTING AND PATCHING

A. Confirm Cutting and Patching Requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

B. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections, and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Contracting Officer/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Contracting Officer for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching, and repairing for work specified in this Division including gypsum, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, repair, refinish and leave in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost adjustment to the Contract.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost adjustment to the Contract.

3.6 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

B. In absence of specific requirements, comply with the individual Division 28, Electronic Safety Sections, and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt, and construction dust.
2. Protect equipment and pipe to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect devices, panels, and similar items until in service.

4. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage to be replaced before installation.

3.7 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 28, Electronic Safety Sections.

B. Upon completion of work and adjustment of equipment, test systems, demonstrate to Contracting Officer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Contracting Officer's Staff as specified in Division 01, General Requirements and individual Division 28, Electronic Safety Sections.

C. Manufacturer's Field Services: Furnish services of a qualified factory certified instructor at time approved by Contracting Officer, to instruct maintenance personnel, correct defects, or deficiencies, and demonstrate to satisfaction of Contracting Officer that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.8 CLEANING

A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 28, Electronic Safety Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.9 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 28, Electronic Safety Sections.

B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to building structure. Maintain manufacturer's recommended clearances.

C. Start-up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

D. Provide miscellaneous supports required for installation of equipment, conduit, and wiring.

3.10 PAINTING

A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes.

3.11 DEMOLITION

A. Confirm requirements in Division 01, General Requirements and Division 02, Existing Conditions.

B. In the absence of specific requirements, comply with individual Division 28, Electronic Safety Sections, and the following:

1. Scope:
   a. It is the intent of these documents to provide necessary information and adjustments to electronic safety system required to meet code, and accommodate installation of new work.
   b. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, pay for damages caused by failure to locate and preserve underground utilities. Replace damaged items with new material to match existing. Promptly notify Contracting Officer if utilities are found which are not shown on Drawings.
   c. Coordinate with Contracting Officer so that work can be scheduled not to interrupt operations, normal activities, building access, access to different areas. Contracting Officer will cooperate to best of their ability to assist in coordinated schedule, but will remain final authority as to time of work permitted.
2. Examination:
   a. Determine exact location of existing utilities and equipment before commencing work, pay for damages caused by failure to locate and preserve utilities. Replace damaged items with new material to match existing.
   b. Verify that abandoned wiring and equipment serve only abandoned facilities.
   c. Demolition drawings are based on casual field observation and existing record documents.
      1) Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish work.
      2) Verify location and number of electronic safety system devices, panels, etc. in field.
   d. Report discrepancies to Contracting Officer before disturbing existing installation.
3. Promptly notify Contracting Officer if systems are found which are not shown on Drawings.
4. Execution:
   a. Remove existing electronic safety equipment, devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless shown as retained or relocated on Drawings.

b. Provide temporary wiring and connections to maintain electrical continuity of existing systems during construction. Remove or relocate electrical boxes, conduit, wiring and equipment as encountered in removed or remodeled areas in existing construction affected by this work.

c. Remove and restore wiring which serves usable existing outlets clear of construction or demolition.

d. If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing electrical equipment which is being retained, provide new conduit and wire to bypass abandoned outlets.

e. If existing conduits pass through partitions or ceiling which are being removed or remodeled, provide new conduit and wire to reroute clear of construction or demolition and maintain service to existing load.

f. Extend circuiting and devices in existing walls to be furred out.

g. Remove abandoned wiring to source of supply.

h. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

i. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

j. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

k. Existing electronic safety system components are indicated on demolition plans. Verify exact location and number of existing devices and components in field. Only partial existing systems shown. Locations of items shown on Drawings as existing are partially based on Record and other Drawings which may contain errors. Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish intent of Contract Documents.

l. Remove abandoned wiring to leave site clean.

m. If existing electrical equipment contains PCBs (Polychlorinated Biphenyl), replace with new non-PCB equipment. Dispose of material containing PCBs as required by federal and local regulations.

n. Repair adjacent construction and finishes damaged during demolition work.

o. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

5. Existing Fire Alarm System: Maintain existing system in service during construction. Disable system only to make switchovers and connections.

a. Notify Contracting Officer before partially or completely disabling system.

b. Notify local fire service.

c. Make notifications at least five working days in advance.

d. Make temporary connections to maintain service in areas adjacent to work area.

3.12 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

B. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections. System cannot be considered for acceptance until work is completed and demonstrated to Contracting Officer that installation is in strict compliance with Specifications, Drawings, and manufacturer's installation instructions, particularly in reference to following:

1. Cleaning
2. Operation and Maintenance Manuals
3. Training of Operating Personnel
4. Record Drawings
5. Warranty and Guaranty Certificates
6. Start-up/Test Documents and Commissioning Reports

3.13 FIELD QUALITY CONTROL

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

B. In absence of specific requirements, comply with individual Division 28, Electronic Safety Sections, and the following tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Closeout Documents.
2. During site evaluations by Contracting Officer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement in letter that electronic safety systems were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals.

B. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in operating and maintenance manuals.

END OF SECTION

SECTION 280010 – SUPPLEMENTAL REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplemental requirements generally applicable to the Work specified in Division 28.
   a. Work specified in Division 28 may be applicable to, or in coordination with, trades other than division 28. It is the contractor's responsibility to coordinate with other trades to define and complete the scope of work.

B. Related Requirements:

1. Refer to the division 26 specifications for further information regarding:
   a. Abbreviations, acronyms, definitions, and additional coordination drawing submittal requirements.
2. Section 270010 "Supplemental Requirements for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
3. Refer to the specifications below:
   a. 281300 – Access Control Software and Database Management
   b. 281400 – Access Control System Hardware
   c. 281600 – Intrusion Detection
   d. 282000 – Video Surveillance

1.2 REFERENCES

A. Abbreviations and Acronyms for Electronic Safety and Security:

1. ACU: (mass notification) Autonomous control unit.
2. BMS: Building management system.
3. FACU: Fire-alarm control unit.
4. HPSA: (mass notification) High power speaker array.
5. LOC: (mass notification) Local operator console.
6. PoE: Power over Ethernet.
7. POTS: Plain old telephone service. See "public switched telephone network."
8. SCBA: Self-contained breathing apparatus.
9. TCP/IP: Transmission control protocol/Internet protocol.

B. Definitions for Electronic Safety and Security:

1. Calling Party Control (CPC): A momentary break in phone line loop current, which is used to signal voicemail and other automated telephone company services that distant party has hung up.
2. Private Branch Exchange (PBX): Analog telephone switch that routes calls internal to a business or organization so a direct external line for each phone is unnecessary.
3. Public Switched Telephone Network (PSTN): Analog telephone technology that uses twisted-pair cables from a telephone-provider central office for the transmission medium. PSTN refers to the telephone network; POTS refers to the individual subscriber line.
4. Remote Office Phone System (ROPS): VoIP system that allows phones for a business or organization located anywhere in the world with internet connectivity to behave similar to phones connected to a PBX.
5. Ringer Equivalence Number (REN): The loading effect of a single traditional telephone ringing circuit. TIA-968 defines REN 1 as an impedance of 7000 Ω at 20 Hz (Type A ringer) or 8000 Ω from 15 Hz to 68 Hz (Type B ringer). The sum of the RENs for all devices on a subscriber line circuit may not exceed the maximum permitted REN for the subscriber line.
6. Voice over Internet Protocol (VoIP): Digital telephone packet technology that uses the internet for its transmission medium.

1.3 COORDINATION

A. The Technology drawings and specifications provide the scope and requirements of construction applicable to multiple trades and systems. These systems are inclusive of, but not limited to, video surveillance, access control, intrusion detection, and other such communication systems. Each system requires the coordination of multiple contracting trades and disciplines. It is the responsibility of each contractor to review all technology scope and to coordinate with other disciplines.

B. Contractor shall coordinate with all other trades prior to construction, at minimum, contractor shall coordinate with the general, electrical, and other low voltage contractors. It is the contractor's responsibility to ensure all other contractor trades are aware and knowledgeable of the system requirements and associated responsibilities as defined in these construction documents.

C. Contractor shall always maintain a working set of the construction documents in field (These may be printed or virtual). These documents shall always represent the latest information as well as capture all changes to final constructed solution(s). Any cost associated with an unaccepted installation, and subsequent reinstallation, due to the wrong documentation reference is the sole responsibility of the contractor and shall not be a cost transferred to the contracting officer. At a minimum, the working set of construction documents shall include:
   1. The latest version of construction documents
   2. All changes associates with change orders, RFIs, Addenda, email, and/or other such documentation
   3. All field coordinated changes and/or changes to be captured in as-built drawings.

D. For any and all discrepancies, contractor shall provide written notification to contracting officer and general contractor prior to commencement of work and procurement of material.

E. Interruption of Existing Security System: Do not interrupt security system to facilities occupied by Contracting Officer or others unless permitted under the following conditions:

1. Notify Contracting Officer no fewer than 20 business days in advance of proposed interruption of security system.
2. Do not proceed with interruption of security system without Contracting Officer's written permission.

F. Multi-disciplinary coordination requirements: Ensure that all trades and integrators who are impacted or dependent on the Division 28 scope of work (either via scheduling, constructability, support, or other such means) are contacted and informed of coordination items relevant to their scope of work at least 10 days prior to commencement of work. Furthermore, ensure all trades and integrators whose work has a similar effect on the Division 28 scope of work are contacted for information regarding items relevant to the scope of work at least 10 days prior to work commencement.

1.4 PREINSTALLATION MEETINGS

A. Electronic Safety and Security Preconstruction Conference: Schedule conference with General Contractor and Contracting Officer not later than 10 days after notice to proceed. Agenda topics include, but are not limited to, the following:

1. Installation schedule for security systems.
2. Installation schedule for all systems effecting, or effected by, the security scope of work.
3. Value analysis proposals and requests for substitution of communications equipment.
4. Utility service coordination, outages, inspections, and/or activation.
5. Sustainability activities.
6. Submission of action submittals specified in Division 28.
7. Submission of information submittals specified in Division 28.
8. Submission of closeout submittals specified in Division 28.
9. Orders placed for major equipment.
10. Arrival of major equipment on-site.
11. Preinstallation meetings specified in Division 28.
12. System startup, testing, and commissioning activities for communications equipment.
13. System startup, testing, and commissioning activities for Work specified in other divisions that depends on Work specified in Division 28.
14. Requests for special inspections.
15. Requests for inspections by authorities having jurisdiction.

1.5 ACTION SUBMITTALS

A. Submittals shall be provided in accordance with Division 01 specifications.

B. The items listed below outline the multiple categories of action submittals, and the associated items comprising each category, that may be included in a system's specification. Refer to each division 28 specification for the system specific submittal requirements.
1. Product Data
    a. Manufacturer and Part number

1) Shall be highlighted to indicate version of equipment to be utilized when multiple models/variations of product are present on documentation.

2. Shop Drawings
   a. Contractor shall provide Site Plans, Overall plans, Floor plans, Ceiling plans, One-line Diagrams, Wiring Diagrams, and/or Elevations views as needed to indicate system specific fabrication, installation, layout, connectivity, and coordination.

1.6 INFORMATIONAL SUBMITTALS

A. Submittals shall be provided in accordance with Division 01 specifications.

B. Information submittals shall be submitted to General Contractor at monthly intervals unless otherwise noted/directed by General Contractor.

C. At each issuance, a combined submittal shall be submitted that includes the information submittals from all the division 28 specifications referenced herein.
   1. Where multiple specification sections indicate the same or similar recorded item, it is acceptable for the contractor to submit a combined submittal to address multiple specification sections.
      a. For example, Field Quality Control Reports can be combined to encompass multiple specification sections. It must be noted on report which sections are included in report.

D. The items listed below outline the multiple categories of information submittals, and the associated items comprising each category, that may be included in a system's specification. Refer to each division 28 specification for the system specific submittal requirements.
   1. Coordination Drawings
      a. Drawings indicating specific coordination items between the division 28 scope of work components with elements from architectural, structural, and other trades.
   2. Installer Qualification Data
      a. Certification information of each title as specified.
   3. Field Quality Control Reports
      a. Reports that include the following:
         1) Adherence and/or adjustments to installation schedule
         2) Adherence and/or adjustments to procurement schedule
         3) System Start-up, Testing, Commissioning and Turn-Over schedules
         4) System outages and downtime
         5) Major Equipment order placing and arrival schedules
         6) Waste-management and work site cleanliness adherence
         7) Testing and Verification Results
   4. Factory Test Reports
      a. Manufacturer generated test reports validating the products viability prior to being shipped.
   5. System Testing Plans
      a. A scheduled plan to execute the testing requirements of a specific product in accordance with manufacturer requirements, industry recommendations, and specification requirements.

b. Plan shall include testing procedures, testing equipment, pass/fail thresholds per test, testing parameters of equipment and test, and the proposed schedule for testing plan.

6. Certificates

a. Seismic-Load Performance Certificates: Provide special certification as indicated in Paragraph 13.2.2 "Special Certification Requirements for Designated Seismic Systems" of ASCE/SEI 7-16 for designated seismic-load systems identified on Drawings or in the Specifications.

1) Include the following information:

a) Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

b) Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

c) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

d) Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

e) Provide equipment manufacturer's written certification for each designated active electrical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction.

f) Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by qualified structural professional engineer.

b. Wind-Load Performance Certificates: Provide special certification for designated wind-load systems and components identified on Drawings or in the Specifications.

1) Include the following information:

a) Provide equipment manufacturer's written certification for each designated system and component, stating that it will remain in place and operable following the design wind event and comply with requirements of authorities having jurisdiction.

b) Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

1.7 CLOSEOUT SUBMITTALS

A. Submittals shall be provided in accordance with Division 01 specifications.

B. A combined submittal shall be submitted to the Contracting Officer that includes the closeout submittals from all the division 28 specifications referenced herein.

1. Where multiple specification sections indicate the same or similar recorded item, it is acceptable for the contractor to submit a combined submittal to address multiple specification sections.

a. For example, Record Documentation can be combined to encompass multiple specification sections. It must be noted on document which sections are included in document.

C. The items listed below outline the multiple categories of closeout submittals, and the associated items comprising each category, that may be included in a system's specification. Refer to each division 28 specification for the system specific submittal requirements.

1. Record Documentation:
   a. Including the installed location of equipment and components.
2. Operation and Maintenance Data:
   a. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device listed below:
   b. Manufacturer's operating specifications.
   c. User's guides.
   d. Schedule of maintenance material items recommended to be stored at Project site.
   e. Detailed instructions covering operation under both normal and abnormal conditions.
   f. Instructions for setting field-adjustable components.
   g. Manufacturer's instructions for testing, adjusting, and maintaining component/equipment.
3. Warranty Information
   a. Manufacturer's and Contractor's Warranty Documents
   b. Maintenance Contracts and Service Agreements
4. Software and Firmware Operational Documentation: Provide software and firmware operational documentation, including the following:
   a. Software operating and upgrade manuals.
   b. Names, versions, and website addresses for locations of installed software.
   c. Device address list.
   d. Printout of software application and graphic screens.
   e. Testing and adjusting of panic and emergency power features.
   f. Provide the program Software Backup username and password for approved online or cloud solution.
   g. Provide to Contracting Officer the upgrades and unrestricted licenses for installed and backup software, including operating systems and programming tools required for operation and maintenance.
5. Extra Materials
   a. Furnish to Contracting Officer extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
6. Field Test and Inspection Reports
   a. Preform testing per system specification and submit associated report.
   b. All test reports shall be combined and submitted as a single file and combined report.

1.8 QUALIFICATIONS

A. Qualified Regional Manufacturer: Manufacturer, possessing qualifications specified in Section 014000 "Quality Requirements," that maintains a service center capable of providing

training, parts, and emergency on-site repairs to Project site with response time less than forty-eight hours.

B. Security Design Professional: Design professional with active Physical Security Professional (PSP) certification issued by American Society for Industrial Security (ASIS) and with documented experience managing installation of security systems in similar size and complexity.

C. Security Testing Agency: Entity possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

1. On-site security testing supervisor must have an ASIS certification and documented training and experience with testing security equipment in accordance with ASIS testing standards.

PART 2 - PRODUCTS

2.1 SECURITY EQUIPMENT

A. Products shown within the associated division 28 specifications, and/or within associated drawings/schedules, shall be considered as basis of design, unless specifically noted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Immediately upon initial (1st day) arrival to site, contractor shall coordinate with General Contractor for all site and project specific information. Contractor shall adhere to all General Contractor requirements throughout duration of project.

2. Prior to commencement of work, contractor shall reference and/or inspect the following conditions:
   a. All safety and security protocols specific to site construction.
   b. The most current version of construction documents as specified in section 1.3.C herein.
   c. The most updated/recent version of project and installation schedule(s).
   d. All coordinated work previously completed and coordinated work that is uncompleted but scheduled for prior completion.
   e. Current construction conditions affecting scope of work.

3. For any and all questions, concerns, coordination, or other project specific information, especially those affecting schedule, quality of work, or system acceptance, contractor shall inform General Contractor in as timely a manner as possible.

B. Preinstallation Testing:

1. It is the contractor's responsibility to ensure that all material and equipment is tested for acceptance pursuant to the manufacturer's specifications and parameters prior to installation.

2. All material and equipment shall be tested for acceptance immediately upon being received by contractor.
   a. If material and/or equipment is received off-site, material and/or equipment shall be retested and confirmed to be acceptable upon arrival on-site.

3. Any material and/or equipment that fails testing procedure and is unacceptable for installation shall be noted and communicated to manufacturer. Dependent upon scope and breadth of failures, contractor shall coordinate required replacement material and maintain installation schedule. If failures affect the installation schedule and/or project schedule, contractor shall inform the General Contractor.

3.2 PREPARATION

A. Protection of In-Place Conditions:

1. Contractor shall always maintain a neat and orderly workspace while on site. The workspace shall not interfere with, or in any other form, disallow other trades to complete their scope of work or maintain proper schedule of work.

2. All tools, material, equipment, trash, etc., shall be maintained to be always neat and orderly while on site.

3. All material and equipment that has been installed shall be protected in place. It is the contractor's responsibility to ensure all installed equipment is protected in place through means of protective coverings, enclosed/restricted spaces, and coordination with other trades. The items of note include, but are not limited to:
   a. Capping/Taping the open ends of unused conduit and open backboxes while protecting pull string.
   b. Covering of all active equipment and termination components to ensure any openings, ports, or other such component orifices are protected from elements such as water, dust, and construction debris and/or material.
   c. Isolation of telecommunication rooms and equipment from general construction whenever possible to minimize water, dust, and construction debris and/or material.
   d. Protection of active equipment from tampering, especially pre-configured or recently configured.
   e. Proper bonding and grounding of all equipment immediately upon installation.

3.3 INSTALLATION OF ELECTRONIC SAFETY AND SECURITY WORK

A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' instructions, comply with NFPA 70, NFPA 72, NFPA 731, and NECA NEIS 1 for installation

of Work specified in Division 28. Consult Contracting Officer for resolution of conflicting requirements.

3.4 SYSTEM STARTUP

A. Commissioning Activities:

1. Contractor shall reference and adhere to manufacturer's startup/activation requirements for commissioning.

2. Commissioning effort shall ensure that system is complete and operational prior to final testing, system turnover and substantial completion.

3.5 FIELD QUALITY CONTROL

A. Administrant for Security Tests and Inspections:
   1. Contractor shall administer and perform tests and inspections.
   2. Contractor may utilize assistance of factory-authorized service representative, or a third-party certified testing authority, at no cost to Contracting Officer.

3.6 CLEANING

A. Waste Management:

1. Proper disposal and on-site management of all waste material, packaging, and other such extra items not scheduled for install is required. It is the contractor's responsibility to ensure all waste management procedures and protocols are observed and practiced with regards to any and all waste accumulated.

2. Prior to initial (1st day) arrival on site, contractor shall coordinate with General Contractor for current site conditions, rules, regulations, and requirements regarding the accumulation and disposal of waste.

3. The requirements below are in addition to General Contractor defined site requirements, not in lieu of, and shall not supersede any site requirements. Any discrepancy between the below and the site requirements shall be communicated to General Contractor for further clarification.
   a. All trash or waste accumulated shall be properly disposed of at the end of each day.
   b. Any material deemed hazardous must be disposed of immediately. Disposal of material shall be communicated to, and coordinated with, General Contractor.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration:

1. Contractor shall coordinate with Contracting Officer and general contractor to schedule time and attendance for a contractor provided demonstration of the operability of the following systems and equipment:

    a. Access Control System (ACS)
    b. Video Surveillance System (VSS)
    c. Intrusion Detection System (IDS)

2. It is acceptable for contractor to engage sub-contractors, manufacturer representatives, and/or third parties, to conduct demonstration. Any engagement of such shall be at no cost to Contracting Officer.

3. At Contracting Officer's request, Contractor shall record demonstration(s) or allow Contracting Officer to record demonstration(s). Any contractor provided recording shall be at no extra cost to Contracting Officer.

B. Training:

1. Train Contracting Officer's maintenance personnel on any system and/or equipment defined herein. Training shall be administered by contractor(s) over a duration as specified below. This shall include the training of how to adjust, operate, update, and maintain the system(s) as specified in:
    a. Section 281300 "Access Control Software and Database Management"
        1) 1 hour at minimum
    b. Section 281400 "Access Control System Hardware"
        1) 1 hour at minimum
    c. Section 281600 "Intrusion Detection"
        1) 3 hours at minimum
    d. Section 282000 "Video Surveillance"
        1) 3 hours at minimum

2. At Contracting Officer's request, Contractor shall record training session(s) or allow Contracting Officer to record session(s). Any contractor provided recording shall be at no extra cost to Contracting Officer.

END OF SECTION 280010

SECTION 28 08 00 - COMMISSIONING OF FIRE ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Test Equipment

B. Summary:

1. Fire alarm commissioning requirements are included in this Section.
2. Commissioning is the process of reviewing system installation and operation to confirm the systems are installed and operating per the design intent and contract documents. It does not replace the official testing and acceptance of the authority having jurisdiction.

C. Definitions:

1. Reference Division 28, Electronic Safety and Security and Division 01, General Requirements.
2. Commissioning Authority: Commissioning Agent, representing the Contracting Officer and directing commissioning activities.

1.2 RELATED SECTIONS

A. Contents of Division 28, Electronic Safety and Security and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 01 91 14, Total Building Commissioning
2. Section 28 00 01, Electronic Safety Basic Requirements
3. Section 28 46 00, Fire Detection and Alarm

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

B. In addition, meet the following:

1. ASHRAE Guideline 0 - The Commissioning Process
2. NFPA 3 - Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems

1.4 SUBMITTALS

A. Submittals as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

B. In addition, provide:

1. Reference Section 01 91 14, Total Building Commissioning, for specific Commissioning submittal requirements.
2. In addition, submit the following:
   a. NFPA 72 Record of Completion
   b. Smoke Detector Sensitivity Report
   c. Alarm Signal Audibility (dB) Levels Report

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

B. In addition, provide:

1. Manufacturer's Warranty.
2. Commissioning, inspecting, and testing not to modify terms or time periods of fire alarm equipment, systems, and controls warranties including related equipment and systems, and adjacent work.

1.7 COORDINATION

A. Coordination as required by Division 28, Electronic Safety and Security and Division 01, General Requirements. Reference Section 01 91 14, Total Building Commissioning, for requirements pertaining to coordination during the commissioning process.

B. In addition, reference Section 01 91 14, Total Building Commissioning, for requirements pertaining to coordination during the commissioning process.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide testing equipment required to perform startup, initial checkout and functional performance testing for the equipment being tested under Division 28, Electronic Safety and Security. Furnish two-way radios for each testing participant.

B. Testing equipment to be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installation contractors, the Commissioning Authority will prepare Pre-Functional Checklists for commissioned systems.

B. Red-Lined Drawings:

1. Verify equipment, devices and wiring are shown correctly on red-lined drawings.
2. Record the red-lined drawing changes, as a result of Functional Testing and incorporate into the final As-Built Drawings.

C. Operation and Maintenance (O&M) Data:

1. Submit a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for commissioned equipment and systems.
2. The Commissioning Authority will review the O&M literature once for conformance to project requirements.
3. The Commissioning Authority will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.

D. Demonstration and Training:

1. Provide demonstration and training as required by the specifications.
2. Submit complete training plan and schedule to the Commissioning Authority four weeks prior to training.
3. Submit training agenda for each training session to the Commissioning Authority one month prior the training session.
4. Notify the Commissioning Authority at least one week in advance of scheduled tests so that testing may be observed by the Commissioning Authority and Contracting Officer. Submit copies of the test record to the Commissioning Authority and Contracting Officer.
5. Engage a Factory-authorized service representative to train Contracting Officer's maintenance personnel to operate and maintain specific equipment.

6. Train Contracting Officer's maintenance personnel on procedures and schedules for trouble shooting, servicing, and maintaining equipment.
7. Review data in O&M Manuals.

3.2 CONTRACTOR'S RESPONSIBILITIES

A. Provide submittals to the Commissioning Authority for review.

B. Provide information requested by the Commissioning Authority for final commissioning documentation.

C. Prepare preliminary schedule for system orientation and inspections, operation and maintenance manual submissions, training sessions and functional performance testing for Contracting Officer. Distribute preliminary schedule to commissioning team members.

D. With input from the Commissioning Authority, update the construction schedule as required with detailed commissioning tasks throughout the construction period.

E. During the startup and initial checkout process, execute the related portions of the prefunctional checklists for commissioned equipment.

F. Provide ladders, radios, and test equipment to facilitate the commissioning process.

G. Gather operation and maintenance literature on equipment, and assemble in binders as required by the specifications. Submit to Commissioning Authority 45 days after submittal acceptance.

H. Provide any proprietary equipment required to verify the system functionality.

I. Pretest all system components and controls and correct all deficiencies prior to scheduling the Commissioning Authority for functional performance testing.

J. Coordinate with the Commissioning Authority to provide one week's advance notice so that the witnessing of equipment and system testing can begin.

K. Perform commissioning tests at the direction of the Commissioning Authority.

L. Participate in, and schedule vendors and contractors to participate in the training sessions.

3.3 TESTING PREPARATION

A. Provide written notification to the Commissioning Authority that the work has been completed in accordance with the contract documents, the equipment, systems, and sub-system are operating as required, and that successful pre-testing has been completed.

1. Detection devices are installed, powered, programmed, labeled and pre-tested.
2. Notification appliances are installed, powered, synchronized, and pre-tested.
3. Fire alarm associated supply and/or exhaust fan shutdown are programmed and pre-tested.

4. Fire alarm control panel programmed per fire alarm sequence of operation.
5. Communication between the FACP and Central Station verified.
6. Check safety cutouts, alarms, and interlocks with life-safety systems during each mode of operation.
7. Prior to scheduling the Commissioning Authority for commissioning tests, certify in writing that testing procedures have been completed and that testing reports have been submitted, discrepancies corrected, and corrective work approved.

3.4 GENERAL TESTING REQUIREMENTS

A. Functional performance testing of the system, as observed by the Commissioning Authority, may not begin until the Fire Alarm contractor has completed all required pre-testing checklists and documentation.

1. The Commissioning Authority along with the fire alarm contractor to prepare detailed testing plans, procedures, and checklists for fire alarm systems, subsystems, and devices.
2. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the Commissioning Authority.
3. Scope of testing includes the entire system installation.
4. Test operating modes, interlocks, control responses, and responses to abnormal or trouble conditions, and verify proper response of the system control equipment.
5. If tests cannot be completed because of a deficiency outside the scope of the system, document the deficiency and report it to the Contracting Officer. After deficiencies are resolved, reschedule tests.

3.5 FIRE ALARM SYSTEMS, SUBSYSTEMS AND EQUIPMENT TESTING PROCEDURES

A. Functional Performance Testing Procedures shall include the following components and parties involved:

B. Fire Alarm Control Panel: The Commissioning Authority will witness the Fire Alarm contractor perform field tests as described in the Functional Performance Tests to ensure all initiating devices, alarming devices and programming associated with the fire alarm control panel operate per the fire alarm sequence of operation and contract documents.

C. Fire Alarm Remote Annunciator: The Commissioning Authority will witness the Fire Alarm contractor perform field tests as described in the Functional Performance Tests to ensure all initiating devices, alarming devices and programming associated with the fire alarm control panel operate per the fire alarm sequence of operation and contract documents.

D. Initiation Devices: The Commissioning Authority will witness the Fire Alarm contractor perform field tests as described in the Functional Performance Tests to ensure all initiating devices are located, labeled, annunciate correctly at the FACP and function per the fire alarm sequence of operation and contract documents.

E. Manual Pull Stations: The Commissioning Authority will witness the Fire Alarm contractor perform field tests as described in the Functional Performance Tests to ensure all manual pull stations are located, labeled, annunciate correctly at the FACP and function per the fire alarm sequence of operation and contract documents.

F. Smoke Detectors: The Commissioning Authority will witness the Fire Alarm contractor perform field tests as described in the Functional Performance Tests to ensure all smoke detection devices are located, labeled, annunciate at the FACP and function per the fire alarm sequence of operation and contract documents. This may be conducted using either a listed canned aerosol smoke approved by the manufacturer or other method approved.

G. Duct Mounted Smoke Detectors: The Commissioning Authority will witness the Fire Alarm contractor perform field tests as described in the Functional Performance Tests to ensure all duct smoke detection devices are located, labeled, annunciate at the FACP and function per the fire alarm sequence of operation and contract documents. Verify air flow through detector by using a manometer or other manufacturer approved test.

H. Fire Alarm Notification Appliances: The Commissioning Authority will witness the Fire Alarm contractor perform field tests as described in the Functional Performance Tests to ensure all notification devices are located, labeled, and operate in coordination with each other per the contract documents.

I. Fire Suppression Flow and Tamper Switches: The Commissioning Authority will witness the Fire Alarm contractor perform field tests as described in the Functional Performance Tests to ensure all flow and tamper detection switches are located, labeled, annunciate at the FACP and function per the fire alarm sequence of operation and contract documents.

3.6 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

A. Reference Section 01 91 14, Total Building Commissioning, for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.7 OPERATION AND MAINTENANCE MANUALS

A. The Operation and Maintenance Manuals to conform to Contract Documents requirements as stated in Division 28, Electronic Safety and Security and Division 01, General Requirements.

3.8 TRAINING OF CONTRACTING OFFICER PERSONNEL

A. Contractor Training Responsibilities:

1. Provide the Commissioning Authority with a training plan four weeks before the planned training.
2. Provide designated Contracting Officer personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned equipment or system.

3. Training starts with classroom sessions, if necessary, followed by hands on training on each piece of equipment, which illustrates the various modes of operation, including startup, shutdown, power failure, etc.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
5. The appropriate trade or manufacturer's representative provides the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installation contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. The training sessions follows the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals and record drawings for reference.
7. Training Includes:
    a. Use the printed installation, operation and maintenance instruction material included in the O&M manuals.
    b. Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions.
    c. Discuss warranties and guarantees.
    d. Cover common troubleshooting problems and solutions.
    e. Explain information included in the O&M manuals and the location of plans and manuals in the facility.
    f. Discuss any peculiarities of equipment installation or operation.
8. Fully explain and demonstrate the operation, function and overrides of any local packaged controls.

B. Schedule training after functional testing is complete, unless approved otherwise by the Contracting Officer.

END OF SECTION

SECTION 281300 - ACCESS CONTROL SOFTWARE AND DATABASE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 280010 "Supplemental Requirements for Electronic Safety and Security" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

C. Section 281400 "Access Control System Hardware" for hardware required to run software specified in this Section.

1.2 SUMMARY

A. Section Includes:

1. Software for access control system units.
2. Software for access control system supplementary computer equipment.

1.3 DEFINITIONS

A. RAM: Random-access memory.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Software for access control system units.
2. Software for access control system supplementary computer equipment.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings
1. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:
   a. Installation and programming instructions for operating system software, including all applicable software add-ons.
   b. Manufacturer's recommended setup and testing procedure for operating system software and applicable software add-ons.
   c. Troubleshooting instructions for operating system software and applicable software add-ons.

d. Installation and programming instructions for antivirus and security protection software.
e. Manufacturer's recommended setup and testing procedure for antivirus and security protection software.
f. Troubleshooting instructions for antivirus and security protection software.

B. Installer Qualification Data
1. Qualifications per specification 280010 “Supplemental Requirements for Electronic Safety and Security”
2. Manufacturer certification indicating completion of manufacturer specific training and/or accreditation for the installation of products submitted.

C. Field Quality Control Reports

D. System Testing Plans

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data

B. Warranty Information

C. Software and Firmware Operational Documentation

D. Field Test and Inspection Reports

PART 2 - PRODUCTS

2.1 SOFTWARE FOR ACCESS CONTROL SYSTEM UNITS

A. Description: This category covers software products intended for installation on access control system units.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70 and NFPA 72, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
b. Comply with NFPA 1, NFPA 730, NFPA 731, and ICC IBC.

2. Listing Criteria:

a. Cybersecurity: UL CCN CYBR; including UL 2900-1 and UL 2900-2-3.
b. Access Control System Functionality: UL CCN ALVY; including UL 294.
c. Hardware that Interfaces with Fire Alarm or Mass Notification: UL CCN UOJK; including UL 864.

C. Access Control System Unit Operating System Software:
   1. Existing system integration
      a. Other buildings within park utilize Mercury or Identiv controllers and equipment to support park requirements, contractor shall utilize components consistent with the existing park infrastructure and existing system at Grand Lake Entrance Station.
      b. There is an existing access control system at the Grand Lake Entrance Station. The existing system is the “ACRE Access It!”.
      c. Contractor shall coordinate with the contracting officer to migrate existing system software functionality from Grand Lake entrance facility to the Kawuneeche Visitor Center (KVC) and integrate with new hardware at KVC.
      d. All equipment and components specified shall be compatible with, and shall be able to integrate into, the existing access control system.

PART 3 - EXECUTION

3.1 INSTALLATION OF ACCESS CONTROL SOFTWARE

A. Comply with manufacturer's published instructions.

B. Reference Standards:

   1. Installation of Access Control Software: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with requirements in guide information for UL CCN ALVY, UL CCN CYBR, and UL CCN UOJK.
   2. Consult Contracting Officer for resolution of conflicting requirements.

C. Interfaces with Other Work:

   1. Coordinate installation of new access control software with existing equipment and system conditions.

   2. Coordinate with Section 281400 "Access Control System Hardware" for physical and functional interfaces with access control system and for compliance with system-wide performance requirements.
   3. Coordinate with Section 281500 "Integrated Access Control System Hardware Devices" for products that require access control software specified in this Section for operation and compliance with system-wide performance requirements.

D. Systems Integration:

   1. Integration of access control management system with other systems shall allow user to have a single interface and platform in which control of system notifications, alerts, and programmed system responses across all systems may be configured, controlled, monitored, and updated.

   2. Integration with other systems as listed below is required:

a. Video Surveillance System (VSS)
   1) Coordinate with Section 282000 “Video Surveillance” for VSS coordination and system requirements.
b. Intrusion Detection System (IDS)
   1) Coordinate with Section 283100 “Intrusion Detection” for IDS coordination and system requirements.

3.2 FIELD QUALITY CONTROL OF ACCESS CONTROL SOFTWARE

A. Field tests and inspections must be witnessed by Contracting Officer or Contracting Officer specified party(ies). The authority having jurisdiction (AHJ) shall be included at their discretion, coordinate with Contracting Officer for scheduling and required attendees.

B. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.

C. Nonconforming Work:

1. Software will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective software and retest.

D. Collect, assemble, and submit test and inspection reports.

E. Manufacturer Services:

1. It is acceptable to engage factory-authorized service representative to support and/or supervise field tests and inspections. This shall be at no additional cost to Contracting Officer. In addition, it is at the discretion of the Contracting Officer to require the representative to be present for testing and inspection.

3.3 SYSTEM STARTUP

A. Perform startup service.

1. Complete software installation and startup checks in accordance with manufacturer's published instructions.
2. It is at the discretion of the Contracting Officer to require the representative to be present for start up services at no additional cost to Contracting Officer.

3.4 MAINTENANCE

A. Software and Firmware Service Agreement:

1. Technical Support: Beginning at Substantial Completion, verify that software and firmware service agreement includes software and firmware support for a minimum of two years.
2. Upgrade Service: At Substantial Completion, update software and firmware to latest version. Install and program software and firmware upgrades that become available

within two years from date of Substantial Completion. Verify that upgrading software includes operating system and new or revised licenses for using software.

a. Upgrade Notice: No fewer than 30 days to allow Contracting Officer to schedule and access the system and to upgrade computer equipment if necessary.

3. Upgrade Reports: Prepare report after each update, documenting upgrades installed.

END OF SECTION 281300

SECTION 281400 - ACCESS CONTROL SYSTEM HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 280010 "Supplemental Requirements for Electronic Safety and Security" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

C. Section 281300 "Access Control Software and Database Management" for hardware required to run software specified in this Section.

1.2 SUMMARY

A. Section Includes:

1. Access control system units.
2. Access control system power supplies and battery chargers.
3. Access control system supplementary computer equipment.

1.3 DEFINITIONS

A. DGP: Data gathering panel.

B. LAN: Local area network.

C. NFC: Near Field Communications.

D. RAID: Redundant array of inexpensive disks; redundant array of independent disks.

E. RAM: Random-access memory.

F. WAN: Wide area network.

1.4 ACTION SUBMITTALS

A. Product Data:
1. Access control system units.
2. Access control system power supplies and battery chargers.
3. Access control system supplementary computer equipment.

B. Shop Drawings:

1. Project general notes.
2. Hardware and equipment locations.
3. Device layout.
4. Block diagram and cable/conduit routing.
5. System communications details.
6. System mounting details.
7. Hardware and equipment installation details.
8. Secondary power calculations.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings

B. Installer Qualification Data
1. Qualifications per specification 280010 “Supplemental Requirements for Electronic Safety and Security”
2. Manufacturer certification indicating completion of manufacturer specific training and/or accreditation for the installation of products submitted.
3. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:
   a. Installation instructions for access control system servers.
   b. Installation instructions for access control system DGPs.
   c. Installation instructions for access control system input/output interface.
   d. Installation instructions for access control system door controllers.
   e. Installation instructions for access control system workstation.
   f. Manufacturer's recommended testing and inspection procedure for operation of access control system servers, panels, input/output interfaces, door controllers, and workstations.
   g. Installation instructions for access control system power supplies and battery chargers.
   h. Manufacturer's recommended testing and inspection procedure for operation of access control system power supplies and battery chargers.
   i. Installation instructions for access control system printers.
   j. Manufacturer's recommended testing and inspection procedure for operation of access control system printers.

C. Field Quality Control Reports

1.6 CLOSEOUT SUBMITTALS

A. Record Documentation.

B. Operation and Maintenance Data.

C. Warranty Information.

D. Extra Material
1. Credential Reader: One of Each type

2. Special Tools: Furnish to Contracting Officer proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to integrated access control hardware devices, that are packaged with protective covering for storage on-site and identified with labels describing contents.

E. Field Test and Inspection Reports

1.7 WARRANTY FOR ACCESS CONTROL SYSTEM HARDWARE

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed access control system hardware perform in accordance with specified requirements and agrees to repair or replace systems, assemblies, components, or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: Two years from date of Substantial Completion; full coverage for labor, materials, and equipment.

B. Special Manufacturer Extended Warranty: Manufacturer warrants that access control system hardware perform in accordance with specified requirements and agrees to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: A minimum of Five years from date of Substantial Completion; coverage for labor, materials, and equipment.
2. Follow-On Extended-Warranty Period: Eight years from date of Substantial Completion; full coverage for materials only, free on board destination, freight prepaid.

1.8 WARRANTY FOR BATTERIES

A. Special Manufacturer Extended Warranty for Batteries: Manufacturer warrants that the batteries perform in accordance with specified requirements and agrees to provide repair or replacement of batteries that fail to perform as specified within extended-warranty period.

1. Initial Extended-Warranty Period for Li-ion Batteries: Five years from date of Substantial Completion; full coverage for materials only, free on-board destination, freight prepaid.
2. Follow-On Extended-Warranty Period for Li-ion Batteries: Ten years from date of Substantial Completion; prorated coverage for materials only, free on-board destination, freight prepaid.
3. Extended-Warranty Period for Ni-MH Batteries: Three years from date of Substantial Completion; prorated coverage for materials only, free on-board destination, freight prepaid.
4. Extended-Warranty Period for Ni-Cd Batteries: Five years from date of Substantial Completion; prorated coverage for materials only, free on-board destination, freight prepaid.
5. Warranted Cycle Life for Valve Regulated (Sealed) Lead Calcium or Lead Selenium Batteries: Equal to or greater than that represented in manufacturer's published table, but not less than the following, based on annual average battery temperature of 77 deg F (25 deg C):

a. For discharge rate not faster than eight hours, discharge duration not longer than eight hours, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than six discharge cycles.
b. For discharge rate not faster than 30 minutes, discharge duration not longer than 30 minutes, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 20 discharge cycles.
c. For discharge rate not faster than 15 minutes, discharge duration not longer than 45 seconds, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 120 discharge cycles.

6. Warranted Cycle Life for Premium Valve Regulated (Sealed) Lead Calcium or Lead Selenium Batteries: Equal to or greater than that represented in manufacturer's published table, but not less than the following, based on annual average battery temperature of 77 deg F (25 deg C):

a. For discharge rate not faster than eight hours, discharge duration not longer than eight hours, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 40 discharge cycles.
b. For discharge rate not faster than 30 minutes, discharge duration not longer than 30 minutes, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 125 discharge cycles.
c. For discharge rate not faster than 15 minutes, discharge duration not longer than 90 seconds, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 750 discharge cycles.

7. Warranted Cycle Life for Flooded (Wet Cell or Open) Lead Calcium or Lead Selenium Batteries: Equal to or greater than that represented in manufacturer's published table, but not less than the following, based on annual average battery temperature of 77 deg F (25 deg C) and preventive maintenance performed in accordance with manufacturer's published instructions:

a. For discharge rate not faster than eight hours, discharge duration not longer than eight hours, and voltage at end of discharge not less than 1.75 V, warranted life must be not fewer than 40 discharge cycles.
b. For discharge rate not faster than one hour, discharge duration not longer than one hour, and voltage at end of discharge not less than 1.75 V, warranted life must be not fewer than 80 discharge cycles.
c. For discharge rate not faster than 15 minutes, discharge duration not longer than 45 seconds, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 2700 discharge cycles.

PART 2 - PRODUCTS

2.1 ACCESS CONTROL SYSTEM UNITS

A. Description: This category covers head end units, control units, integrated authentication units, and status sensors for access control systems, providing a means of regulating or controlling physical entry into an area, or access to or use of device by electrical, electronic, and/or mechanical means. Access control systems are considered a complete configuration based upon

manufacturer's specified system components. Access control systems are intended to comply with applicable life safety access and egress requirements.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70 and NFPA 72, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
b. Comply with NFPA 1, NFPA 730, NFPA 731, and ICC IBC.

2. Listing Criteria: UL CCN ALVY; including UL 294.

C. System Compatibility
1. The components listed herein shall be compatible with one another and with the equipment listed in specification 281300 “Access Control Software and Database Management”.
2. The components listed herein shall be in accordance with system requirements defined in specification 280010 “Supplemental Requirements for Electronics Safety and Security”.
3. The components listed herein shall be compatible with all existing software and hardware components that are scheduled for existing to remain or are intended to be reused in conjunction with new components.

D. Access Control System Server:

1. Options:

a. Ethernet port for connection to LAN/WAN.
b. Input Voltage: 120 V(ac).
c. Operating Temperature: 50 to 82 deg F (10 to 28 deg C).
d. Server Type: Windows.
e. Server Model: Refer to schedules
f. Drive Space: 500 GB.
g. Memory: 24 GB RAM.
h. Mounting: EIA/ECA-310 standard 19 inch (482.6 mm) rack mount.

2. Accessories:

a. DIN rails for mounting.

E. Access Control System Door Controllers:
1. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

a. Mercury: LenelS2

2. Additional Characteristics:

a. Data ports for connection to LAN and downstream controllers.
b. Integral terminal blocks for connection of inputs/outputs to field devices.

c. Controller Inputs:

1) Auxiliary input.
2) Door contact.
3) Request to exit.
4) Cabinet tamper.
5) Power monitor.

d. Controller Outputs:

1) Auxiliary output.
2) Door strike.
3) Door operators.
4) Credential readers.

F. Reader for Card, Fob, or Smartphone:

1. Refer to schedule for more information.
2. Performance Criteria:

a. Listing Criteria:

1) UL CCN ALVY; including UL 294.
2) Plastic Enclosure: UL CCN QMFZ2; including UL 94.

b. General Characteristics: Visual LED indication of card read.

3. Options:
a. Operating Temperature: Minus 40 to plus 160 deg F (Minus 40 to plus 71 deg C).
b. Materials: Long-wearing polymeric plastic.
c. Colors: Black.
d. Climate: Indoor and outdoor.

G. Access Control Cards:

1. Performance Criteria:

a. Reference Standards:

1) Personal Identity Verification (PIV): FIPS PUB 201-2.
2) Physical: IEC 7810; IEC 10373; IEC 7816 for contact cards; and IEC 14443 for contactless cards.
3) Functional: UL 294; IEC 60839-11-1; and IEC 60839-11-2.
4) Material Durability: INCITS 322.

b. Format: Customizable, including artwork:

1) On Front: Photograph, full name (surname first), affiliation, organization, organization logo, card expiration date, color-coding, two-dimensional bar code.

2) On Back: Physical characteristics of cardholder, employee ID number, card number, magnetic stripe, linear bar code, return address. Include the following message:

3) Stored Data Elements: PIN, employee ID number, two fingerprint templates, electronic facial image, one iris image, digital signature private key and certificate, key management private key and certificate, card authenticate data, and PIV authentication data.

2. Options:

a. Data Format: Wiegand 26 bit
b. Transmit Frequency: 125 kHz and 13.56 MHz.
c. Data Retention: 20 years.
d. Memory Capacity: 32 kB.
e. Operating Temperature: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
f. Materials: PVC laminate.
g. Color: White.
h. Reading Medium: Proximity

H. Request-to-Exit (REX) Motion Sensor:

1. Performance Criteria:

a. Regulatory Requirements: 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.
b. Listing Criteria: UL CCN ALVY; including UL 294.

2. Options:

a. Input Power: 125 V(ac).
b. Operating Temperature: Minus 13 to plus 140 deg F (Minus 25 to plus 60 deg C)
c. Sensing Technology: Passive infrared (PIR)
d. Color: Black
e. Mounting: Wall surface

I. Door Position Switch

1. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

a. Approved Equal

2. Must activate within an inch of separation from the base magnet.
3. Must be capable of 500,000 activations before failure.
4. Must be wired with pry tamper and magnetic tamper lamps.

2.2 ACCESS CONTROL SYSTEM POWER SUPPLIES AND BATTERY CHARGERS

A. Description: This category covers power supplies and battery chargers for access control system units, controllers, input/output interfaces, workstations, printers, and encoders.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70 and NFPA 72, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
b. Comply with NFPA 1, NFPA 730, NFPA 731, and ICC IBC.

2. Listing Criteria: UL CCN ALVY; including UL 294.

C. Access Control System Power Supply and Battery Charger:

1. Source Limitations: Obtain products from single manufacturer.
2. Additional Characteristics:

a. Input Voltage: 120 V(ac).
b. Output Voltage: 12 to 24 V(dc).
c. Operating Temperature: 32 to 120 deg F (0 to 49 deg C).
d. Network connection for remote supervision, management, and testing.
e. Enclosure lock with tamper switch and monitoring.
f. Built-in battery charger.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Installation of Access Control System Hardware and Wiring: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with requirements in guide information for UL CCN ALVY.
2. Consult Contracting Officer for resolution of conflicting requirements.

C. Special Techniques:

1. Cable Type: Unshielded
2. Analog Maximum Cable Length: 1000 ft (300 m).
3. Digital Maximum Cable Length: 300 ft (100 m).

D. Interfaces with Other Work:

1. Coordinate installation of new access control hardware with existing equipment and system conditions.
2. Coordinate with Section 281300 "Access Control Software and Database Management" for products that require access control software for operation and compliance with system-wide performance requirements.

E. Systems Integration:

1. Integration of access control management system with other systems shall allow user to have a single interface and platform in which control of system notifications, alerts, and programmed system responses across all systems may be configured, controlled, monitored, and updated.

2. Integration with other systems as listed below is required:
   a. Video Surveillance System (VSS)
      1) Coordinate with Section 282000 “Video Surveillance” for VSS coordination and system requirements.
   b. Intrusion Detection System (IDS)
      1) Coordinate with Section 283100 “Intrusion Detection” for IDS coordination and system requirements.

3.2 FIELD QUALITY CONTROL OF ACCESS CONTROL SOFTWARE

A. Field tests and inspections must be witnessed by Contracting Officer or Contracting Officer specified party(ies). The authority having jurisdiction (AHJ) shall be included at their discretion, coordinate with Contracting Officer for scheduling and required attendees.

B. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.

C. Nonconforming Work:

1. Software will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective software and retest.

D. Collect, assemble, and submit test and inspection reports.

E. Manufacturer Services:

1. It is acceptable to engage factory-authorized service representative to support and/or supervise field tests and inspections. This shall be at no additional cost to end user or Contracting Officer. In addition, it is at the discretion of the Contracting Officer to require the representative to be present for testing and inspection.

3.3 DEPLOYMENT OF CREDENTIALS

A. Comply with manufacturer's published instructions.

B. Third-Party Issuing of Access Control Credentials:

1. Provision of New Credentials: Contractor must be capable of programming and issuing credentials compatible with end user's access control system.

a. Initial Issuance: Provide spreadsheet or form for collecting data for generation of credentials. Contracting Officer will submit completed form containing data for personnel to be issued credentials. Print and provide initial run, printed and programmed credentials in specified format within four weeks of request.

3.4 SYSTEM STARTUP

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's published instructions.
2. It is at the discretion of the Contracting Officer to require the representative to be present for start up services at no additional cost to Contracting Officer or End User.

3.5 ADJUSTING

A. Adjust printers and ribbons to function smoothly, and lubricate as recommended in writing by manufacturer.

3.6 PROTECTION

A. After installation, protect access control system hardware from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Contracting Officer.

END OF SECTION 281400

SECTION 281600 - INTRUSION DETECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 280010 "Supplemental Requirements for Electronic Safety and Security" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 SUMMARY

A. Section Includes:
1. Enclosures
2. Secure and Access Devices
3. Duress Alarm Switches
4. Master Control Unit
5. Security Fasteners

1.3 DEFINITIONS

A. CCTV: Closed-circuit television.

B. PIR: Passive infrared.

C. RFI: Radio-frequency interference.

D. UPS: Uninterruptible power supply.

E. Control Unit: System component that monitors inputs and controls outputs through various circuits.

F. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.

G. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.

H. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.

I. Standard Intruder: A person who weighs 100 lb (45 kg) or more and whose height is 60 inches (1525 mm) or more; dressed in a long-sleeved shirt, slacks, and shoes unless environmental conditions at the site require protective clothing.

J. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.

K. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.

L. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Enclosures
2. Secure and Access Devices
3. Door and Window Switches
4. Microwave-PIR Dual Technology Sensors
5. Duress Alarm Switches
6. Master Control Unit
7. Audible and Visual Alarm Devices

B. Shop Drawings:

1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify programmable logic controllers, networks, and control interface devices and media to be used. Describe characteristics of network and other data communication lines.
2. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building. Include room layout for master control-unit console, terminal cabinet, racks, and UPS.
3. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings
1. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:
   a. Installation and programming instructions for operating system software, including all applicable software add-ons.

b. Manufacturer's recommended setup and testing procedure for operating system software and applicable software add-ons.
c. Troubleshooting instructions for operating system software and applicable software add-ons.
d. Installation and programming instructions for antivirus and security protection software.
e. Manufacturer's recommended setup and testing procedure for antivirus and security protection software.
f. Troubleshooting instructions for antivirus and security protection software.

B. Installer Qualification Data
1. Qualifications per specification 280010 “Supplemental Requirements for Electronic Safety and Security”
2. Manufacturer certification indicating completion of manufacturer specific training and/or accreditation for the installation of products submitted.
3. Installer Qualifications:
a. An employer of workers, at least one of whom is a Certified Alarm Technician, Level 1.
b. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
c. Layout Responsibility: Preparation of Shop Drawings cabling administration Drawings, and field testing program development by a Technician.
d. Installation Supervision: Installation shall be under the direct supervision of Technician who shall be present at all times when Work of this Section is performed at Project site.
4. Intrusion Detection Systems Integrator Qualifications:
a. An experienced intrusion detection equipment supplier who has completed systems integration work for installations 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.
1) At least one of whom is a Certified Systems Integrator.

C. Field Quality Control Reports

D. System Testing Plans

1.6 CLOSEOUT SUBMITTALS

A. Record Documentation
1. Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.

B. Operation and Maintenance Data

C. Warranty Information

D. Software and Firmware Operational Documentation

E. Extra Material

1. Intrusion Detection Devices: Furnish quantity equal to five percent of the number of units of each type installed, but no fewer than one of each type.
2. Fuses: Three of each kind and size.
3. Tool Kit: Provide two sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.
4. Security Fasteners: Furnish no fewer than 1 box for every 50 boxes or fraction thereof, of each type and size of security fastener installed.

F. Field Test and Inspection Reports

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Altitude: Sea level to 8000 feet (2440 m).
2. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
3. Interior, Controlled Environment: System components, except master control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambients of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
4. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambients of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
5. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick.
6. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings shall be rated, listed, and installed according to NFPA 70.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Description: Hard-wired, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.

B. Supervision: System components shall be continuously monitored for normal, alarm, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.
2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.

C. System Control: Master control unit shall directly monitor intrusion detection units and connecting wiring.

D. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

E. Operator Commands:

1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
5. Protected Zone Test: Initiate operational test of a specific protected zone.
6. System Test: Initiate system-wide operational test.
7. Print reports.

F. Timed Control at Master Control Unit: Allow automatically timed "secure" and "access" functions of selected protected zones.

G. Automatic Control of Related Systems: Alarm or supervisory signals from certain intrusion detection devices control the following functions in related systems:

1. Switch selected lights.
2. Open a signal path between certain intercommunication stations.
3. Shift sound system to "listening mode" and open a signal path to certain system speakers.
4. Switch signal to selected monitor from CCTV camera in vicinity of sensor signaling an alarm.

H. Save Record of Events: Use has the ability to reference a record of alarm, supervisory, and trouble events. Sort and report by protected zone, device, and function. When master control unit receives a signal, record a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.

I. Response Time: A maximum of two seconds between actuation of any alarm and its indication at master control unit.

J. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

K. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

L. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.2 SYSTEM COMPONENT REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.

C. Comply with NFPA 70.

D. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.

E. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.

F. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.

G. Tamper Protection: Tamper switches on detection devices, control units, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Master control-unit alarm display shall identify tamper alarms and indicate locations.

H. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master control unit.

I. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to master control unit as an alarm signal.

J. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.

2.3 ENCLOSURES

A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.

B. Interior Electronics: NEMA 250, Type 12.

C. Exterior Electronics: NEMA 250, Type 4X.

D. Corrosion Resistant: NEMA 250, Type 4X.

E. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.4 SECURE AND ACCESS DEVICES

A. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.

B. Key-Operated Switch: Change protected zone between secure and access conditions.

2.5 DURESS-ALARM SWITCHES

A. Description: A switch with a shroud over the activating lever that allows an individual to covertly send a duress signal to master control unit, with no visible or audible indication when activated. Switch shall lock in activated position until reset with a key.

1. Minimum Switch Rating: 50,000 operations.
2. Push Button: Finger activated, suitable for mounting on horizontal or vertical surface.

2.6 MASTER CONTROL UNIT

A. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.

1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
2. Include a real-time clock for time annotation of events on the event recorder and printer.
3. Addressable initiation devices that communicate device identity and status.
4. Control circuits for operation of mechanical equipment in response to an alarm.

B. Construction: Desk-mounted console, modular, with separate and independent alarm and supervisory system modules. Arrangements that require removal of field wiring for module replacement are unacceptable.

C. Comply with UL 609

D. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: LCD, multiple line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.
4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.
5. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:

    a. Acknowledge alarm.
    b. Silence alarm.
    c. System reset.
    d. LED test.

6. Timing Unit: Solid state, programmable, 365 days.

7. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
8. Alarm Indication: Audible signal sounds and a plain-language identification of the protected zone and/or addressable detector originating the alarm appears on LED or LCD display at master control unit. Annunciator panel displays a common alarm light and sounds an audible tone.
9. Alarm activation sounds a bell or siren and strobe.

E. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of 25 percent.

F. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a 25 percent increase in load.

G. UPS shall be sized to provide a minimum of six hours of master control-unit operation.

H. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch (25 mm) high. Identify, with permanent labels, individual components and modules within cabinets.

I. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635.

J. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

2.7 SECURITY FASTENERS

A. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.

B. Manufacturers: Subject to compliance with design requirements, provide products by one of the following, or an approved equal:

a. Approved Equal

C. Socket Flat Countersunk Head Fasteners:

1. Heat-treated alloy steel, ASTM F835 (ASTM F835M).

2. Stainless steel, ASTM F879 (ASTM F879M), Group 1 CW.

D. Socket Button Head Fasteners:

1. Heat-treated alloy steel, ASTM F835 (ASTM F835M).
2. Stainless steel, ASTM F879 (ASTM F879M), Group 1 CW.

E. Socket Head Cap Fasteners:

1. Heat-treated alloy steel, ASTM A574 (ASTM A574M).
2. Stainless steel, ASTM F837 (ASTM F837M), Group 1 CW.

F. Protective Coatings for Heat-Treated Alloy Steel:

1. Zinc chromate, ASTM F1135, Grade 3 or Grade 4, for exterior applications and interior applications where indicated.
2. Zinc phosphate with oil, ASTM F1137, Grade I, or black oxide unless otherwise indicated.

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 intrusion detection.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.

D. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.

1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.

E. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEM INTEGRATION

A. The park is supported by ALARMSPECIALIST, Inc. at other locations within the park. This facility shall be included with the installation of the system as noted herein.

B. Contractor shall coordinate with ALARMSPECIALIST, Inc. to ensure all components specified are compatible with, and integrate into, the park's overall system and support structure.

C. Integration with Access Control System and Video Surveillance system shall be consistent with integrations requirements at other facilities. This shall be coordinated with ALARMSPECIALIST, Inc.

D. Upon depression/activation of a panic button (duress button), dispatch shall be notified.

3.3 SYSTEM INSTALLATION

A. Comply with UL 681 and NFPA 731.

B. Equipment Mounting: Install master control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 70548.16 "Seismic Controls for Communications Systems."

C. Connecting to Existing Equipment: Verify that existing perimeter security system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the Supervising Station.
3. Expand, modify, and supplement existing control/monitoring equipment as necessary to extend existing control/monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

3.4 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceways according to Section 270528 "Pathways for Communications Systems." Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring Method: Install wiring in metal raceways according to Section 270528 "Pathways for Communications Systems," except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

C. Wiring Method: Cable, concealed in accessible ceilings, walls, and floors when possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Wires and Cables:

1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
2. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
3. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable, according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
4. Data and Television Signal Transmission Cables: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

G. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

H. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 270553 "Identification for Communications Systems."

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Section 270553 "Identification for Communications Systems."

B. Install instructions frame in a location visible from master control unit.

3.6 GROUNDING

A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.

B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.

D. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Section 270526 "Grounding and Bonding for Communications Systems."

3.7 FIELD QUALITY CONTROL

A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."

1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
2. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."

D. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."

E. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal occupancy hours for this purpose. Visits for this purpose shall be in addition to any required by warranty.

3.9 DEMONSTRATION

A. Train Contracting Officer's maintenance personnel to adjust, operate, and maintain the intrusion detection system. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training."
1. It is acceptable to engage a factory authorized representative to assist in, or lead, the training effort.

END OF SECTION 281600

SECTION 282000 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 280010 “Supplemental Requirements for Electronic Safety and Security” for general construction, administration, system requirements.

1.2 SUMMARY

A. Section Includes:
1. Camera
2. Camera Supporting Equipment

1.3 DEFINITIONS

A. AGC: Automatic gain control.

B. BNC: Bayonet Neill-Concelman - type of connector.

C. B/W: Black and white.

D. CCD: Charge-coupled device.

E. FTP: File transfer protocol.

F. IP: Internet protocol.

G. LAN: Local area network.

H. MPEG: Moving picture experts group.

I. NTSC: National Television System Committee.

J. PC: Personal computer.

K. PTZ: Pan-tilt-zoom.

L. RAID: Redundant array of independent disks.

M. TCP: Transmission control protocol - connects hosts on the Internet.

N. UPS: Uninterruptible power supply.

O. WAN: Wide area network.

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Each Camera included
   2. Camera Supporting Equipment

B. Shop Drawings:
   1. Indicate camera locations, mounting equipment, mounting requirements, and coordination with architectural elements.
   2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
   4. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
   5. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings
   1. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:
      a. Installation and programming instructions for operating system software, including all applicable software add-ons.
      b. Manufacturer's recommended setup and testing procedure for operating system software and applicable software add-ons.
      c. Troubleshooting instructions for operating system software and applicable software add-ons.
      d. Installation and programming instructions for antivirus and security protection software.
      e. Manufacturer's recommended setup and testing procedure for antivirus and security protection software.
      f. Troubleshooting instructions for antivirus and security protection software.

B. Installer Qualification Data
   1. Qualifications per specification 280010 “Supplemental Requirements for Electronic Safety and Security”
   2. Manufacturer certification indicating completion of manufacturer specific training and/or accreditation for the installation of products submitted.

C. Field Quality Control Reports

D. System Testing Plans

1.6 CLOSEOUT SUBMITTALS

A. Record Documentation
   1. Include an equipment list consisting of every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

B. Operation and Maintenance Data

C. Warranty Information

D. Software and Firmware Operational Documentation

E. Field Test and Inspection Reports

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

   1. Control Station: Rated for continuous operation in ambient temperatures of 60 to 85 deg F (16 to 29 deg C) and a relative humidity of 20 to 80 percent, noncondensing.
   2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
   3. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 12 enclosures.
   4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick. Use NEMA 250, Type 4 enclosures.
   5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
   6. Corrosive Environment: System components subject to corrosive fumes, vapors, and wind-driven salt spray in coastal zones. Use NEMA 250, Type 4X enclosures.
   7. Security Environment: Camera housing for use in high-risk areas where surveillance equipment may be subject to physical violence.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Internet Protocol (IP) based, Power Over Ethernet (POE) enabled, High Definition (HD) cameras shall be installed at locations as indicated to provide visual surveillance and event monitoring in specified areas.

B. Local video storage capabilities and remote viewing capabilities.

C. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.

1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.

D. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Video surveillance system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

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 NECA 1.

D. Comply with NFPA 70.

E. Electronic data exchange between video surveillance system with an access-control system shall comply with SIA TVAC.

2.3 VIDEO MANAGEMENT SYSTEM (VMS)

A. The existing video management system and equipment shall be relocated from the Grand Lake entrance facility to Server 116 as indicated in drawings. All components herein shall be integrated into, and be compatible with, the existing system components.

2.4 CAMERAS

A. Camera
1. Camera type defined is not for reference outside of this document and is only meant to differentiate between general camera types specified for the project.
2. Camera selection is defined within equipment schedules in construction drawings. Items and components defined below shall be in coordination with device specified and shall serve as guideline for review of devices submitted other than specified on schedule.
3. Options:

a. Min and Max Resolution: 2MP - 8MP (1080p - 4k)
b. Frame Rate: 30 fps
c. Color: White
d. IP rating: IP 66
e. IK rating: IK10
f. Minimum Horizonal Field of View: 100 degrees
g. Minimum Vertical Field of View: 30 degrees
h. Minimum compression standard of H.264, recommended to have H.265.
i. Operating Temperature Range: -40 to 122 deg F (-40 to 50 deg C)
j. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of less than 0.5 lux at less than or equal to F1.8.

2.5 CAMERA-SUPPORTING EQUIPMENT

A. Any and all support equipment including, but not limited to, ceiling mounts, wall mounts, and pole mounts, shall be of the same manufacturer as the camera submitted.

B. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.

C. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.

D. Protective Housings for Fixed and Movable Cameras: Steel enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.

1. Tamper switch on access cover sounds an alarm signal when unit is opened or partially disassembled. Central-control unit shall identify tamper alarms and indicate location in alarm display. Tamper switches and central-control unit are specified in Section 283100 "Intrusion Detection."
2. Camera Viewing Window: Aligned with camera lens.
3. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.
4. Built-in, thermostat-activated heater and/or blower units. Units shall be automatically controlled so the environmental limits of the camera equipment are not exceeded.
5. Sun shield shall not interfere with normal airflow around the housing.
6. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.
7. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.

E. Dedicated Security Camera Network Switch
1. Refer to schedules for basis of design information.
2. A dedicated network switch shall provide network and POE connection to the cameras as indicated on plan.

2.6 NETWORK VIDEO RECORDERS

A. The existing network video recorder (NVR) and equipment shall be relocated from the Grand Lake entrance facility to Server 116 as indicated in drawings. All components herein shall be integrated into, and be compatible with, the existing system components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

B. Examine roughing-in for LAN, WAN, and IP network before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING

A. Comply with requirements in Section 270528 "Pathways for Communications Systems."

B. Comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."

C. Surge Protection: When a camera, or any portion of cabling support the camera and/or connected to the camera, is outside the building envelope, surge protection units shall be utilized.

1. Refer to specifications and details on drawings for surge protection unit type and mounting requirements.

3.3 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Install cameras and infrared illuminators level and plumb.

B. Installation locations and heights are defined on drawings. Precise field coordination with architectural elements is required prior to rough-in.
   1. Contractor shall be aware of ceiling heights, overhangs, trees, and any other obstructions that would obscure the view intended for the camera. Communication with the Contracting Officer General Contractor is required for any such observed issue prior to rough in and installation.

C. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.

D. Identify system components, wiring, cabling, and terminals according to Section 270553 "Identification for Communications Systems."

3.4 FIELD QUALITY CONTROL

A. Field tests and inspections must be witnessed by Contracting Officer or Contracting Officer's specified party(ies). The authority having jurisdiction (AHJ) shall be included at their discretion, coordinate with Contracting Officer for scheduling and required attendees.

B. Manufacturer Services:

   1. It is acceptable to engage factory-authorized service representative to support and/or supervise field tests and inspections. This shall be at no additional cost to Contracting Officer. In addition, it is at the discretion of the Contracting Officer to require the representative to be present for testing and inspection.

C. Tests and Inspections:

   1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
   2. After all equipment has been migrated to facility, contractor shall validate that connection to all existing equipment is functional and operational prior to integrating new equipment into system.
   3. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:

      a. Prepare equipment list described in "Informational Submittals" Article.
      b. Verify operation of auto-iris lenses.

c. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
d. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet (17 to 23 m) away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
e. Set and name all preset positions; consult Contracting Officer's personnel.
f. Set sensitivity of motion detection.
g. Connect and verify responses to alarms.
h. Verify operation of control-station equipment.

4. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
5. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

D. Video surveillance system will be considered defective if it does not pass tests and inspections.

E. Collect, assemble, and submit test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months (1 year) of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:

1. Check cable connections.
2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
3. Adjust all preset positions; consult Contracting Officer's personnel.
4. Recommend changes to cameras, lenses, and associated equipment to improve Contracting Officer's use of video surveillance system.
5. Provide a written report of adjustments and recommendations.

3.6 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.7 DEMONSTRATION

A. Train Contracting Officer's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

END OF SECTION 282000

SECTION 28 46 00 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Fire Alarm Control Panel
2. Notification Appliance Circuit Panels
3. Fire Alarm Transmitters
4. Fire Alarm Annunciators
5. Manual Pull Stations
6. Fixed Temperature Heat Detectors
7. Rate-of-Rise and Fixed Temperature Heat Detectors
8. Photoelectric Type Detectors
9. Duct-Mounted Smoke Detectors
10. Relay Modules
11. Control Modules
12. Input Modules
13. Fault Isolation Modules
14. Combination Horn/Strobes
15. Strobes
16. Horns
17. Weatherproof/Surface Backboxes
18. Circuit Conductors
19. Surge Protection
20. Batteries
21. Locks and Keys
22. Document Storage Cabinet
23. Instruction Charts
24. Framed Floor Map

B. Scope:

1. Provide a new fire alarm system.
2. Provide a new fire alarm transmitter communication system.

C. In addition, provide design for the following as required in these Contract Documents:

1. Fire Alarm System
2. Fire Alarm Transmitter Communication System

D. In addition, remove existing fire alarm system throughout the entire building.

E. System Design:

1. Design Criteria:

a. Design systems utilizing equipment, appliance, and device layouts depicted in the contract documents and as required by code.

b. Fire Alarm Sequence of Operation: Activation of manual fire alarm box, automatic fire detector, or fire extinguishing system causes system to enter “alarm” mode including the following operations:

1) Local English language annunciation of device location, address and condition and audible and visual alarm signal at control panel and remote annunciators.

2) Manual "acknowledge" function at control panel and remote annunciators to silence audible alarm signal, visual signal remains displayed until initiating alarm is cleared.

3) Transmit “alarm” signal to off-premises equipment, i.e., to local fire department or Contracting Officer's selected vendor. Provide necessary connections to transmitter.

4) Activate fire alarm notification appliances.

5) Activate Emergency Control Functions as required by code.

(a) Transmit signal to initiate shutdown of air handling equipment.

(b) Transmit signal to release fire doors.

c. Supervisory Sequence of Operation: Fire sprinkler tamper or supervisory pressure switch activation, or duct-mounted smoke detector activation causes system to enter "supervisory" mode including the following operations:

1) Local English language annunciation of device location, address and condition and audible and visual supervisory signal at control panel and remote annunciators.

2) Manual "acknowledge" function at control panel and remote annunciators to silence audible supervisory signal, visual signal remains displayed until initiating supervisory is cleared.

3) Transmit "supervisory" signal to off-premises equipment.

4) Transmit signal to initiate shutdown of air handling equipment (duct detector only).

d. Trouble Sequence of Operation: System trouble, including single ground or open of supervised circuit, or power or system failure, causes system to enter "trouble" mode including the following operations:

1) Local English language annunciation of device location, address and condition and audible and visual trouble signal at control panel and remote annunciators.

2) Manual "acknowledge" function at control panel and remote annunciators to silence audible trouble signal, visual signal remains displayed until initiating trouble is cleared.

3) Transmit "trouble" signal to off-premises equipment.

2. Design of Fire Alarm Transmitter Communication System: Provide design of the fire alarm transmitter communication system as required by code.

1.2 RELATED SECTIONS

A. Contents of Division 28, Electronic Safety and Division 01, General Requirements apply to this Section.

B. Division 26, Electrical requirements apply to this Section.

C. In addition, reference the following:

1. Section 28 00 01, Electronic Safety Basic Requirements
2. Section 28 08 00, Commissioning of Fire Alarm

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Division 28, Electronic Safety and Division 01, General Requirements.

B. In addition, meet requirements of the following:

1. NFPA 72, National Fire Alarm and Signaling Code, adopted edition.
2. NFPA 70, National Electrical Code, adopted edition.
3. Fire alarm system to be designed by someone meeting or exceeding one or more of the following requirements:
   a. A fire alarm engineer.
   b. A NICET III technician for the type of system designed.
   c. As approved by the AHJ.
4. Fire alarm system to be installed by someone meeting or exceeding one or more of the following requirements:
   a. State or municipal certified/licensed alarm contractor.
   b. Qualified by the manufacturer.
   c. NICET Level II.
   d. As approved by the AHJ.

1.4 SUBMITTALS

A. Submittals as required by Division 28, Electronic Safety and Division 01, General Requirements.

B. Shop Drawings:

1. Submit shop drawings which include documentation required per NFPA 72, Shop Drawings.

2. In addition, provide the following:
   a. Provide system designer NICET certification number or Engineer's signature and seal on shop drawings.
   b. Identification of system designer and evidence of qualification or certification of designer as required by AHJ.

C. Operation and Maintenance Manuals:

1. Provide manuals containing the documentation required in NFPA 72, Completion Documentation.
2. In addition, provide the following:
   a. One year warranty agreement including parts and labor. Warranty period begins upon date of substantial completion.
   b. Instruction chart.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Division 28, Electronic Safety and Division 01, General Requirements.

B. In addition, meet City of Grand Lake, Colorado requirements, ordinances, and amendments.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Division 28, Electronic Safety and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Substitutions: Reference Specification Section 01 67 00, Product Requirements.

B. Submit product data showing features and certification by Contractor that the design will comply with contract documents.

C. Equipment to be supplied by a certified manufacturer representative.

2.2 FIRE ALARM CONTROL PANEL

A. Salient Characteristics:

1. Multiprocessor Based: Configurable as an addressable, point identified system.

2. Central Processing Unit (CPU):
    a. CPU continuously monitors the communications and data processing cycles of microprocessor. CPU failure generates an audible and visual trouble signal on control panel and remote annunciators.
    b. House the CPU in fire alarm cabinet with sufficient space to allow maximum system expansion and to enclose alphanumeric display.
    c. Retain basic life safety software in field programmable non-volatile memory. Provide CPU with minimum capacity of 50 addressable points.
    d. Equip CPU with software to provide a control-by-event feature, whereby receipt of an alarm point is programmed to operate control points within system. Provide control-by-event actions for life safety functions in programmable non-volatile memory. CPU software programming for control of systems defined in this Section is installed as part of this Section.
3. System Capabilities:
    a. System capable of addressing and operating smoke detectors, manual pull stations, open contact devices and addressable auxiliary control relays on the same communication loop.
    b. System capable of displaying sensitivity of each smoke detector, address, and condition of fire alarm monitoring points.
4. Program Software:
    a. Field configuration program provides programmable operating instructions for system. Store resident program in non-volatile memory.
    b. Devices meet criterion specified under materials.
    c. Verification and display of sensitivity of each addressable smoke detector can be read using the operating software.
5. Control Panel Display Modules:
    a. Provide keyboard display module with minimum 80-character backlit LCD. Each alarm/trouble condition appears in English language with description and location of alarm/supervisory/trouble.
    b. Alarm/supervisory/trouble may be acknowledged, silenced and system reset from control panel or remote annunciator(s).
6. Power Supply: Provide power supply(s), adequate to serve control panel modules, remote annunciators, addressable devices, notification appliances and other connected devices.
7. Power Requirements:
    a. Loss of 120VAC power automatically causes system to transfer to secondary power. Indicate battery power operation by yellow lamp and audible annunciation at control panel and remote annunciator panels. Upon return of 120VAC power, unit recharges batteries to full capacity and maintains battery on float charge. Provide trickle charge adequate capacity to maintain battery fully charged with automatic rate charge.
    b. Provide batteries in locking cabinet manufactured for purpose.
8. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each function in this portion of the Specifications and for equipment interconnections required under electrical and mechanical specifications.

9. Auxiliary Switches: Provide auxiliary equipment control switches with labeled status indicating lights for each switch.
10. System Reset:
    a. Key-accessible control function returns system to normal, non-alarm state, if initiating circuits have cleared.
    b. Provide reset on both main fire alarm control panel and remote annunciators.
11. Addressing: Provide each initiating device with its own discrete address.

B. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

2.3 NOTIFICATION APPLIANCE CIRCUIT PANELS

A. Salient Characteristics:

1. Provide batteries in locking cabinet manufactured for purpose.
2. Minimum 6 amps of notification power.
3. Three amps per output circuit.
4. Class A and Class B configurable circuits.
5. 24 VDC filtered output voltage.
6. Four power-limited notification outputs.
7. Ground fault detector/indicator.
8. Built-in synchronization for System Sensor, Gentex, Wheelock, Faraday, and AMSECO.
9. UL and CSFM listed.

B. Provide power supply(s), adequate to serve modules, remote annunciators, initiating devices, notification appliances and other connected devices or appliances.

2.4 FIRE ALARM TRANSMITTERS

A. Salient Characteristics:

1. Electrically supervised, capable of transmitting alarm, supervisory and trouble signals over Radio Alarm Transmitter (RAT), Cellular, or Ethernet lines to off-premises receiver. Signal transmitter interfaces fully with receiver station of local fire department or Contracting Officer's selected vendor.
2. Signal transmitter interfaces fully with receiver station of local fire department or Contracting Officer's selected vendor.

B. For radio and cellular transmitters, provide exterior antenna where required to facilitate communication with supervising station.

C. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

2.5 FIRE ALARM ANNUNCIATORS

A. Salient Characteristics:

1. Same manufacturer as fire alarm control equipment.
2. Alphanumeric Remote Annunciator with Controls: Back lit LCD alphanumeric annunciator minimum 80 characters long. Provide under locking cover test switch, alarm and trouble buzzer, buzzer silence switch and buzzer silence message and reset switch, flush mount with finished cover, vandal-resistant UV stabilized Lexan (or approved equivalent) overlay and required modules, control panel, etc., to drive annunciator. Self-contained, suitable for wet location where located exterior.

B. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

2.6 MANUAL PULL STATIONS

A. Salient Characteristics:

1. Same manufacturer as fire alarm control equipment.
2. Semi-flush, red finish, nongrasping operation; maximum pull strength as allowed per ADA criteria.
3. Stations do not allow closure without keyed reset.

B. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

2.7 FIXED TEMPERATURE HEAT DETECTORS

A. Salient Characteristics:

1. Same manufacturer as fire alarm control equipment.
2. Rated 135 degrees F or 190 degrees F as required by space use.
3. Provide white, low-profile detectors.

B. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

2.8 RATE-OF-RISE AND FIXED TEMPERATURE HEAT DETECTORS

A. Salient Characteristics:

1. Same manufacturer as fire alarm control equipment.
2. Responding to 15 degrees F temperature rise per minute and to 135 degrees F fixed temperature as required by space use.

3. Provide white, low-profile detectors.

B. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

2.9 PHOTOELECTRIC TYPE DETECTORS

A. Salient Characteristics:

1. Same manufacturer as fire alarm control equipment.
2. Panel adjustable sensitivity, LED source, multiple cell, 360 degree smoke entry, visual latching operation indicator, insect screen, functional test switch, two-wire operation, and vandal-resistant locking feature.

B. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

2.10 DUCT-MOUNTED SMOKE DETECTORS

A. Salient Characteristics:

1. Same manufacturer as fire alarm control equipment.
2. Photoelectric type. Duct sampling tubes extending width of duct, visual indication of detector actuation, direct housing mount. Detector powered from control panel, power on indicator light. Detector rated for air velocity, humidity and temperature of duct and environment where installed.

2.11 RELAY MODULES

A. Salient Characteristics:

1. Same manufacturer as fire alarm control equipment.
2. Signaling line circuit interface module that connects to other building systems for control of fire/life safety functions, e.g., air-handler shutdown, fire/smoke damper closure.
3. Module powered from control panel.

2.12 CONTROL MODULES

A. Salient Characteristics:

1. Same manufacturer as fire alarm control equipment.
2. Signaling line circuit interface module that provides notification appliance circuits or system control outputs.
3. Module powered from control panel.

2.13 INPUT MODULES

A. Salient Characteristics:

1. Same manufacturer as fire alarm control equipment.
2. Signaling line circuit interface module provides initiating device circuits for connection to contact closure initiating devices.
3. Module powered from control panel.

2.14 FAULT ISOLATION MODULES

A. Salient Characteristics:

1. Same manufacturer as fire alarm control equipment.
2. Signaling line circuit interface modules that provide isolation of wire-to-wire shorts on a signaling line circuit with automatic reconnection upon correction of short circuit.
3. Provide module with status indicator LED.

2.15 COMBINATION HORN/STROBES

A. Salient Characteristics:

1. Multi-candela, flush wall and ceiling mount, white finish, insect-proof.
2. Provide horn/strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971. Candela rating as required by NFPA 72.
3. Must be compatible with fire alarm control equipment and notification appliance circuit panels.

2.16 STROBES

A. Salient Characteristics:

1. Multi-candela, flush wall and ceiling mount, white finish, insect-proof.
2. Provide strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971. Candela rating as required by NFPA 72.
3. Must be compatible with fire alarm control equipment and notification appliance circuit panels.

2.17 HORNS

A. Salient Characteristics:

1. Flush wall and ceiling mount, white finish, insect-proof.
2. Provide horns that meet the latest requirements of NFPA 72.

3. Must be compatible with fire alarm control equipment and notification appliance circuit panels.

2.18 CIRCUIT CONDUCTORS

A. Salient Characteristics:

1. Copper or optical fiber; color code and label. Type FPL, FPLR and FPLP. Cable type as required by the NEC and the manufacturer.
2. Minimum signaling line circuit and initiating device circuit wire size: AWG18.
3. Minimum notification appliance circuit wire size: AWG14, or as approved by Contracting Officer.

2.19 SURGE PROTECTION

A. Install in accordance with IEEE C62.41 B3 combination waveform and NFPA 70; except for optical fiber conductors.

B. Provide for alternating current circuits powering fire alarm equipment.

2.20 BATTERIES

A. Salient Characteristics:

1. Sealed lead acid
2. Absorbent Glass Mat (AGM) technology.
3. ABS case.
4. 12 Volt.

B. Provide additional cabinet, if required due to space limitations in control panels.

2.21 LOCKS AND KEYS

A. Salient Characteristics:

1. Provide same standard lock and key for each key operated switch and lockable panel and cabinet.
2. Provide five keys of each type.

2.22 DOCUMENT STORAGE CABINET

A. Salient Characteristics:

1. Suitable for as-built drawings, operation and maintenance manual, system data file disk and tools.
2. Constructed from steel with baked enamel finish, size adequate for full size drawings, operation and maintenance manual, spare parts, and tools.

2.23 INSTRUCTION CHARTS

A. Salient Characteristics:

1. Printed instruction chart for operators, showing steps to be taken when signal is received (normal, alarm, supervisory and trouble), easily readable from normal operator's station.
2. Frame: Stainless steel or aluminum with polycarbonate or glass cover.

B. Confirm make and model with Contracting Officer prior to ordering.

2.24 FRAMED FLOOR MAP

A. Salient Characteristics:

1. Provide framed floor plan of facility.
2. Frame: Stainless steel or aluminum with polycarbonate or glass cover.

B. Confirm make and model with Contracting Officer prior to ordering.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Provide a complete and operable system compliant with all applicable codes and standards.

B. Install per manufacturer's instructions and recommendations.

C. Obtain Contracting Officer's approval of locations of devices, appliances, and annunciators before installation.

D. Circuits:

1. Signaling Line Circuits (SLC): Class B
2. Notification Appliance Circuits (NAC): Class B.

E. Spare Capacity:

1. New Notification Appliance Circuits:
   a. Minimum 25 percent spare current capacity.
   b. Maximum 10 percent voltage drop.

c. Utilize UL maximum current draw value for notification appliances in calculations.

2. New Signaling Line Circuit: Minimum 25 percent spare device capacity.

F. Power Sources:

1. Primary: Dedicated branch circuits of facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate fire alarm system under normal supervisory condition for 24 hours and operate alarm signals for five minutes at end of standby period.

G. Obtain approval of system design from AHJ prior to installation. Do not begin installation without approval from AHJ and submittal review comments from Contracting Officer.

H. Install in accordance with applicable codes, NFPA 72, NFPA 70 and the Contract Documents.

I. In accordance with manufacturer's instructions, provide wiring, conduit and outlet boxes required for the erection of a complete system as described in these specifications, as shown on Drawings, and as required by AHJ.

J. Conceal wiring, conduit, boxes and supports where installed in finished areas.

K. Provide raceway system for cabling concealed in walls and hard ceilings and in locations where cabling is exposed. Where exposed, provide surface raceway in finished areas and surface mounted EMT in non-finished areas.

L. Provide cabling and conduits system suitable for wet locations for below grade systems.

M. At junction boxes and termination points, provide identification tags on wires and cables.

N. Route wiring to avoid blocking access to equipment requiring service, access, or adjustment.

O. Fire Safety Systems Interfaces:

1. Provide conduit, wiring, boxes, and terminations from fire alarm system to monitored components. Provide a separate input module for each switch or relay to be monitored.
   a. Alarm Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:
      1) Fire sprinkler water flow switches.
      2) Fire sprinkler dry-pipe alarm pressure switches.
      3) Fire sprinkler preaction system alarm condition.
      4) Other alarm inputs.
   b. Supervisory Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:
      1) Fire sprinkler water control valve tamper switches.
      2) Fire sprinkler dry-pipe system low air pressure switches.
      3) Fire sprinkler preaction system supervisory condition.

c. Trouble Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:
   1) Fire sprinkler preaction system trouble condition.
   2) Other trouble inputs.

2. Fire Safety Functions:
   a. Provide power and control conduit, wiring, boxes and terminations to power devices and interface to fire alarm system.
   b. HVAC Systems; Air-Moving Systems:
      1) Provide duct-mounted smoke detector for air systems with air flow rates exceeding 2000 CFM. Coordinate with Division 23, HVAC.
      2) Install duct-mounted smoke detector(s) on return side of air system.
      3) Provide control wiring from addressable relay contacts to air handling equipment controller.
      4) Provide duct-mounted smoke detectors rated for air velocity, temperature, and humidity of duct. Verify quantities, locations and requirements with Division 23, HVAC Drawings, and mechanical system installer.
      5) Where duct-mounted smoke detectors are mounted in inaccessible building void spaces provide access hatch. Provide access hatch with fire rating equivalent to rating of wall, ceiling, or shaft being penetrated.

P. Inspection and Testing for Completion:

1. System testing and commissioning to be performed by a certified manufacturer representative.
2. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities, document each inspection and test.
3. Document audibility measurements and verify intelligibility for each space on record drawings.
4. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
5. Provide tools, software and supplies required to accomplish inspection and testing.
6. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required to test system.
7. Correct defective work, adjust for proper operation and retest until entire system complies with Contract Documents.
8. Notify Contracting Officer seven days prior to beginning completion inspections and tests.
9. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
10. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without any system or equipment malfunctions.
    a. Record all system operations and malfunctions.
    b. If a malfunction occurs, start diagnostic period over after correction of malfunction.

c. Replace devices with readings outside of allowed value at time of system check out.
d. Contracting Officer will provide attendant operator personnel during diagnostic period; schedule training to allow Contracting Officer personnel to perform normal duties.
e. At end of successful diagnostic period, complete and submit NFPA 72 "Inspection and Testing Form."

Q. Designated Personnel Instruction:

1. Provide the following instruction to Contracting Officer designated personnel:
   a. Hands-On Instruction: On-site, using operational system.
   b. Classroom Instruction: Contracting Officer furnished classroom, on-site or at other local facility.
2. Basic Operation: One-hour sessions for attendant personnel, security officers and associated staff; combination of classroom and hands-on:
   a. Initial Training: One session pre-closeout.
   b. Refresher Training: One session post-occupancy.
3. Detailed Operation: Two-hour sessions for engineering and maintenance staff; combination of classroom and hands-on:
   a. Initial Training: One session pre-closeout.
   b. Refresher Training: One session post-occupancy.
4. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data and record drawings available during instruction.
5. Provide means of evaluation of trainees suitable to type of training given; report results to Contracting Officer.

R. Closeout:

1. Closeout Demonstration:
   a. Demonstrate proper operation of functions to Contracting Officer.
   b. Be prepared to conduct any of the required tests.
   c. Have at least one copy of operation and maintenance data, copy of project record drawings, input/output matrix and operator instruction chart(s) available during demonstration.
   d. Have authorized technical representative of control unit manufacturer present during demonstration.
   e. Demonstration may be combined with inspection and testing required by AHJ. Notify AHJ in time to schedule demonstration.
   f. Repeat demonstration until successful.
2. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   a. Specified diagnostic period without malfunction has been completed.
   b. Approved operating and maintenance data has been delivered.
   c. Spare parts, extra materials and tools have been delivered.

d. All aspects of operation have been demonstrated to Contracting Officer.

e. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.

f. Occupancy permit has been granted.

g. Specified pre-closeout instruction is complete.

3. Perform post-occupancy instruction within three months after date of occupancy.

3.2 FIRE ALARM CONTROL PANEL

A. Provide control panels with 120VAC dedicated circuit per NFPA requirements.

B. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.

C. Provide instruction charts at each control panel where system operations are performed. Obtain approval from the Contracting Officer prior to mounting.

D. Perform system programming at the fire alarm control panel. Program the system without shutting the system down. Programming is done offline. Provide copy of site-specific program on electronic storage media. Locate in document enclosure.

E. Room Name Labeling: Control panel schedules, programming, and labeling for electrical equipment, to use the room names and room numbers that the Contracting Officer adopts at the date of substantial completion of construction. This work is to be done at no added cost to the Contract.

F. Programmable Function Keys: Provide control panel accessible function keys for the notification bypass, fire drill, fire door bypass, and supervising station bypass.

G. Programmed control point activation includes selective control of HVAC, fire door release, , and other fire safety and auxiliary functions.

H. Provide machine printed labels on switches and indicators.

3.3 NOTIFICATION APPLIANCE CIRCUIT PANELS

A. Provide notification appliance circuit panel power supplies with 120VAC dedicated circuit per NFPA requirements.

B. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.

3.4 FIRE ALARM TRANSMITTERS

A. Provide conduit and wiring for connections to the transmitter as required for fire alarm system off site supervision.

B. Verify and provide call sequence and message as directed by Contracting Officer and the AHJ.

3.5 FIRE ALARM ANNUNCIATORS

A. When required by the manufacturer, provide fire alarm annunciator with 120VAC dedicated circuit per NFPA requirements.

B. Provide machine printed labels on switches and indicators.

C. Verify location with AHJ before installation.

3.6 MANUAL PULL STATIONS

A. Provide machine printed address labels on addressable devices.

B. Provide protective guard where device is subject to abuse and where required by AHJ.

3.7 FIXED TEMPERATURE HEAT DETECTORS

A. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

B. Provide protective guard where device is subject to abuse and where required by AHJ.

3.8 RATE-OF-RISE AND FIXED TEMPERATURE HEAT DETECTORS

A. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

B. Provide protective guard where device is subject to abuse and where required by AHJ.

3.9 PHOTOELECTRIC TYPE DETECTORS

A. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

B. Provide protective guard where device is subject to abuse and where required by AHJ.

3.10 DUCT-MOUNTED SMOKE DETECTORS

A. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

3.11 RELAY MODULES

A. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification. Labels to include description of controlled function.

3.12 CONTROL MODULES

A. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification. Labels to include description of controlled function.

3.13 INPUT MODULES

A. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification. Labels to include description of monitored input.

3.14 FAULT ISOLATION MODULES

A. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

B. Provide Fault Isolator Modules for signaling line circuit per code requirements and manufacturer instructions.

3.15 COMBINATION HORN/STROBES

A. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.

B. Provide protective guard where device is subject to abuse and where required by AHJ.

3.16 STROBES

A. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.

B. Provide protective guard where device is subject to abuse and where required by AHJ.

3.17 HORNS

A. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.

B. Provide protective guard where device is subject to abuse and where required by AHJ.

3.18 WEATHERPROOF/SURFACE BACKBOXES

A. Provide manufacturer's weatherproof backbox listed for use in areas where the device or appliance is subject to humidity in excess of listed rating. Provide manufacturer surface backboxes where devices cannot be installed recessed.

3.19 CIRCUIT CONDUCTORS

A. Provide wiring to meet the requirements of national, state, and local electrical codes. Provide color coded wiring as recommended and specified by the fire alarm and detection system manufacturer.

B. Provide Type FPLR cable when in a riser application or FPLP cable when installed in plenums.

3.20 SURGE PROTECTIONS

A. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

3.21 BATTERIES

A. Provide machine printed label with installation date, and date of month and year of battery manufacture (MM/YYYY).

3.22 LOCKS AND KEYS

A. Deliver to Contracting Officer.

3.23 DOCUMENT STORAGE CABINET

A. Provide document storage cabinet adjacent to fire alarm control panel.

3.24 INSTRUCTION CHARTS

A. Install chart adjacent to fire control panel.

3.25 FRAMED FLOOR MAP

A. Provide framed floor plan of facility adjacent to the annunciator panel identifying room names/numbers, device/addresses or fire zone number and description as utilized on the annunciator panel, as required by local AHJ.

B. Check with the local fire department for size and approved mounting location.

END OF SECTION

SECTION 31 10 00 – SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Removing trees.
2. Clearing and grubbing.
3. Surface material, weedy scrape, and organic material.
4. Disposal of material from clearing, grubbing, thinning and demolition in approved off-site disposal areas.
5. Filling of voids and excavations resulting from the work.

B. Related Sections:

1. Section 01 35 13.22 – Archeological Protection
2. Section 01 57 13 – Temporary Storm Water Pollution Prevention
3. Section 02 41 13 – Selective Demolition
4. Section 31 20 00 – Earth Moving
5. Section 32 40 00 – Tree and Vegetation Retention and Protection
6. Section 32 92 00 – Revegetation

1.3 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain on the Owner's property, cleared materials shall become Contractor's property and shall be removed and disposed of legally except agreed upon felled trees which are to remain onsite. When possible, the Contractor should re-use or sell materials generated by Site Clearing such as timber, firewood, or wood chips.

1.4 SITE CONDTIONS

A. Site conditions existing during the bidding period will be maintained by the government insofar as practical.

B. Actual site condition variations that differ from those of the bidding period and which affect site clearing operations shall be brought to the attention of the Contracting Officer (CO) prior to the commencement of any site work.

1.5 SUBMITTALS

A. The Contractor shall submit the following information to the CO for review before commencing work:

1. Permits for transport and disposal of debris.
2. Demolition procedures and operational sequence.

PART 2 - PRODUCTS – Not Used.

PART 3 - EXECUTION

3.1 PROTECTION

A. The Contractor shall flag the limits of clearing shown on the drawings by accurate field survey with marked stakes or other means acceptable to the CO. Trees to remain shall be clearly identified during this staking process. The CO shall be notified a minimum of five (5) working days prior to scheduled commencement of clearing operations to review the flagged limits. Adjust the clearing limits as directed by the CO.

B. Before clearing begins, protect designated trees to remain with tree protection fencing as described in 32 40 00 – Tree and Vegetation Retention and Protection.

C. Place tree protection fencing as required to protect other plants, adjacent property areas to remain uncleared, monuments, and existing improvements from damage.

D. The Contractor shall repair or replace immediately any damage to existing trees or root systems that are to remain. The Contractor shall employ an arborist licensed in the State of Washington to determine the repair and replacement needs and methods for approval by the CO.

E. Replace damaged shrubs and other vegetation designated to remain with the same size and species.

F. The tree protection fencing shall be maintained for the duration of construction operations. The work shall include immediate replacement of any damaged fence. Fencing shall be removed from the site at the completion of construction operations. The fencing disposal shall be in accordance with local, state, and federal laws and regulations for the disposal of the material.

3.2 UTILITIES

A. Notify all corporations, companies, individuals, or local authorities owning or having jurisdiction over utilities running to, through, or across areas to be affected by site clearing operations.

B. Locate and identify existing utilities that are to remain and protect them from damage.

C. For utilities to be disconnected, have utility services disconnected in accordance with the requirements of the utility owner.

3.3 CLEARING

A. Clearing shall include cutting, removal, and off-site disposal of trees, bushes and shrubs, refuse, trash and other incidental materials not required for reuse on the site.

B. The Contractor shall remove tree stumps and root systems, except for those to remain.

C. Depressions, excavations and voids resulting from the removal of stumps or roots shall be filled with suitable native soil and compacted as specified under Section 31 20 00 – Earth Moving.

3.4 TOPSOIL

A. Remove vegetation per paragraph 3.3 prior to stripping of topsoil. Topsoil refers to the uppermost soil horizon including the top 6 inches which includes organic duff and other materials capable of supporting vegetation. Limits of topsoil stripping shall be verified with the CO prior to removal, and stockpile locations shall be identified so as not to interfere with the other work.

B. The topsoil, after being stripped, shall be immediately stockpiled for reuse in staging area determined by the CO.

C. Store topsoil in windrow or pile formation with a maximum height of 3 feet protected from wind and water erosion, compaction, and contaminants unless otherwise approved by the CO. Separate topsoil from other excavated material. Do not mix topsoil with subsoil. Stockpiles shall be stabilized with excelsior logs/silt fence or natural fiber (excluding straw) blankets if determined necessary by the CO. Flag or install barriers to keep heavy equipment/vehicles from driving on stockpiled topsoil. Coordinate at least 2 weeks prior to topsoil salvage with CO and NPS to ensure their on-site presence at the initiation of salvage activities. Stockpiles shall be watered down periodically by the Contractor as necessary to mitigate the formation of windblown dust.

D. Stockpile topsoil and surface soil away from edge of excavations without intermixing it with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 36″ unless authorized by CO.
2. Do not stockpile topsoil within drip line of remaining trees
3. Stockpile surplus topsoil to allow for respreading a thicker layer of topsoil

3.5 STOCKPILING

A. Stockpiling shall include collecting fallen timber, organic surface material, brush, and stones required for reuse on the site for revegetation.

B. The Contractor shall store stockpiled material on site for re-use in project revegetation.

3.6 DISPOSAL

A. Remove all material resulting from site clearing and demolition operations from site except agreed upon stockpiled material to remain.

B. No burning of any material will be allowed.

END OF SECTION 31 10 00

SECTION 31 20 00 – EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for roadways and parking areas.
2. Preparing subgrades for walkways.
3. Subbase and base course for cement concrete paving.
4. Excavating and backfilling for utility trenches.
5. Geotextile for drainage.

B. Related Sections include the following:

1. Section 01 57 13 – Temporary Storm Water Pollution Prevention
2. Section 31 10 00 – Site Clearing
3. Section 31 25 00 – Erosion and Sediment Control
4. Section 32 12 16 – Asphalt Paving
5. Section 32 13 20 – Site Concrete
6. Section 32 40 00 – Tree and Vegetation Retention and Protection

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: The layer or layers of specified material placed on a subbase or subgrade to support a surface course.

C. Bedding Material: Granular material placed over the excavated subgrade in a trench above and below a pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Earth Grade: The elevation of the completely graded roadway before placing the pavement structure.

F. Engineered Fill: Clean, crushed, granular material that will support structures. Structural fill material will be material that is considered an all-weather fill material.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by CO. Unauthorized excavation, as well as remedial work directed by CO, shall be without additional compensation.

H. Fill: Soil materials used to raise existing grades.

I. Pavement Structure: All combinations of subbase, base course, and surface course, including shoulders, placed on a subgrade.

J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by an independent geotechnical testing agency, according to ASTM D 1586.

K. Structures: Buildings, footings, foundations, retaining walls, curbs, or other man-made stationary features constructed above or below the ground surface.

L. Subbase Course: The layer of specified material placed on the subgrade as a part of the pavement structure.

M. Subgrade: The portion of the earth grade upon which the pavement structure is placed.

N. Utilities: On-site underground pipes, conduits, ducts, and cables.

O. Earthwork Terminology: Terms used in this Section and not defined herein shall be interpreted in accordance with the definitions given in ASTM D653.

P. Embankment: Soil or soil-rock material placed to raise the subgrade or natural grade of the site for embankment construction.

Q. Native Soil: Sand or silt naturally occurring on site that was never imported to the site, is weed free, and supports local native habitats.

R. Unsuitable Material: Excavated material or material below the natural ground surface in embankment areas or below subgrade elevation in excavated areas, which is unsuitable for its planned use as determined by the Contracting Officer. Unsuitable material is further defined as material determined to be:

1. Of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content.
2. Too wet to be properly compacted and circumstances prevent suitable in-place drying prior to incorporation into the Work.
3. Not meeting requirements specified in Part 2 of this Section.
4. Otherwise unsuitable for the planned use.

The presence of excessive moisture in a material is not, by itself, sufficient cause for determining that the material is unsuitable.

Q. Relative Compaction: The ratio, expressed as a percentage, of the in-place dry density of fill materials as compacted in the field to the maximum dry density of the same material.

R. Optimum Moisture Content: The water content at which a soil can be compacted to a maximum dry unit weight by a given compactive effort.

1.4 LAWS AND REGULATIONS

A. Work shall be accomplished in accordance with regulations of local, township, county, state and federal agencies or utility company standards as they apply.

1.5 SUBMITTALS

A. Delivery Tickets: Submit a delivery ticket with each load of imported material delivered to the site, stating the type of fill material, source, and the quantity.

B. Product Data: For the following:

1. All aggregates proposed for use.
2. Import fill.
3. Geotextile fabric.

C. Material Test Reports: The Contractor shall conduct testing at their own expense for material testing of material that does not come from a pre-approved quarry. The test information shall be provided to the CO for approval prior to material import. Material test reports shall be from a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site and import soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 1557 for each on-site and import soil material proposed for fill and backfill.

D. Compaction test results.

E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.6 QUALITY ASSURANCE

A. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination.”

B. Tolerances:

1. Construct finished subgrades to plus 0 or minus 1/2-inch of the elevations indicated.
2. Construct finished grade of slopes not steeper than 2:1 plus or minus 1/2 inch and on slopes steeper than 3:1 plus or minus two inches (2").
3. Maintain the moisture content of fill material as it is being placed within plus or minus 2% of the optimum moisture content of the material as determined by the laboratory tests herein specified.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted in writing by Contracting Officer and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Contracting Officer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Contracting Officer's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

C. Unfavorable Weather Conditions:

1. Excavating, filling, backfilling, and grading work shall not be performed during weather conditions that might damage or be detrimental to the condition of existing ground, in-progress work, or completed work. When the Work is interrupted by rain, freezing weather, or other conditions deemed unsuitable by the Project Representative, excavating, filling, backfilling, and grading work shall not resume until the site and soil condition (moisture content) are suitable for compaction.
2. Subgrade shall be free from mud, snow, ice, and deleterious material when work is resumed.
3. Soil material that is too wet for compaction shall be left to drain, to be aerated and dried by disking and harrowing or other approved method until the moisture content of the area is uniform and within the specified limits.

D. Erosion Prevention: Protect stockpiles, ditches, embankments, filled, backfilled, and graded areas to prevent erosion until such time as permanent drainage and erosion control measures have been installed per the requirements of Section 01 57 23 – Temporary Storm Water Pollution Prevention.

E. Control of Dust: Employ construction methods and means that keep flying dust to the minimum throughout the entire Contract period. It may include watering and sprinkling, or other approved methods at the construction site of such frequency that will satisfactorily control the dust caused by construction operations.

F. Control of Dirt: Promptly remove from existing roadways all dirt and other materials that have been spilled, washed, tracked, or otherwise deposited thereon by construction operations whenever the accumulation is sufficient to cause the formation of mud, interfere with drainage, damage pavements, or create a traffic hazard.

G. Indicated locations of existing facilities and systems are approximate. Investigate and determine exact location and nature of utilities, facilities, and systems, and be solely responsible for damages caused by construction activities.

H. Excavation in areas that have or may have underground facilities:

1. Delineate with white paint, flags, or other methods the area to be excavated and contact Underground Location Service to request that Government mark the location of underground utilities.
2. Identify temporary survey markings using PINK colored markings in accordance with Underground Service alert requirements.
3. Government will field mark approximate location and number of subsurface installations affected by excavation using the following colors:

    a. Safety RED – Electric power, distribution, and transmission installations, or municipal electric installations.
    b. High Visibility Safety YELLOW – Gas distribution and transmission installations, oil distribution and transmission installations containing or transporting dangerous materials, products, or steam.
    c. Safety Alert ORANGE – Telephone and telegraph installations, police and fire communication installations, and cable television installations.
    d. Safety Precaution BLUE – Water installations and slurry pipelines.
    e. Safety GREEN – Sewer installations.
    f. Do not use above listed colors for Contractor's temporary markings suck as survey points; use U.S.A. designated PINK color.

PART 2 - PRODUCTS

2.1 STRUCTURAL FILL MATERIALS

A. Structure backfill must be free of organic or other unsatisfactory material.

B. Structural fill, including fill supporting structures and pavements should be free of all debris and organic matter. Structural fill shall be near the optimum moisture content and otherwise capable of being compacted to the required specifications for the particular use. Material used for structural fill shall include clean sand and gravel; well-graded mixtures of sand and gravel (commonly called "granular borrow" or "pit run"); mixtures of silt, sand, and gravel; crushed rock; quarry spalls; and controlled density fill (CDF). If on-site soils do not meet the criteria for structural fill, or cannot be reworked to a suitable condition, imported granular fill consisting of clean, well-graded sand and gravel complying with the requirements below shall be used.

1. If the imported material has a sand equivalent less than 30, it must have less than 5% passing the No. 200 sieve, in accordance with AASHTO T 27 / T 11.

Other materials may be used with the approval of the CO. Structural fill imported during wet weather shall be free-draining.

C. Rocks exceeding four inches (4″) in largest dimension and deleterious material shall be removed from the site and disposed of as specified herein under Disposal of Surplus Material.

D. Excavated material not suitable for use as structure backfill may be used to replace imported borrow or other excavated material.

2.2 SOIL MATERIALS

A. Aggregate for Base Course: Aggregates for bases shall be crushed stone, crushed slag, crushed gravel, natural gravel, or crushed reclaimed concrete. Aggregate Base Course shall be Class 6 and shall comply with the following gradation:

Sieve Size	**Base Course**
	Percent Passing
1”	100
3/4”	95-100
No. 4	30-65
No. 8	25-55
No. 200	3-12

B. Embankment: All embankment material shall consist of clean well-graded soil with little or no potential for expansion.

C. Pipe Bedding Material: Bedding material shall consist of natural sand obtained from acceptable pits. The sand shall be free of clay or organic material and shall comply with the following gradation requirements:

Sieve Size	**Percentage Passing**
No. 4	90-100
No. 200	0-5

D. Sand: ASTM C 33; fine aggregate, natural, or manufactured.

E. Permeable Base Course: Permeable Base Course shall be No. 6 and shall comply with the following gradation:

Sieve Size	**Permeable Base Course**
	Percent Passing
1”	100
3/4”	90-100
½”	20-55
3/8”	0-15
No. 4	0-5

F. Riprap:

1. Riprap shall consist of hard, dense, durable stone, angular in shape and resistant to weathering. Rounded stone or boulders shall not be used as riprap material. The stone shall have a specific gravity of at least 2.5. Each piece shall have its greatest dimension not greater than three times its least dimension.
2. Riprap shall conform to the following material test requirements:
   a. Abrasion Resistance by Los Angeles Machine: 50% loss, max, per ASTM C535
   b. Unconfined Compressive Strength of Drilled Core Specimen: 2500 psi, min, per AASHTO T24
3. Riprap shall be d_{50}=6" and meet the following requirements for grading:

Percent of Material Smaller than Typical Stone Mass	**Typical Stone Dimensions (in.)**	**Typical Stone Weight (lbs)**
70-100	12	85
50-70	9	35
35-50	6	10
2-10	2	0.4

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation for earthwork operations including removal of vegetation, topsoil, debris, and obstructions, from ground surface is specified in Section 31 10 00 – Site Clearing.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust.

3.2 STAKING AND GRADES

A. Layout the work, establish all necessary markers, benchmarks, grading stakes, and other stakes as required, in accordance with the lines and grades of the Plans.

3.3 UTILITIES

A. Verify on site the location and depth (elevation) of all existing utilities and services before performing any excavation work. Use the 811-call utility service and other means required to verify locations.

B. Active utility lines encountered, which are not indicated in the Contract Documents, shall be reported immediately to the Contracting Officer and utility owners involved. The Contracting Officer and utility authorities shall be permitted free access to determine the measures deemed necessary to repair, relocate, or remove the utility.

C. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.4 EARTHWORK GENERAL REQUIREMENTS

A. Erosion Protection: Prevent erosion of the site and turbidity in adjacent waterbodies of the site at all times. Conform to all the requirements as per Section 01 57 13 – Temporary Storm Water Pollution Prevention and Section 31 25 00 – Erosion and Sediment Controls.

B. Construction Traffic: Protect exposed soil layers with high moisture content from excessive wheel loads.

C. On-Site Excavation:

1. Do not excavate or remove any material from the project site which is not within the designated excavation.
2. The Contractor is responsible for retaining enough excavated material for reuse for any actions and for disposing excess material off-site.

D. Disposal of Surplus Material:

1. Excess earth materials, unsuitable materials, and debris shall be removed from the site and disposed of in a legal manner. The Contractor is to provide the CO with copies of the documentation for the legal disposal of materials.

E. Maintenance of Excavations, Slopes, and Embankments:

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Maintain slopes and embankments until final completion and acceptance of the Work. Promptly repair slides, slipouts, washouts, settlements, and subsidence that occur for any reason, and refinish the slope or embankment to the indicated lines and grades.

F. Dust and Dirt Control: Provide satisfactory control or remove dust and/or dirt at the project site and adjacent roadways whenever traffic or buildings that are occupied or in use, are affected.

3.5 ROUGH GRADING AND FILLING

A. Fill or backfill holes, swales, and low points that will not otherwise be removed in the course of the Work, to the indicated grades.

3.6 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Discharge locations shall be identified in a preconstruction submittal and approved by the CO. All discharge shall avoid turbidity or erosion into adjacent water bodies.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.7 EXPLOSIVES

A. Explosives: Do not use explosives.

3.8 EXCAVATION

A. The bottoms of excavations shall be level, firm, undisturbed earth, clean and free from loose material, debris, and foreign matter.

B. Protect existing structures during excavation.

C. Excavate to the lines and grades indicated on the Contract Drawings.

D. Support and maintain excavation so that sides are stable and will not move. Excavations may be maintained by sloping cut faces where space permits, or by providing structural support of earth walls.

E. Limits of excavations shall allow for adequate working space for installing forms, and as required for safety of personnel.

F. Excavation and its restoration, when conducted for convenience of the Contractor, shall be at no additional expense to the Government.

G. Place excavated material at sufficient distance from edge of excavation so as not to cause cave-ins or bank slides, but in no case closer than three feet (3′) from the edge of excavations.

H. Condition excavated earth material that is suitable for backfill or embankment for re-use. Test, screen, and mix as necessary to meet specified requirements.

I. Footing excavations shall be free of any loose, soft, or disturbed material, and water prior to placement of reinforcing bars and concrete.

3.9 EMBANKMENT CONSTRUCTION

A. Fill shall be placed in level lifts not exceeding 8 inches in loose thickness. Each lift shall be brought to within 3 percent of optimum moisture content and compacted to at least 90 percent compaction.

B. Finished fill slopes shall be constructed at an inclination no steeper than 2:1. Fill slopes shall be overbuilt and trimmed back as necessary to expose a well-compacted surface.

C. Structural fill supporting footings shall extend laterally outside of the footing base at a 1H:1V or flatter inclination projected down and away from the bottom edges of the footing.

D. Routine maintenance of slope sloughing and erosion should be anticipated. Fill slopes and areas disturbed during construction shall be planted with vegetation to reduce erosion.

E. Remove material that cannot be compacted to the required density within specified tolerances and replace with suitable material at no additional expense to the Government.

3.10 STRUCTURAL FILL SUBGRADE PREPARTION

A. The subgrade surface shall be free of any water, debris, organic, loose, soft, disturbed, or other deleterious material prior to placement of fill, reinforcing bars, and concrete.

B. If grading or excavation to the subgrade during construction reveal highly variable conditions within the foundation footprint, subgrade shall be over excavated and replaced with compacted engineered fill to achieve a uniform subgrade surface.

C. Native subgrade that is wet, unsuitable, or that has become loosened by the contractor's operation shall be properly moisture conditioned and compacted or over-excavated and replaced with a suitable engineered fill. Caution should be exercised if compacting by means of proof rolling so as not to damage the subgrade.

D. Structural fill shall be placed in level lifts not exceeding 8 inches in loose thickness and compacted to at least 95 percent of maximum ASTM D 1557 dry density below all footings and within 3 feet of final grade in pavement areas.

E. Structural fill placed around footings should be compacted to at least 95 percent of maximum ASTM D 1557 dry density.

F. After the densification process, a firm, unyielding, stable surface shall be produced.

G. Proof-rolling shall be performed prior to constructing any structures founded on engineered fill with a fully loaded 10-yard dump truck. Remove yielding areas to expose suitable subgrade.

H. Notify CO when excavations have reached required subgrade and before placing any fill material. If CO determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

I. For pavement, slab, structural fill, or foundation subgrade, any suitable material loosened during excavation or other activities prior to placement of structural fill, pavement or slab materials, or foundations shall be compacted.

J. If wet fine-grained soils are encountered at the subgrade, geotextile meeting the requirements of Section 2.2.C shall be installed prior to backfilling.

K. Where fill will be placed adjacent to an existing slope, steps shall be excavated into the existing slope to help "key" the new fill into the slope.

L. Structural fill shall be placed on firm, un-yielding subgrade prepared in accordance with these specifications.

M. Perform all cutting, blading, and shaping as required to cut and shape the subgrade to the grades and elevations indicated.

N. Subgrade preparation includes fine grading, reworking as necessary, and preparation of cut, fill, or embankment upon which structure and equipment foundations, pipe, base, and pavement will be placed.

O. The upper 6 inches of subgrade under pavements shall be moisture conditioned and compacted to at least 95 percent relative compaction and should be smooth and unyielding.

P. After the material has been thoroughly mixed and moisture-conditioned, accurately construct and fine grade the subgrade to indicated line, grade, and contour with high and low spots eliminated. Compact for full width to the specified density. Remove soft spots developed during working, fill with approved material, and re-compact.

Q. If soil moisture conditions allow, after exposing the subgrade for pavement, slab, or structural fill, proof-rolling the subgrade with a loaded dump truck or other heavy wheeled vehicle to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5km/h).
2. Proof-roll with loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by CO and replace with compacted backfill or fill as directed.

R. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

S. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by CO, without additional compensation.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
2. Temporary stockpiles shall be no higher than 5 feet.

3.12 BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place backfill in horizontal layers not to exceed 8 inches of loose material and compact each layer to at least 90 percent of maximum ASTM D1557 dry density before the next layer is placed.

C. Place backfill material in such a manner that unbalanced horizontal loads will not be applied to a newly placed structure or portion of a structure, utilities, or pipelines.

D. Do not backfill on or against structural concrete until the specified 28-day concrete strength has been attained.

E. Do not use compaction equipment and methods that produce excessive horizontal or vertical earth pressures.

3.13 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Trenches shall be graded uniformly sloped between pipe elevations as shown on the drawings.

C. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

D. Place and compact initial backfill of pipe bedding material to a height of 6 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

F. Backfill and compact over excavations to ninety (90) percent relative compaction with bedding material. There shall be no additional payment to the Contractor for over excavations not directed by the CO. Remove unsatisfactory material encountered below the grades shown as directed by the CO and replace with bedding material. Payment for removal and replacements of such unsatisfactory material directed by the CO shall be made in accordance with the provisions of the General Conditions.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer for the parking lot/picnic area or trail before compaction to within 3 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Fill compaction shall be verified by means of in-place density tests performed per ASTM D6938 (or appropriate alternative when ASTM D6938 is not suitable for the fill material) during fill placement so that compaction may be evaluated as earthwork progresses.

D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

Fill Application	**Minimum Compaction %**
Building Pad	95
Footing subgrade or bearing pad	95
Slab-on-grade floor subgrade and subbase	95
Retaining wall footing subgrade	95
Concrete slab subgrades	95
Asphalt pavement base and subbase	95
Asphalt pavement subgrade, within 3 feet of finished grade	95
Asphalt pavement subgrade, more than 3 feet below finished grade	90
Retaining wall backfill	90
Footing and stem wall backfill	90

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

3.17 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase and base course to required crown elevations and cross-slope grades.
3. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
4. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.18 SHORING AND SHEETING

A. Construct and maintain all shoring, sheeting, and slope lay-back necessary to protect the excavation, as need for safety of the employees and as required by applicable State and Federal laws.

B. For trenches over five (5) feet deep, provide suitable barricades for worker protection. When work area is left open and unattended by Contractor, provide suitable barricades for public safety, regardless of trench depth.

C. For trenches over four (4) feet deep, provide suitable exit means in accordance with applicable provisions in OSHA.

D. Do not remove timber or sheeting if it is in a compacted zone. Trim timber or sheeting off at a safe level above that zone.

E. As directed, remove all other sheeting and shoring when no longer needed.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. The subgrade must be protected from other construction activities, traffic, and weather conditions. The subgrade will degrade and become unsuitable if the soil gets too wet or too dry. Construction activity and equipment of all types have the potential to disturb and negatively impact the prepared subgrade. The contractor shall implement suitable procedures to protect the subgrade, such as excavating without tracking on the native soils, use of a crushed rock or gravel-working mat, dewatering, soil admixing, geotextiles, or other suitable procedures during construction.

B. Pavement and foundation subgrade shall be maintained in a well-compacted state and protected from degradation prior to paving or placing concrete. Protection measures may include restricted traffic, perimeter drain ditches, or placement of a protective gravel layer on the subgrade. Disturbed or wet areas in the subgrade shall be removed and replaced with suitably compacted structural fill.

C. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

D. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by CO; reshape and recompact.

E. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it.

B. Disposal: Remove and legally dispose of all miscellaneous debris, trash, construction materials off Park property.

END OF SECTION 31 20 00

SECTION 31 25 00 – EROSION & SEDIMENT CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Perimeter sediment control.
2. Site erosion control.

B. Related Sections:

1. Section 01 57 23 – Temporary Storm Water Pollution Prevention
2. Section 31 10 00 – Site Clearing
3. Section 31 20 00 – Earth Moving
4. Section 32 40 00 – Tree and Vegetation Retention and Protection

1.3 SUBMITTALS

A. Product data for the following:

1. Wattles.

PART 2 - PRODUCTS

2.1 GENERAL

A. To the extent feasible, use wildlife safe materials for erosion control products.

2.2 WATTLES

A. Wattles shall consist of seed free, straw fibers encased in tubular netting shall be a minimum of 8 inches in diameter.

B. Wattles shall be installed in accordance with the manufacturer's recommendations.

C. Non-plastic all-natural jute, coir or cotton type netting. Netting material shall be from cuts, tears, or weak places.

D. Stakes for wattles shall be made of wood from untreated Douglas fir, hemlock, or pine species.

PART 3 - EXECUTION

3.1 WATTLES

A. Wattles shall be installed as soon as construction will allow or when designated by the CO. Wattle installation and trenching shall begin from the base of the slope prior to any topsoil or compost placement. Excavated material from trenching shall be spread evenly along the uphill slope and be compacted using hand tamping or other method approved by the CO. On gradually sloped or clay-type soils trenches shall be 2 to 3 inches deep. On loose soils, in high rainfall areas, or on steep slopes, trenches shall be 3 to 5 inches deep, or half the thickness of the wattle, whichever is greater.

B. Wattles shall be laid out, spaced, and staked. If trenching and staking is not possible due to rocky soils, compost socks shall be used instead of wattles.

C. The Contractor shall exercise care when installing wattles to ensure the method of installation minimizes the disturbance of waterways and prevents sediment or pollution discharge into water bodies.

END OF SECTION 31 25 00

SECTION 32 12 16 – ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Hot mix asphalt (HMA) for parking areas and miscellaneous paving.

B. Related Sections:

1. Section 31 20 00 – Earth Moving
2. Section 32 13 20 – Site Concrete
3. Section 32 17 00 – Paving Specialties

1.3 SUBMITTALS

A. Product data for asphalt concrete mix design, asphalt binder, and aggregates.

B. Results from tests described in Section 3.9.

1.4 FIELD CONDITIONS

A. Hot mix asphalt shall be placed only on properly prepared unfrozen surfaces that are free of water, snow, and ice.

B. The hot mix asphalt shall be placed only when both the air and surface temperatures equal or exceed the temperatures specified below. If the temperature falls below the minimum air or surface temperatures, paving shall stop.

Compacted Layer Thickness (inches)	**Minimum Surface and Air Temperature °F Top Layer**	**Minimum Surface and Air Temperature °F Layers Below Top Layer**
< 1 ½	60	50
1 ½ - 3	50	40
3 or more	45	35

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphalt Binder: ASTM D946.

B. HMA shall be Class ½″ PG 64-22 unless noted otherwise on the drawings and shall conform to the following:

Property	PG 64-22	AASHTO Test No.
Flash Point Temp., °C, minimum	230	T 48
Viscosity at 135°C, Pas, minimum	3	T 316
Dynamic Shear, Temp °C	64	T 315
Acid or Alkali Modification (pass-fail)	Pass	CP-L 2214

C. HMA mixtures shall conform to the tolerances listed below:

HMA Gradations	Tolerance
Passing the 3/8" and larger sieves	± 6%
Passing the No. 4 and No. 8 sieves	± 5%
Passing the No. 30 sieve	± 4%
Passing the No. 200 sieves	± 2%
Asphalt Content	± 0.3%
Asphalt Recycling Agent	± 0.2%

PART 3 - EXECUTION

3.1 GENERAL

A. Conduct paving operations in a manner to minimize interference with roads and used facilities. Do not close or obstruct roads or other adjacent occupied or used facilities without permission from CO and authorities having jurisdiction. Provide alternate signed routes around closed or obstructed traffic ways.

3.2 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.3 PREPARATION

A. Place and compact subbase and base course.

B. Soil subgrades should be proof-rolled with a loaded dump truck or heavy compactor to verify density. Any areas of yielding subgrade disclosed during this proof-rolling operation should be over excavated and replaced with a suitable structural fill material.

C. The subgrade and aggregate base material shall be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557).

D. Contractor shall be responsible for protection of the subgrade.

3.4 PREPARATION – TACK COAT

A. Patch and clean the existing surface and ensure it is without irregularities to provide a reasonably smooth and uniform surface to receive the treatment. Clean the edges of existing pavement that are to be adjacent to new pavement to allow adhesion.

B. Where a new asphalt surface joins an existing asphalt surface, tack coat shall be applied to the existing surface at the rate of 0.1 gallons per square yard. Fine building sand shall be swept into the joint to function as filler. Joints shall be trimmed to form near vertical surfaces and neat lines prior to asphalt placement.

C. Broom before applying tack coat. lightly spray the surface of the roadway to be swept with enough water to prevent brooming operations from creating dust to the extent that it would violate air pollution regulations or create a safety hazard.

D. Apply the asphalt tack coat uniformly and completely by fogging with a hand spray attachment or by another approved method when application with a distributor spray bar is not practical.

E. Squeegee the excess asphalt from the surface.

3.5 HOT-MIX ASPHALT PAVEMENT

A. Do not use mixes produced from different plants.

B. Measure temperature of the asphalt concrete mix in the hauling vehicle just before dumping into the spreader or measure it in the windrow immediately before pickup.

C. Lifts:

1. Asphalt sections over 2” in thickness shall be placed in two lifts.
2. Asphalt sections 2” or less in thickness shall be placed in one lift.

D. In areas where mechanical spreading and finishing is impractical, place and finish the asphalt concrete mix with alternate equipment to produce a uniform surface closely matching the surface obtained when using a mechanical paver.

3.6 COMPACTION

A. Thoroughly and uniformly compact the asphalt by rolling.

1. Size the rollers to achieve the required results.
2. Operate rollers according to the recommendation of the manufacturer.
3. Do not use diesel fuel as a release agent with rollers used to compact asphalt concrete mix.

B. Compact the asphalt concrete mix with alternate equipment approved by the CO to obtain the required compaction along forms, curbs, headers, walls, and other places inaccessible to rollers. Do not cause cracking, shoving or undue displacement.

C. Where HMA is placed in areas not retained by curb faces, walls, and other vertical surfaces, the closed edges of the asphalt concrete shall be compacted to meet the same density requirements as the other asphalt surfaces.

D. Continue compaction until surface marks are eliminated and cracks are sealed and surfacing meets the compaction requirements.

3.7 JOINTS, TRIMMING EDGES, AND CLEANUP

A. Make transverse joints vertical to the depth of the new pavement at connections to existing pavements and previously placed lifts. Form transverse joints by cutting back the previous run to expose the full-depth course.

B. Apply an asphalt tack coat to the edge of both transverse and longitudinal joints per Section 3.4.

C. Place the asphalt concrete mix as continuously as possible. Do not pass rollers over an unprotected edge of freshly laid asphalt concrete mix.

D. Dispose of material trimmed from the edges and other discarded asphalt concrete mix.

3.8 PAVING TOLERANCES

A. Pavement Straightedge Measurement:

1. Measure the pavement surface using a 10-foot metal straightedge at right angles and parallel the curb line or edge of walkway.
2. Defective areas are deviations between the surface and the bottom of the straightedge in excess of ¼ inches measured between two contacts of the straightedge or deviations in excess of ¼ inches measured at the end of the straightedge.

B. Defective Area Correction

1. Obtain approval before starting corrective work. Allow 7 days for review and approval of correction method proposal.
2. Correct defective areas by one of the following methods:

    a. Milling: Replace the defective area by milling at least one-half the pavement depth and repaving with the approved asphalt concrete mix.
    b. Saw cutting: Replace the defective area by saw cutting and removing the defective area and repaving with the approved asphalt concrete mix.
    c. Other: Submit a proposal for approval for other correction methods not listed above.

3.9 FIELD QUALITY CONTROL AND TESTING

A. Placement temperature

1. Sample temperature of first five loads and one out of every five thereafter.
2. Sampling shall occur in hauling vehicle before dumping.

B. Density Testing

1. Take nuclear gauge density readings and cut and test core samples.

    a. Test Core Samples

1) Cut two 6-inch diameter side by side cores.
2) Remove them with a core retriever and fill and compact the core holes with asphalt concrete mixture.
3) Label the cores and protect them from damage due to handling and temperature.
4) Submit one core for verification testing.
5) Dry the other core to constant mass at 125±5 °F or vacuum dry it according to ASTM D7227 before performing the core density and measuring the thickness. Use 62.245 pounds per cubic foot to convert specific gravity to density.

b. Density testing shall be in accordance with AASHTO T 166.
c. Sampling frequency shall be one per 350 tons.
d. Sample in-place after compacting.
e. Deliver cores to CO after testing is completed.

C. Monitor the compaction process with nuclear density gauges and compact according to:

1. The lower specification limit is 91.0 percent of the maximum specific gravity (density) determined according to AASHTO T 166 and AASHTO T 209.
2. The percent compaction will be determined using the average maximum specific gravity (AASHTO T 209) from all samples tested each day.

3.10 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury until surface temperature is less than 140 degrees F.

END OF SECTION 32 12 16

SECTION 32 13 20 – SITE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, concrete materials, mixture design, placement procedures, and special concrete flatwork finish, for the following:

1. Concrete parking and concrete walkways as shown.
2. Concrete Foot Bridge with curbing at both sides.
3. Concrete sidewalk ramps.
4. Concrete curb.
5. Concrete flow pan.

B. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

B. Broom Finish Concrete Paving: Where shown on the drawings, using a medium bristle concrete finishing brush perpendicular to the direction of travel.

C. Sand Finish: a concrete finish consisting of exposed micro-aggregate (sand) achieved by using a retarder and wash process.

D. Integral Color Concrete: ‘Yosemite Brown’

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar

diagrams, bar arrangement, splices and laps, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Qualification Data: For manufacturer testing agency.

E. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Curing compounds.
5. Adhesives.
6. Vapor retarders.
7. Semirigid joint filler.
8. Joint-filler strips.
9. Repair materials.

F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates.

G. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing will be performed by an independent testing laboratory selected by the Contractor. All tests will be paid for by the Contractor.

B. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

C. Special Concrete Finishes Installer Qualifications: project personnel shall be concrete finish specialist experienced with the use of retarders to produce exposed sand finish. The basis for qualifications shall be the contractor-produced mock-up panel finish. Three mock panels shall be created for review with the following saturation: 90%, 100%, and 110%. Mockups shall be 2’ x 2’ in dimension and brought to the project site for review. If, in the opinion of the CO.COR the contractor’s concrete finishing personnel have not produced an acceptable finish on the mock up panel, then personnel shall receive professional training in sand finishing and an additional mock up panel produced with both training and mock up panel at the contractors expense.

D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA’s “Certification of Ready Mixed Concrete Production Facilities.”

E. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

F. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

H. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Bundles of reinforcing bars shall be tagged showing quantity, grade, size, and suitable identification to allow checking, sorting, and placing. Identification of steel shall be maintained after bundles are broken.

B. Reinforcing steels shall be stored off the ground in a manner that will prevent bending and be protected from earth, oil, or any other material that might impair bond to concrete. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. The form-release agent shall be natural, organic, VOC compliant, and biodegradable.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.2 CONCRETE MATERIALS

A. Cementitious Material

1. Cement shall be from a preapproved source listed on CODOT's Approved Products List. Use cementitious materials, of the same type, brand, and source, throughout the project.

B. Silica Fume

1. ASTM C 1240, amorphous silica.
2. Silica flume shall be from a preapproved source listed on CODOT's Approved Products List.

C. Fly Ash

1. ASTM C618, Class C or Class F with the following exceptions:
   a. The loss on ignition shall not exceed 3.0 percent.
   b. The CaO in Class F fly ash shall not exceed 18 percent.
2. Fly ash shall be from a preapproved source listed on CODOT's Approved Products List.

D. High-Reactivity Pozzolans (HRPs)

1. AASHTO M 321.
2. HRPs shall be from a preapproved source listed on CODOT's Approved Products List.

E. Slag Cement

1. ASTM C989, Grade 100 or Grade 120
2. Slag cement shall have a maximum aluminum oxide content of 11.0 percent.
3. Slag cement shall be from a preapproved source listed on CODOT's Approved Products List.

F. Aggregates

1. Use a fine and coarse concrete aggregate that meets the requirements described below.
2. Fine aggregate shall conform to the requirements of AASHTO M 6, Class A, and shall meet the following requirements:

Fine Aggregate Gradation

Sieve Size	% Passing
3/8"	100
No. 4	95-100

No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

Fine Aggregate Criteria

Characteristic	**Test Method**	**Requirements**
Sand Equivalent	Colorado Procedure 37	80 minimum
Fineness Modulus	AASHTO T 27	Not less than 2.50 or greater than 3.50

3. Coarse aggregate shall conform to the requirements of AASHTO M 80, Class A, except that the percentage of wear shall not exceed 45 when tested per AASHTO T 96. Coarse aggregate shall meet the following requirements:

Coarse Aggregate Size No. & Gradation

Sieve Size	**% Passing**								
	No. 3	**No. 357**	**No. 4**	**No. 467**	**No. 57**	**No. 6**	**No. 67**	**No. 7**	**No. 8**
2 ½”	100	100							
2”	95-100	95-100	100	100					
1 ½”	35-70		90-100	95-100	100				
1”	0-15	35-70	20-55		95-100	100	100		
¾”			0-15	35-70		90-100	90-100	100	
½”	0-5	10-30			25-60	20-55		90-100	100
3/8”			0-5	10-30		0-15	20-55	40-70	85-100
No. 4		0-5		0-5	0-10		0-10	0-15	10-30
No. 8					0-5		0-5	0-5	0-10
No. 16									0-5

G. Water

1. ASTM C 94/C 94M and potable.

2.3 ADMIXTURES

A. Air-Entraining Admixtures must comply with ASTM C260.

B. Chemical Admixtures must comply with ASTM C494.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1 or 2, Class A or B.

2.5 RELATED MATERIALS

A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned based on laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. Provide concrete with an ultimate strength of 4000 psi.
3. Air entrainment shall be between 4.5% min. and 7.0% max.
4. Use a locally-obtained sand to match the geology of the park location.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.7 REINFORCING STEEL

A. Refer to Section 03 20 00 – Concrete Reinforcing.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Use either fixed forms or slip forms.

B. Provide straight, full depth, un-warped forms that will resist springing during concrete placement.

C. Firmly stake fixed forms.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

F. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

G. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

H. Form liners shall not be used for the final finish.

3.2 REMOVING AND REUSING FORMS

A. General: Formwork that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete shall be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Contracting Officer (CO).

3.3 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.4 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 REINFORCEMENT

A. Reinforcement: Place according to Section 03 30 00 – "Cast-in-Place Concrete."

3.6 JOINTS

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

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

E. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING CONCRETE

A. Float the surface, but do not over-float, to produce a smooth surface, free from irregularities. Round the edges and joints with finishing tools.

B. Sand finish is achieved by using a retarder and washing away cementitious material to expose the micro aggregate. Sand finished concrete shall have a ¾" inch coarse aggregate to facilitate sinking the coarse aggregate into the slab slightly. After screeding flat, concrete shall be worked with a roller tamper to push down the aggregate from the surface. Concrete shall then be immediately bull-floated in both directions. Concrete shall be troweled to a level and smooth surface without bird baths, trowel marks, edger marks or jointer marks on the surface. Concrete surface shall have moisture - not standing bleed water on the surface when applying retarder.

3.9 CONCRETE PAVING SAW-CUT JOINTS

A. All control joints and construction joints shall be saw-cut. Only isolation joints and expansion joints may have tooled joints. Saw-cutting shall employ a light walk-behind machine cutting to the width and depth shown on the plans. Joints shall be saw-cut as soon as the concrete is cured

sufficiently to support a light walk-behind machine without marking the surface or within 4 hours unless approved by the CO. In no case shall concrete paving be left overnight without being saw-cut.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces to deter moisture loss due to hot, dry, or windy conditions before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by the following method:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.11 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor shall engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173 volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. Test results shall be reported in writing to CO, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.13 INSPECTIONS

A. Accessibility Inspection: Accessibility inspection shall be performed by the Contractor in a two-part process to ensure compliance of final installation. The two-part process inspections shall occur pre-installation and post-installation.

1. Pre-installation inspection shall examine slopes, dimensions, base materials and preparation work prior to concrete placement. Check formwork, embedded items, reinforcing, etc. Pre-installation work shall conform to National Park Service Accessible Route Design Standards.
2. Post-installation inspection shall examine completed concrete placement. Report non-compliance with ABAAS for running and cross slopes, landings, vertical changes in elevation, transitions, imperfections or flaws, improper drainage, slippery surfaces, and dimensional accuracy.

B. Contractor shall utilize the National Park Service CQC Accessibility Inspection Report as basis for recording findings. Any non-compliant conditions shall be documented. Supplement Report with digital images, notation, red-line drawings, sketches and dimensions, product literature,

submittal, etc. to explain installed work. Submit completed Report to CO within 24 hours of commencing inspection.

END OF SECTION 32 13 20

SECTION 32 15 43 – PERMEABLE AGGREGATE SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes Filterpave® Porous Pavement System (FPPS), including materials, formwork, sub-grade preparation, and installation procedures.

B. Provide all materials, labor, tools, and equipment for installation of the Filterpave® Porous Pavement System (FPPS) as shown in the Contract Documents.

1.3 SUBMITTALS

A. Manufacturer's shop drawings, product data, and layout.

B. Product color samples; Sahara Gold, Osage River and Mo River

C. Installer qualifications demonstrating experience with FPPS.

1.4 QUALITY ASSURANCE AND CONTROL

A. FPPS materials shall be supplied by a single manufacturer.

B. Contractor shall provide qualifications and references for previous FPPS installations.

C. If the contractor lacks FPPS experience, a manufacturer-approved site engineer must supervise installation.

D. Provide mockup panel. Mockups shall be 2' x 2' in dimension and brought to the project site for review.

E. Conduct a pre-installation meeting with all involved parties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packaging.

B. Store materials per manufacturer instructions; protect from sunlight and moisture.

C. Handle materials to prevent damage.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

A. The product named is used to establish the required performance characteristics, quality level, configuration, and functional intent for this section:

1. Named Product: Filterpave Products LLC 451 W Shore Dr., Cairo, MO 56239 Phone: (573) 881-1133 Email: info@filterpave.com Website: www.filterpave.com.
2. Performance Requirements: Provide products that meet or exceed all characteristics of the Basis of Design product, including but not limited to: Physical dimensions, Material properties, Performance criteria, Durability and service life expectations.
3. Substitutions: Comply with Division 01 requirements for substitution requests. Proposed alternatives must demonstrate equivalence to the Basis of Design product in all performance and quality attributes. The burden of proof of equivalency rests with the Contractor.

2.2 MATERIALS

A. General

1. Use proven, locally available materials. Recycled glass and elastomeric binder must be approved by the manufacturer.

B. Base Aggregate

1. Crushed aggregate, 3/8"–1" particle size
2. 1½" choker course of 1/4"–3/8" clean crushed aggregate
3. Less than 5% fines

C. Binder

1. High strength elastomeric binder formulated for FPPS
2. Shipped in sealed containers
3. Use desiccant caps after opening
4. Maintain binder temperature between 70–90°F
5. Provide MSDS and binder to glass ratio

D. Aggregate Specifications

1. Glass Aggregate

Item	Specification
Amino Silane Treatment	6% solution by weight
Particle Size	100% passing #4, retained on #12; ≤1% fines
Colors	Mixed
Moisture	<0.1% average
SuperSak Rating	5.1 or better
Capacity	2500 lb max

2. Stone Aggregate

Item	Specification
Type	Igneous rock, Mohs ≥6.2, absorption <1%
Particle Size	100% passing 3/8" & retained on #8, or passing 1/4" & retained on #12
Colors	Varies by region
Moisture	<0.1% average
SuperSak Rating	5.1 or better
Capacity	3000 lb max

E. Pigment

1. Added per manufacturer instructions
2. Colors selected from standard palette

F. Proportions

1. Binder ratio must meet manufacturer specifications (±5%)
2. Glass must be 100% post consumer
3. Stone must meet FPPS aggregate specifications
4. Admixtures adjusted for weather conditions

G. Surface Overcoat

1. Manufacturer supplied
2. Applied by sprayer

H. Geotextiles

1. Non woven, minimum 8 oz/yd²
2. Infiltration rate ≥90 gal/min/sq ft
3. Alternatives require engineer approval

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions and layout

B. Do not begin work until unacceptable conditions are corrected

3.2 INSTALLATION

A. Subgrade Preparation

1. Test permeability (minimum 1 in/hr)
2. Ensure adequate support for equipment
3. Borrow material must be clean and compacted to 90% Standard Proctor
4. Groundwater should be ≥3 ft below base
5. Base depth per Contract Documents
6. Choker course leveled within 1/4"
7. Compact all materials to 90% Standard Proctor

B. Formwork

1. Forms may be aluminum, wood, steel, or plastic
2. Full pavement depth
3. Must support screeding equipment
4. Use only non-petroleum release agents
5. No protruding stakes

C. Mixing

1. Use volumetric mixers designed for FPPS
2. Mix on site
3. Minimum 300 RPM
4. Keep mixer components dry
5. Calibrate binder content

D. Placement

1. Continuous discharge
2. Place material close to final position
3. Use construction joints if delays occur

E. Finishing

1. Strike off with vibratory screed
2. Correct imperfections immediately
3. Complete finishing within 10 minutes
4. Edge immediately after finishing
5. Joint spacing per project specifications

F. Surface Overcoat

1. Apply two coats (2–3 mils) after minimum 4 hours
2. Clean and dry surface if traffic has occurred
3. Protect from precipitation for 4 hours

G. Curing

1. Minimum 3 days above 60°F
2. Minimum 5 days if temperatures fall below 60°F
3. Maintain material above 50°F
4. Protect from disturbance during curing

H. Paving Restrictions

1. Base is unstable or frozen
2. Rain or snow is occurring
3. Air temperature <50°F or >100°F
4. Frost is expected within 72 hours without protective measures

END OF SECTION 32 15 43

SECTION 32 17 00 – PAVING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Pavement surface preparation.
2. Furnishing and installing:

a. New pavement markings.
b. Accessible parking signage.

B. Related Sections include the following:

1. Section 32 12 16 – Asphalt Paving
2. Section 32 13 20 – Site Concrete

1.2 SUBMITTALS

A. Submit material certificate to the Contracting Officer (CO), signed by the material producer and Contractor, certifying that materials comply with these specifications.

B. Shop Drawings:

1. Shop Drawings of all signs and supports. Do not order material or begin fabrication until the Contracting Officer's (CO) approval has been obtained.
2. Show sizes and thicknesses of all members, types of materials, methods of construction and assembly, type of surface treatment, complete dimensions, hangers, brackets, anchorage, fasteners, relationship to surrounding work by other trades, shop finishes, sign designs, layouts, and lettering, and other pertinent details of fabrication and installation.

C. Product Data: Pavement markings, signs, and detectable warning surface.

1.3 SITE ACCESS

A. Normal, heavy snow accumulation in the work areas, access to project sites will not be guaranteed between October 1 and June 1 of each year. Contact Contracting Officer for information on site conditions prior to scheduling work. Work will be required in parking areas while area and individual parking spaces are occupied by park visitors. Manual and specialized methods will be required to complete work in parking areas occupied by park visitors.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pavement Markings

1. Pavement marking paint shall comply with AASHTO M-248, Type "F", or waterborne pavement markings from the Federal Highway Administration, *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects*, FP-14 2014, USDOT, FHWA, section 718,718.10, Waterborne Traffic Paint, 718.11 Epoxy Markings. Centerlines will be yellow paint unless otherwise specified by task orders. Edge lines, stop bars, arrows, crosswalks and lane delineations will be white paint unless otherwise specified.
2. Glass beads: Reflective glass beads shall comply with AASHTO M247, Type 1.
3. The pavement marking paint hall meet the following requirements:
   a. White: Federal Standard No. 595B-17925. The Yellowness Index (YI) of white shall not exceed 8.0 per ASTM E313 initially. The color after drying shall be a flat white, free from tint, and shall provide the maximum amount of opacity and visibility under both daylight and artificial light.
   b. Yellow: Materials for pavement markings shall meet the initial daytime chromaticity that falls within the box created by the following corner points:

Initial Daytime Chromaticity Coordinates (Corner Points)

	1	**2**	**3**	**4**
x	0.530	0.510	0.455	0.472
y	0.456	0.485	0.444	0.400

4. Waterborne Paint shall meet the following requirements:

Property	**White**	**Yellow**	**Test Method**
Volatile organic compounds, oz/gallon	20.0	20.0	EPA Method 24
Pigment, percent by mass	45-55	45-55	ASTM D3723
Lead, chromium, cadmium, or cobalt	0	0	ASTM D3335 ASTM D3718
Viscosity, Krebs units	75-90	75-90	ASTM D562
Drying Time (max) - Dry to no pickup - Drying to no track	 10 minutes 90 seconds	 10 minutes 90 seconds	 ASTM D711 ASTM D713
Density, lb/gal	12.0	12.0	ASTM D1475
Freeze Thaw Stability, Kreb Units Max	± 5		ASTM D2243
Bleeding Ratio[1]	0.96	0.96	ASTM D868
Daylight Reflectance, percent relative to magnesium oxide standard	84	55	ASTM E 347
Dry Opacity, Contrast Ratio at 319 ft^2/gallon spreading rate	0.96	0.96	ASTM D2805

[1] Determine minimum reflectance according to ASTM D1347 immediately after drying. Divide the average of three reflectance readings of paint over the bleeding surface by the average of three readings over the non-bleeding surface to determine the bleeding ratio.

B. Signs

1. General

a. The sign face shall be uniform, flat, smooth, and free from defects, scratches, chips, wrinkles, gel, hard spots, streaks, extrusion marks, and air bubbles.
b. The front, back, and edges of sign panels must not have bends, router chatter marks, burns, sharp edges, loose rivets, delaminated skins, excessive adhesive over-spray, or aluminum marks.
c. Do not store sign panels directly on the ground. Keep sign panels dry at all times and store:
   1) In a dry environment.
   2) On edge vertically whether indoors or outdoors.
   3) In enclose, climate-controlled trailers or containers in areas of high heat and humidity.
   4) Indoors whenever the panels will be stored for more than 30 days.

2. Aluminum Sheeting

a. Sheet aluminum signs shall be constructed of an alloy and temper conforming to ASTM B209 and shall be aluminum alloy 6061-T6 or 5052-H38.
b. Aluminum sheeting must be pretreated for corrosion resistance as specified in ASTM B449.
c. The surface of the sheeting must be cleaned, deoxidized, and coated with a light, tightly adherent chromate conversion coating free from powdery residue. The conversion coating shall be Class 2 with a weight from 10 to 35 mg/sq ft and an average weight of 25 mg/sq ft.
d. Aluminum sheeting shall be protected from exposure to grease, oils, dust, and contaminants.
e. The aluminum sheeting must be free from buckles, warps, dents, cockles, burrs, and other defects resulting from fabrication.
f. The base plate for standard route markers must be die cut.
g. The aluminum sheeting must be attached to the frame with 3/16-inch-diameter rivets. The rivets must be placed at least 1/2 inch from the web channel edges. The rivets must be made of aluminum alloy 5052 and be anodized or treated with a conversion coating to prevent corrosion.

3. Retroreflective Sheeting

a. Retroreflective sheeting used for the background and legend must comply with ASTM D4956 and must be on the CDOT Approved Products List for signing and delineation materials.
b. Type II retroreflective sheeting may have Class 1, 2, 3, or 4 adhesive backing.
c. Type III, IV, VIII, IX, and XI retroreflective sheeting must have Class 1, 3, or 4 adhesive backing.
d. Adhesive backing shall be pressure sensitive and fungus resistant.

e. Reflective sheeting shall be applied to in the manner specified by the sheeting manufacturer. The applied sign face shall not have bubbles, wrinkles, or foreign material beneath the reflective sheeting.
f. Splices in the retroreflective sheeting shall overlap by at least 1 inch unless otherwise specified by the manufacturer.
g. The retroreflective sheeting on either side of a splice must not exhibit a color difference under incident and reflected light.

4. Sign covering

a. The covering shall consist of 4 mils minimum thickness black polyethylene sheeting of sufficient size to entirely cover the sign and shall extend over the edges of the sign and fastened to the back.

5. Signposts

a. Signposts shall be 4″ x 4″ treated Douglas Fir or treated Hem-Fir, Construction grade. Douglas Fir and Hem-Fir post shall be given a treatment in accordance with AASHTO M133.

C. Detectable Warning Surface

1. Dome Size: Truncated domes in a detectable warning surface shall have a base diameter of 0.9 inch minimum and 1.4 inches maximum, a top diameter of 50 percent of the base diameter minimum to 65 percent of the base diameter maximum, and a height of 0.2 inch.
2. Dome Spacing: Truncated domes in a detectable warning surface shall have a center-to-center spacing of 1.6 inches minimum and 2.4 inches maximum, and a base-to-base spacing of 0.65 inch minimum, measured between the most adjacent domes on a square grid.
3. Material: detectable warning surface shall be unpainted cast iron.

PART 3 - EXECUTION

3.1 PREPARATION

A. The Contractor shall clean the pavement of dust, dirt, old pavement markings, concrete curing compounds, and other foreign material which may be detrimental to the adhesion of the pavement marking materials.

B. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, required clear space, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING APPLICATION

A. The material shall be applied to the pavement by equipment designed and manufactured specifically for the application of pavement markings.

B. Pavement markings shall be applied in accordance with the layout shown on the Drawings. No paint shall be applied to new bituminous pavement until the top course has cured at least one week, and allow two weeks curing for newly installed bituminous concrete curbing.

C. All parking stalls shall be single stripe and shall be spaced equally. The line indicated on the Drawings is on the center line of the stall marking.

D. All parking stall markings shall be straight with sharp corners and clean edges.

E. All markings shall be applied in one coat with brush, spray, or marking machine over clean dry pavement surfaces, when the atmospheric temperature is at or above 40°F, and when the weather is otherwise favorable in the opinion of the CO.

F. Immediately remove drips, overspray, improper markings, paint, and thermoplastic tracked by traffic with an authorized method.

G. Use only skilled workmen who are experienced and normally employed in the work of installing pavement markings. Supply all the necessary equipment and materials required for the work.

H. The Contractor shall protect the buildings, walks, pavement, curbing, trees, shrubs, mulch, and other site fixtures from over-spray of paint and damage from pavement marking operations.

I. Traffic shall not be permitted on the pavement until the paint is thoroughly dry.

3.3 SIGNAGE

A. Protection and Temporary Covers

1. Completed sign panels shall be protected and maintained in good condition, free from dirt, scratches, hand marks or other blemishes. The panels shall be transported in a manner that prevents damage.
2. Subsequent to erection, if required by the CO, exterior signs shall be covered until the actual use is desired. Material used to temporarily cover any sign panel shall effectively conceal the message, be non-injurious to the panel, its finish, its structural integrity, and shall be of sufficient durability for the time period required.

B. Installation

1. Erection of all signs shall be performed by experienced sign erectors. Signs shall be installed true, plumb, and level, located where shown on the Drawings or as required by the CO. No field cutting of any sign work will be allowed. Exercise extreme care in all handling and stacking of signs to avoid chipping.
2. All work shall be rigidly anchored to the supporting construction in accordance with the approved shop drawings.

C. Clean-up

1. Surfaces of signs shall be cleaned as recommended by the sign manufacturer after installation.

2. All defective work shall be removed and replaced with work conforming to the specified requirements.

D. Erection of Posts
1. Drive or embed posts to ensure sign faces and supports are within 3/16 inch of plumb over 3 feet.
2. Do not damage the top of posts during driving.
3. Install steel sign supports and square tubular steel sign supports in accordance with the Caltrans Sign Support Standards.
4. If installing steel sign posts, including square tubular steel sign supports or steel delineator posts through existing concrete, drill or saw cut a separate hole through the concrete for each post. Drill or cut post holes no greater than 1 inch larger than the largest cross-sectional dimension of the post. After drilling or sawing, remove the concrete debris from the hole. Clean and dry the area around the hole. Insert the galvanized steel post into the hole and embed to a depth of 3½ feet below the top of concrete grade. Fill the hole around the post with a silicone sealer.
5. If installing posts in new concrete, the Contractor may form holes before placing the new concrete.

3.4 DETECTABLE WARNING SURFACE

A. The detectable warning surface shall be located as shown in the Plans. Placement of the detectable warning surface shall be in accordance with the manufacturer's recommendation for placement in fresh concrete, before the concrete has reached initial set, or on a hardened cement concrete surface or asphalt pavement surface.

B. Vertical edges of the detectable warning surface shall be flush with the adjoining surface to the extent possible (not more than ¼ inch above the surface of the pavement) after installation.

C. Embossing or stamping the wet concrete to achieve the truncated dome pattern or using a mold into which a catalyst-hardened material is applied shall not be allowed.

END OF SECTION 32 17 00

SECTION 32 31 13 – GUARDRAIL FENCING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies fence/railing.

1.2 RELATED WORK

A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials testing and inspection during construction.

B. Section 03 30 00, CAST-IN-PLACE CONCRETE

C. Section 05 12 00, STRUCTURAL STEEL

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.

B. Shop Drawings: Drawings prepared in accordance with conventional detailing practices that detail steel fabrication and placement. At a minimum, include the following:

1. Steel and hardware material designations
2. Fabrication details, including cuts, connections, holes, fasteners and welds.
3. Procedures for welding, assembly and installation.
4. Angles in railing may be accomplished by using beveled washers and/or fabricating posts to accommodate the angels as shown. Provide full details of posts at angle points and indicate method for constructing the angles.
5. Shop drawing re-submittals shall clearly identify all revisions to previous submittals. Provide heavy ink clouded outlines (revision clouds) around revised areas of individual sheets. Information outside of revision clouds on resubmitted drawings will not be reviewed.

C. Submittal for cable railing system shall include the following at a minimum:

1. Product details developed by railing manufacturer for review and approval by the Engineer.
2. Design calculations stamped by a registered professional engineer in the State of California to determine the cable run length(s) and pretension force on each cable run. According to the California Building Code Cable Railing Requirements, the cable rail shall be designed such that a 4" sphere cannot pass through between the cables at any point with a 50-pound weight suspended from the cable strand below the top. Due to the available anchorage resistance, the pretension must not exceed 200 lbf on each cable.

D. Mill Test Reports:

1. Steel
2. Bolts
3. Nuts
4. Washers

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory provided protective coverings and packaging.

B. Deliver, store and handle steel to prevent damage and discoloration.

C. Inspect materials upon delivery for damage.

D. Material that has been damaged or discolored shall not be incorporated into the project. In field assembly of steel parts, the Contractor shall use methods and equipment not likely to twist, bend, deform or otherwise injure the metal. Any member slightly bent or twisted shall be corrected before it is placed. Parts with serious damage will be rejected.

1. Damaged or discolored members may be repaired and incorporated only if approved by the COR.
2. If the Contractor plans to repair damaged or discolored members, the Contractor shall prepare a Repair Plan for approval by the COR.

a. Repair damage to be indistinguishable from undamaged areas. If damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.
b. Straightening methods shall not fracture or injure the metal.
c. Distorted members shall be straightened mechanically. A limited amount of localized heat may be applied only if carefully planned and supervised, and only in accordance with the heat-straightening procedure in the approved Repair Plan.
d. Parts to be heat-straightened shall be nearly free from all stress and external forces except those that result from the mechanical pressured used with the heat.
e. After straightening, the Contractor shall inspect the member for fractures using a method proposed by the Contractor in the approved Repair Plan.
f. Member showing sharp kinks and bends will be rejected.

E. Store fabricated steel above ground on platforms, skids or approved supports.

F. Store hardware in weather-tight and dry locations.

G. Store packaged materials in original unbroken containers.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Institute of Steel Construction (AISC): Manual of Steel Construction

C. ASTM International (ASTM):
A6/A6M-19 .....Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
A36/A36M-19 .....Standard Specification for Carbon Structural Steel
A992/A992M-20 .....Standard Specification for Structural Steel Shapes

D. American Welding Society (AWS):
D1.1/D1.1M-20 .....Structural Welding Code – Steel

PART 2 - PRODUCTS

2.1 MATERIALS

A. Shapes, Plates, and Bars: ASTM A36

B. Anchor Bolts: ASTM F1554, Grade 36 with Supplemental Requirements S2, S3 and S4

C. Nuts: ASTM A563, Grade DH

D. Washers: ASTM F436

E. Welding Electrodes:

F. Series: E-70 unless otherwise required in ASTM D1.1.

G. Type: Satisfy conditions of use.

H. Shape, Plate and Bar galvanizing: AASHTO M111 (ASTM A123)

I. Bolt, nut and washer galvanizing: AASTHO M232 (ASTM A153)

J. Epoxy Anchor: HILTI HIT-RE 500 V3 or approved equal

K. Cable: Type 304 or 316 stainless steel 7 by 19 wire strand with a minimum breaking strength of 1,800 lb. The cable rail system must incorporate a turnbuckle or other device on each cable so that the tension can be adjusted over time. This device shall include a lock nut or other device so that a child cannot easily reduce the tension of the cable. Turnbuckles must be commercial quality; have jaw or eye ends; have a minimum breaking strength of 2,700 lb; be steel pipe type or drop-forged steel. Crimpled sleeve clamps and stop sleeve clamps must be nonferrous metal; develop the strength of the cable; be the same color as the cable.

2.2 FABRICATION

A. Structural Steel – General:

1. Comply with referenced specifications.
2. Shop-fabricate and shop-assemble members where practicable.
3. Mark and match-mark members for accurate field-assembly.
4. If and where exposed to view, remove any Run-off Tabs or other temporary items.

5. Fabricate holes necessary for securing other work to structural steel. Cut, drill, or punch holes perpendicular to member surface. Do not flame-cut or enlarge holes by burning.
6. Workmanship and finish shall be first-class, equaling the best practice in modern fabrication shops. Welding, shearing, burning, chipping, and grinding shall be done neatly and accurately. All parts of the work exposed to view shall be neatly finished.
7. Edge finishing: all rolled, sheared, and thermal cut edges shall be true to line and free of rough corners and projections. Corners along exposed sheared or cut edges shall be broken by light grinding or another method acceptable to the COR to achieve an approximate 1/16-inch chamfer or rounding. Sheared edges on plates more than 5/8-inch thick shall be planed, milled, ground, or thermal cut to a depth of at least 1/8-inch.
8. Welding:

    a. Welding and repair welding shall comply with the AWS D1.1/D1.1M, latest edition, Structural Welding Code.
    b. Shop and field pile splices, if needed, shall be CJP groove welds.
    c. The Contractor's inspection procedures, techniques, methods, acceptance criteria, and inspector qualifications shall comply with AWS D1.1/D1.1M, latest edition, Structural Welding Code.
    d. Temporary welds shall be shown in the approved shop drawings. No other temporary welding will be allowed.
    e. Welding procedures shall comply with the approved shop drawings. The procedures shall specify the type of equipment to be used, electrode selection, preheat requirements, base materials, and joint details. When the procedures are not prequalified by AWS, evidence of qualification tests shall be submitted.

B. Finishing: Galvanize rail components and hardware after fabrication. Adjust processes to provide as uniform appearance as possible.

PART 3 - EXECUTION

3.1 CABLE RAILING INSTALLATION

A. Anchor bolts shall be positioned with a template to ensure that bolts match the hole spacing of post base plates.

B. Set epoxy anchors in accordance with manufacturer's recommendations.

C. Install posts plumb. All post locations shall be determined before constructing the reinforcement and pouring the concrete in the concrete wall cap and concrete fill wall, due to the additional reinforcement designed at the post anchorage. All posts shall be laid out after wall cap is complete and the post locations shall be approved by COR prior to installation.

D. After first setting the railing, the Contractor shall readjust all or part of it, as needed, to create an overall line and grade pleasing to the eye and get approval from COR prior to grouting base plates.

E. Tension the cables to taut railings between posts after installing the posts, top rail pipes and toe rail pipes. Install cables and apply tension according to manufacturer's instructions after adhesive bond gets fully cured at all posts. Pretension must not exceed 200 lb on each cable. Provide a thimble at each cable loop.

F. Repair damaged galvanized surfaces as follows:

1. Clean by thoroughly wire brushing damaged areas and removing loose and cracked coating.
2. Paint cleaned areas with 2 applications of organic zinc-rich primer.
3. Do not use aerosol cans.
4. Coat a large enough area to provide a uniform visual appearance.

END OF SECTION 32 31 13

SECTION 32 31 14 – POST AND RAIL FENCE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fences: Post and Rail Fence

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include material descriptions, dimensions of individual components and profiles, and finishes for fence.

   1. 6” diameter wood posts
   2. 4” diameter wood rails
   3. ¾” carriage bolt (galvanized)
   4. ¼” x 3” x 18” steel plate

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

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: Prepared on Samples of size indicated below:

   1. In 12-inch lengths for components and on full-sized units for accessories.

E. Product Certificates: For each type of fence and gate, from manufacturer.

F. Product Test Reports: For framing span strength.

G. Field quality-control reports.

H. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Mockups: Build mockups to set quality standards for fabrication and installation.

   1. Include 18-foot length of fence. Place mockup adjacent to approximate final location in order to use acceptable mock up as part of the permanent fence.

B. Preinstallation Conference: Conduct conference at Project site.

   1. Review required testing, inspecting, and certifying procedures.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FENCE POST & RAILS

A. General: Posts and rails will be government provided.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by CO.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines. Do not exceed intervals of 20 feet or line of sight between stakes. Indicate locations of utilities, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install fencing as shown on plans.

3.4 FENCE INSTALLATION

A. Fence Rails: Install into adjoining post notches as shown on plans.

3.5 DEMONSTRATION

A. Train government personnel to adjust and maintain fences.

END OF SECTION 32 31 14

SECTION 32 32 00 – BOULDER PLACEMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.

1.2 SUMMARY

A. Work includes furnishing, transporting, and installing natural boulders to match existing stones on site at Rocky Mountain National Park.

B. Contractor shall source boulders of similar geologic type, color, and texture to existing site stones.

1.3 SUBMITTALS

A. Contractor shall submit the following for review and approval by the National Park Service (NPS):

1. Photographs of proposed boulders showing color, texture, and overall appearance.
2. Dimensions (length, width, height) of each proposed boulder.
3. Source location of boulders.
4. In situ mock-up of 6-foot length

B. Submittals must be approved prior to delivery and installation.

1.4 QUALITY ASSURANCE

A. Boulders shall be natural stone, free of cracks, fractures, or defects that compromise structural integrity.

B. Contractor shall coordinate with NPS representatives to ensure visual compatibility with existing site conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect boulders from staining, chipping, or damage during transport and handling.

B. Store boulders on site in designated staging areas approved by NPS.

PART 2 – PRODUCTS

2.1 BOULDER MATERIAL

A. Natural stone, sourced to match existing site geology.

B. Sizes shall vary as directed by NPS, with minimum dimensions of 24 inches in one direction.

C. Color and texture shall be consistent with existing boulders at the site.

2.2 SOURCE QUALITY

A. Contractor shall identify quarry or collection site.

B. Boulders must be native or geologically compatible with Rocky Mountain National Park region.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify site conditions prior to placement.

B. Confirm approved boulders are on site and inspected by NPS.

3.2 INSTALLATION

A. Place boulders in locations designated by NPS.

B. Orient boulders to present natural appearance, with stable bearing surfaces.

C. Ensure boulders are embedded to a depth that provides stability and mimics natural placement.

3.3 FIELD QUALITY CONTROL

A. NPS representative shall inspect and approve placement prior to final acceptance.

B. Contractor shall adjust placement as directed to achieve desired aesthetic and functional outcome.

3.4 CLEANING AND PROTECTION

A. Protect installed boulders from damage until final acceptance.

END OF SECTION 32 32 00

SECTION 32 33 00 – SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Bollards
2. Bike Rack
3. Log Benches

1.2 SUBMITTALS

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

B. Shop Drawings:

1. Provide details of construction and installation of fabricated items including materials, dimensions, methods of joining, fastening, and anchoring.
2. Obtain approval for minor variations in detail for the purpose of improving fabrication and installation procedures, but not affecting general design for structural stability.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver products in good condition.

B. Store products to prevent corrosion, deterioration and damage.

C. Handle products to prevent damage.

1.4 QUALITY ASSURANCE

A. Accessibility Requirements: Comply with Architectural Barriers Act Accessibility Standards (ABAAS).

PART 2 - PRODUCTS

2.1 BOLLARDS

A. Direct Bury Bollard: Steel Pipe Bollard, 66” overall length, 36” above grade bollard body, 4.5” pipe size

1. Performance Characteristics:

a. Footings must be engineered to meet all commonly used impact and crash ratings.
b. Finish: National Park Service standard brown color powder coat finish.

2.2 BIKE RACK

A. Direct Bury Bike Rack (5 -bike capacity): A durable, weather-resistant bike rack designed to accommodate five bicycles. Intended for outdoor installation. ASTM A53/A500 SCHD 40 Steel Pipe (2.375” OD X .154 wall)

1. Rack Frame:

   a. Material: Schedule 40 steel pipe
   b. Pipe Diameter: 2” nominal
   c. Wall Thickness: 0.154
   d. Finish: Powder coated with NPS Brown (Color Code: RAL 8017 or equivalent. Matt or satin finish to minimize visual impact.
   e. Coating Thickness: Minimum 2.5 Mills

2. Fasteners:

   a. Stainless steel, tamper-resistant bolts for any connections.
   b. All hardware to be corrosion-resistant and suitable for outdoor use.

3. Rack Frame:

   a. Material: Schedule 40 steel pipe
   b. Pipe Diameter: 2” nominal
   c. Wall Thickness: 0.154
   d. Finish: Powder coated with NPS Brown (Color Code: RAL 8017 or equivalent.
   e. Coating Thickness: Minimum 2.5 Mills

4. Welding Process:

   a. All joints shall be welded using MIG (Gas Metal Arc Welding or TIG (Gas Arc Welding methods.
   b. Welds must be continuous and free of gaps, cracks or porosity.
   c. All welds shall be ground smooth and inspected for structural stability.

5. Weld Quality:

   a. Conform to AWS D1.1 Structural Welding Code – Steel.
   b. Welds shall be visually inspected and meet minimum fillet weld size of ¼ inch.

6. Footing Requirements:

   a. Footing Type: Concrete, cast-in-place

b. Depth: 24” minimum
c. Concrete Strength: Minimum 3,000 psi at 28 days.
d. Reinforcement: Rebar, #4 minimum two bars per footing, tied in grid pattern.
e. Anchoring: Rack legs shall be embedded a minimum of 6” into concrete. All embedded steel shall be powder coated.

2.3 LOG Bench

A. Log benches will be government provided; contractor installed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, required clear space, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer’s written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after concrete paving has been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

3.3 INSPECTIONS

A. Performance of accessibility inspection using DSC, CQC Accessibility Inspection Report required within seven days of completion of work and linked to the construction completion schedule.

3.4 CLEANING

A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 32 33 00

SECTION 32 40 00 – TREE AND VEGETATION RETENTION AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Work under this section includes protecting existing trees and vegetation to remain, furnishing, installing, and maintaining tree protection fencing in a vertical and effective position to protect existing trees and vegetation for the entire duration of construction, and practices to protect existing trees and vegetation within the tree protection zones.

B. Related Sections:

1. Section 02 41 13 – Selective Site Demolition
2. Section 31 10 00 – Site Clearing
3. Section 31 20 00 – Earth Moving
4. Section 31 25 00 – Erosion and Sediment Control
5. Section 31 92 00 – Revegetation

1.2 DEFINITIONS

A. Drip Line: The outermost edge of the tree's canopy or branch spread. The area within a tree's dripline is all the ground under the total branch spread.

B. Critical Root Zone: Generally, all of the ground area included in the dripline and approximately one foot per inch of tree at a minimum of a 6' diameter from trunk, whichever is greater.

C. Diameter (Caliper): The size (in inches) of a tree's trunk is measured at:

1. Six (6) inches above grade for trunk diameters up to and including four (4) inches.
2. Twelve (12) inches above grade for trunk diameters from four (4) inches up to and including eight (8) inches.
3. Four and a half (4½) feet above grade for trunk diameters greater than eight (8) inches.

D. Exploratory Excavation: A method approved by the CO to determine the amount and size of tree roots under the surface. Methods may include hand excavation, a pneumatic air excavation tool, or water excavation.

E. Water Excavation: Hydrovac excavation that utilizes high-pressure water to cut and liquefy the soil, while simultaneously using a vacuum to remove the soil from the excavation and will require that import fill is brought to the site to fill trenches after excavation.

F. Pneumatic Air Excavation Tool: A tool specifically designed to excavate soil from around tree roots. Air Spade or Air Knife are examples of pneumatic air excavation tools.

G. Tree Protection Work Plan: The tree protection plan is a plan based on the contract drawings that includes the Contractor's approach to working within and around the Tree Protection Zones.

H. Tree and Vegetation Protection Zone (TPZ): The Tree and Vegetation Protection Zone is the area above and below grade around each tree where construction activities are limited or restricted to preserve tree health and structural integrity of the protected trees, and areas where existing vegetation is to be protected per park and CO direction.

1. The diameter of the tree shall be measured at four and one-half feet (4.5') above grade (referred to as diameter breast height). For every-one inch (1") of tree diameter the Tree Protection Zone shall extend one foot (1.0') radially from the base of the trunk or be placed at the dripline, whichever is **greater**.
2. For areas with groups or groupings of trees, if the distance between trees is less than thirty feet (30'), the Tree Protection Zone may be combined and treated as one contiguous area to create a more clearly defined and manageable Tree Protection Zone.
3. Fencing for trees not immediately adjacent (within two feet of) to construction activities, but for which construction or staging activities will occur within the TPZ, orange construction fencing is installed. will be installed. Fencing will only be installed around parts of the tree trunk that face construction activities and are vulnerable to damage. Construction fencing will be placed at the greatest possible distance of the following from trees a) TPZ edge, b) TPZ edge, or c) [least desirable] construction/staging zone limits (>2 ft from trunk).
4. Trunk protection: For trees immediately adjacent to the work zone (< 2 feet) and or which fencing is not practicable, trunk protection may be used consisting lumber, loosely banded onto the trees with straps, and angled so that the trunk flare and buttress roots are also protected. Closed cell foam padding minimum shall be placed between the trunk and the lumber with straps or wire to bind the planks in place, avoiding any fastener contact with bark or limbs, and do not drive fasteners into the tree. Lumber-covered sections of trees will be wrapped with orange construction fencing to provide a visual cue to heavy equipment operators.
5. Soil protection: Where surface access is unavoidable through either root protection zone, but no subsurface construction actions are being implemented, soil protection consisting of a steel plate or plywood placed on wood straw (or other NPS approved mulch), may be used to bridge over the root protection zone.

1.3 QUALITY ASSURANCE

A. Project Consulting Arborist: Consulting arborist shall be field experienced in tree and vegetation preservation or on-site monitoring of public works or construction projects involving tree and vegetation retention and protection.

1. Consulting Arborist shall provide an analysis/ condition assessment trees within the limits of construction and provide this documentation to the National Park Service.
2. Consulting arborist shall be an independent consultant with a degree in forestry, horticulture, arboriculture, plant pathology, entomology or plant biology; an American Society of Consulting Arborists (ASCA) registered consulting arborist, or an International Society of Arboriculture (ISA) Board Certified Arborist, with at least five (5) years of field experience, including tree and vegetation preservation or on-site monitoring of public works or construction projects involving tree retention and protection. The Project Consulting Arborist shall be approved by the Contracting Officer.

A. If it appears that the completion of the construction may cause damage to the branches, roots or trunk of any tree or existing vegetation to remain, the Contractor shall contact CO prior to work commencement.

B. To prevent or minimize soil compaction and to minimize disruption to existing trees and vegetation, designated routes for equipment and foot traffic by work crews shall be determined prior to commencing construction activities. These routes shall be marked at the site, prior to commencement of construction, with tree and vegetation protection fencing as specified.

C. Motorized equipment and trailers, including tractors, bobcats, bulldozers, trackhoes, trucks, cars, and carts shall not be allowed access within tree and vegetation protection areas.

D. Materials and supplies shall not be stockpiled or stored within the tree and vegetation protection area.

E. Under no circumstances shall any objects or materials be leaned against or supported by a tree's trunk, branches, or exposed roots. The attachment or installation to trees of any sign, cable, wire, nail, swing, or any other material that is not needed to help support the natural structure of the tree is prohibited.

F. Tree and Vegetation Protection Work Plan: Contractor shall submit a tree and vegetation protection plan by Project Consulting Arborist based on the contract drawings for approval by Contracting Officer. The Contractor shall minimize disturbance to native vegetation, particularly in landscape / soil stabilization areas where ground disturbance is not needed.
   1. Proposed methods and schedule for implementing tree and vegetation protection shall be submitted for approval.
   2. Proposed methods, materials, and schedule for root pruning, branch pruning, and other tree maintenance and native vegetation retention practices shall be submitted for approval.

G. Construction Schedule: Contractor shall submit a construction schedule that includes a time frame for work near existing trees and existing areas of native vegetation. Approval of such shall be obtained from Project Consulting Arborist prior to commencement of construction near Tree and Vegetation Protection Zones.

H. Maintenance Schedule: Submit maintenance schedule to Contracting Officer.

1.4 REPLACEMENT COSTS

A. Replacement costs for damage of trees and vegetation and park resources outside the designated limits of disturbance is as defined by the park and CO.

B. Replacement costs for damaged and/or removed trees and vegetation noted to remain within the limit of construction will incur fines and penalties as applied defined by the park and CO.

C. Pruning or removal of vegetation when authorized and supervised by the Contracting Officer is exempted from these penalties.

1.5 SUBMITTALS

A. All Submittals shall be approved by the Contracting Officer prior to mobilization and any Work being conducted on site.

B. Tree and Vegetation Protection Work Plan: Submit a tree and vegetation protection work plan based on the Contract Drawings for approval. Work shall be accomplished to minimize impacts and disturbance to site vegetation, which is a character-defining element of the Kawuneeche Visitor Center site. The plan shall include the following:
   1. Existing conditions including existing trees and vegetation within the limits of construction.
   2. Limit of work and Limit of Construction.
   3. Tree caliper / diameter size, location of dripline, and species.
   4. Areas of existing vegetation to remain and areas of existing vegetation to be removed, salvaged and reinstalled.
   5. Tree and Vegetation Protection Zones with Tree and Vegetation Protection Zone sign locations.
   6. Tree and vegetation protection fencing (chain link) with moveable base shall correspond to the level of construction activity adjacent to protected tree(s). Including but not limited to areas of high traffic, material drop off/pickup, high intensity activity, and earthwork of greater intensity than grubbing.
   7. Plan for the Work occurring within or adjacent to Tree and Vegetation Protection Zones:
      a. Access routes, including designated routes for equipment and foot traffic by work crews to minimize soil compaction and to minimize disturbance to existing vegetation.
      b. Proposed exploratory excavation locations and methods to remove soil from around tree roots within Tree and Vegetation Protection Zones.
   8. Maintenance of Tree and Vegetation Protection Zones and any trees and existing vegetation affected by Construction during the Work.
   9. Trees identified for regular soil moisture readings.
   10. During construction, Tree and Vegetation Protection Plans may need to change per field conditions and contractor work. The Contractor shall continue to update the Tree and Vegetation Protection Work Plan in the field as a redlined or revised plan and submit as often as changes are needed for approval from the Contracting Officer.

C. Tree and Vegetation Protection Work Plan Updates: The Contractor shall submit a highlighted / annotated section of their Tree and Vegetation Protection Work Plan at the Construction Progress Meetings to discuss where they intend to work and what Tree and Vegetation Protection Zones may be impacted for the upcoming week.

D. Pruning: Proposed methods, materials, the Licensed and Insured Project Consulting Arborist, and schedule for root pruning, branch pruning, and other tree maintenance shall be submitted for approval.

E. Pneumatic Air Excavation: Type of pneumatic air excavation tool, the Licensed and Insured Project Consulting Arborist, and schedule for excavation shall be submitted for approval.

F. Water Excavation: Type of hydrovac excavation tool, the Licensed and Insured Project Consulting Arborist, and the schedule for excavation shall be submitted for approval.

G. Watering Plan and Schedule: The Contractor shall submit a watering plan and schedule prior to the start of work that details watering of all trees affected by the Project for review and approval

by the park and CO. Watering Plan and Schedule shall be developed in consultation with the park and CO. When watering is required the following information shall be included:

1. Area of the project site to be watered and how watering will be phased based on construction.
2. Location, identification and caliper inch of each tree or area of existing vegetation to be watered.
3. Total number of trees to be watered and total caliper inches, and total square footage of vegetation to be watered. Identify the amount of water to be applied based on total caliper inches.
4. Schedule for watering during the duration of the project.
5. How trees and will be watered:
   a. Temporary system
   b. Hydrant.
   c. Water truck.
   d. Combination of on-site, hydrant, and water truck.

H. Soil Moisture and Watering Log: The Contractor shall fill out and submit to the Contracting Officer and the park the watering log, attached as an Exhibit. Information on the watering log shall include:

1. Tree(s) watered, identified by the Contractor's Tree and Vegetation Protection Plan.
2. Number of gallons of water applied to each tree during every watering period or irrigation schedule.
3. Soil moisture level readings, on a scale of one to ten (1 – 10). Refer to Part 3 - Execution for soil moisture reading requirements.
4. Dates of each watering.
5. The Soil Moisture and Watering Log shall be provided monthly via email to the Contracting Officer and reviewed at Construction Progress Meetings. If there appears to be an issue with on-site watering, Soil Moisture and Watering Logs may be requested at any time by the Contracting Officer.

1.6 QUALITY CONTROL

A. The Contractor and sub-contractors shall attend a Preconstruction Meeting as outlined in Division 01 "Project Meetings." When the Project requires new sub-contractors to be on-site to complete Work, the Contractor shall include the sub-contractors in the Construction Progress Meetings to review the requirements of this specification.

B. Contractor shall comply with applicable requirements and recommendations of the most current versions of the following standards and guidelines. Where these conflict with other specified requirements, the more restrictive requirements shall govern.

1. ANSI Z133.1: American National Standard for Tree Care Operations.
2. ANSI A300: Tree, Shrub, and Other Woody Plant Management – Standard Practices – Parts - 1,2,5,6 and 8.
3. Guide for Plant Appraisal – Current Edition: Authored by the Council of Tree and Landscape Appraisers; published by the International Society of Arboriculture.
4. Requirements as set forth in these Contract Documents, particularly related to Laminated Root Rot and Douglas Fir protection best practices, and as identified by park staff.

C. Motorized equipment and trailers, including but not limited to tractors, skid loaders, bulldozers, rubber-tired excavators, tracked excavators, trucks, cars, and carts shall not be allowed access within Tree and Vegetation Protection Zones with the exception of paved surfaces. Motorized equipment and trailers shall not be allowed access outside of paved areas or unvegetated areas except as explicityly shown on the plans or as approved by the CO or Project Consulting

Arborist. Should access be necessary within designated Tree and Vegetation Protection Zones the Contracting Officer and Project Consulting Arborist shall be notified and CO shall approve of the access route and driving surface prior to use.

D. Materials, supplies, tools, and construction facilities shall not be stockpiled or stored within the Tree and Vegetation Protection Zones unless otherwise approved by the Contracting Officer. Should temporary storage be approved by the Contracting Officer within designated Tree and Vegetation Protection Zone(s), the existing grade shall be covered as identified in Part 2 – Materials and Part 3 – Execution to help distribute the weight of equipment and to minimize soil compaction and rutting. Plywood and/or mulch are not acceptable bridging materials for driving over exposed tree roots.

E. Under no circumstances shall any objects or materials be leaned against or supported by a tree's trunk, branches, or exposed roots or lain on existing vegetation to remain. The attachment or installation of any sign, cable, wire, nail, swing, or any other material to trees that is not needed to help support the natural structure of the tree is prohibited. Standard arboricultural techniques such as bracing or cabling that are performed by professional arborists and recommended by the Project Consulting Arborist and are acceptable upon approval of the Contracting Officer.

The Contractor shall notify the Contracting Officer prior to mobilization on site with their schedule for installation of tree and vegetation protection. Tree protection shall be in place and approved prior to any work being conducted on-site, this includes erosion control.

PART 2 – PRODUCTS

2.1 TREE AND VEGETATION PROTECTION FENCING

A. For trees not immediately adjacent (within two feet of) to construction activities, but for which construction or staging activities will occur within the TPZ, fencing shall be installed. Fencing shall only be installed around parts of the tree trunk that face construction activities and are vulnerable to damage. Construction fencing shall be placed at the greatest possible distance of the following from trees: a) TPZ edge, b) TPZ edge, or c) [least desirable] construction/staging zone limits (>2 ft from trunk).

B. Black Vinyl-Coated Steel Chain-link fencing – Six feet (6') in height. Black vinyl-coated steel chain link fence panels with above ground base units to hold fence in a vertical position with no staking into ground. Fencing as per tree and vegetation protection detail on plans.

C. Tree and Vegetation Protection Zone (11x17") signs printed and laminated by the Contractor.

D. Refer to Drawings for locations for tree and vegetation retention and protection. Additional areas for protection may be needed to minimize disturbance to trees and native vegetation. and for additional locations as indicated by Contracting Officer.

E. Contractor shall facilitate an on-site pre-construction meeting to include the park and CO to review areas of tree and vegetation retention and protection. Contractor shall adjust the limits of tree and vegetation retention and protection as directed by the CO and park.

1.7 TRUNK PROTECTION: For trees immediately adjacent to the work zone (< 2 feet) and or which fencing is not practicable.

A. Lumber - 2 x 4 lumber, minimum 4-foot in height..
   1. Lumber shall be loosely banded onto the trees with straps, and angled so that the trunk flare and buttress roots are also protected.
   2. Closed cell foam padding minimum of 1/4 in thick shall be placed between the trunk and the lumber.
   3. Use straps or wire to bind the planks in place, avoiding any fastener contact with bark or limbs, and do not drive fasteners into the tree. Additionally, lumber-covered sections of trees will be wrapped with orange construction fencing to provide a visual cue to heavy equipment operators.

1.8 SOIL PROTECTION: Where surface access is unavoidable through either root protection zone, but no subsurface construction actions are being implemented.

A. Steel Plate - A minimum 1/2 in steel plate placed on top of a bed of minimum 2 in of wood straw (or other NPS approved mulch).

B. Plywood - A minimum 3/4 in plywood over minimum of 4 in of woodstraw (or other NPS approved mulch), may be used to bridge over the root protection zone.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The Contractor shall follow the approved Tree Protection Work Plans and access routes.

B. The Contractor shall report any injured or dead trees within the limits of work to the CO and Project Consulting Arborist.

C. Work shall be completed to ensure no damage to existing trees and native vegetation to remain. If it appears any Work may cause damage to a tree or native vegetation to remain, the Contractor shall contact the Contracting Officer and Project Consulting Arborist, who will make the determination as to whether such damage is likely, and the next steps.

D. Methods for working within a Tree and Vegetation Protection Zone shall be approved prior to the start of work and may include the following depending on project site conditions:
   1. Pneumatic air excavation tool. Maximum pressure applied shall be an amount not to damage roots and shall not exceed ninety pounds per square inch (90 PSI). Pneumatic air excavation may not be allowed when in known asbestos areas.
   2. Water excavation. Maximum pressure applied shall be an amount not to damage roots and shall not exceed sixty pounds per square inch (60 PSI). Water excavation may be required when in known asbestos areas.
   3. Directional boring.
   4. Hand digging.
   5. Other methods recommended by Project Consulting Arborist and approved by the Contracting Officer.

3.2 TREE AND VEGETATION PROTECTION FENCING

A. Tree and vegetation protection fencing shall be installed and approved by the Contracting Officer prior to any site activity, including installation of erosion control, and shall remain in place and maintained in the condition in which it was approved until removal is authorized by the Contracting Officer.

B. Tree and vegetation protection fencing shall be constructed as follows:
   1. Fencing shall be installed to protect trees and native vegetation within the Limit(s) of Construction as indicated on the plans.
   2. Fencing is required as delineated on the plans.
      a. Fence shall have posts no less than six feet 6) utilizing above-ground base units and sandbags as shown in the Tree and Vegetation Protection Detail.
      b. Fencing shall not be fully enclosed to prevent entrapment of animals.
      c. Fencing shall be self-supported in an effective vertical position for the duration of construction. Leaning the fence on trees or other site elements shall not be permitted.
      d. Installation of the fencing shall not result in injury to tree above or below ground or to native vegetation.

3.3 TREE AND VEGETATION PROTECTION SIGNS

A. A tree and vegetation protection sign shall be placed one (1) per each Tree and Vegetation Protection Zone, minimum, or per the direction of the Contracting Officer.
   1. The Contractor shall print and laminate (11”x17”) size tree and vegetation protection signs.
      a. The Contractor shall use zip ties on all four (4) corners of the signs to attach to the tree and vegetation protection fencing.
   2. The tree and vegetation protection signs shall be replaced within twenty-four (24) hours if they become unreadable, destroyed, missing, or per the direction of the Contracting Officer.

3.4 GENERAL

B. Provide temporary barriers (e.g., tree and vegetation protection fence) to protect plants, trees, and critical root zones that are designated to remain but are within the construction limits and to protect those areas as indicated by the CO. Barriers shall be in place and approved by the Contracting Officer before any construction equipment is allowed on site. Coordinate with the Contracting Officer to allow adequate time to conduct salvaging or transplanting of plant materials into or out of the project construction limits.

A. Unless areas are specifically designated for the purpose by the Contracting Officer, the following activities are prohibited outside the limits of construction and within the fenced areas surrounding trees and native vegetation designated to remain or as directed to remain by the Contracting Officer and as described above:

   1. Parking vehicles.
   2. Storing materials or supplies.
   3. Disposing of materials including, but not limited to paint, paint thinners, fiberglass materials, fiberglass thinners, concrete or cement residue, washings from cement or concrete mixers or any other material considered harmful by the Contracting Officer.

B. Adhere to the park's pruning guidelines when pruning of trees or shrubs is necessary for construction activities. Avoid damage to trees or roots in or adjacent to the project during construction. All workers on the project involved in pruning operations must receive training by park staff to review methods and requirements prior to the commencement of pruning activities. Coordinate training with the Contracting Officer.

C. Trimming or pruning of branches as approved by the CO.

D. Provide additional water to trees during construction activities and the growing season after construction is complete as approved by Contracting Officer. Do not provide additional fertilizer as this may further stress the trees.

3.4 CONSTRUCTION PROCEDURES IN TREE AND VEGETATION PROTECTION ZONES

A. Construction and excavation work within tree and vegetation protection zones shall be done with hand tools to reduce impacts to root systems.

B. The Contractor shall protect all trees and native vegetation from injury due to construction related work. All injuries to trees and native vegetation shall be mitigated to the satisfaction of the Contracting Officer, and, if appropriate in accordance with penalty guidelines established by the park and NPS. All costs of such mitigating shall be charged to and paid by the Contractor or offending sub-contractor.

C. If access within designated Tree and Vegetation Protection Zones is approved by the Contracting Officer, the existing grade shall be covered with twelve inches (12") of wood mulch and overtopped by three-quarter inch (3/4") plywood with overlapping sheets, six-inches (6") minimum, or the plywood may be approved for use on the bottom of the mulch, to help distribute the weight of equipment and to minimize soil compaction and rutting. Mulch must be maintained at twelve inches (12") and plywood must be replaced when it becomes damaged and cracked to the point of being ineffective as determined by the Contracting Officer.
   1. Ground tracking mats or steel plates may be used as an alternative to plywood and may be required in high-traffic areas. Mulch is still required in combination with ground tracking mats or steel plates. Mats or plates must be appropriately sized for the type of equipment and shall be approved by the Contracting Officer prior to installation.
   2. Mulch shall be kiln dried and approved by the park prior to purchasing and prior to installation.

D. The following procedures shall be used when constructing any hardscape or drainage improvements:
   1. All materials and equipment shall be kept on existing hardscape or within previously approved, compacted sub-base areas.
   2. Protect exposed roots from damage and contamination by stabilization materials and concrete.
   3. Locate concrete washouts outside of and away from Tree and Vegetation Protection Zones. Washout runoff shall be strictly contained within the washout area and shall not flow into Tree and Vegetation Protection Zones.
   4. When excavating, excavated soil should be retained for use on site and covered when temporary stockpiled. NPS must approve movement of excavated soil and soil should not be moved across Ohanapecosh River. No soil shall be moved from G Loop into any loop or F Loop into any loop. Any soil in F Loop or G Loop shall evaluated by actual excavation source by park and CO for re-use on any site.

5. Excavated shall be deposited in trucks and hauled off or deposited temporarily outside the Tree and Vegetation Protection Zones. Excavated and fill soil shall not be deposited, even temporarily, in Tree and Vegetation Protection Zones.
6. If root pruning is needed, refer to section "Pruning."

E. The compaction of sub soil within Tree and Vegetation Protection Zones shall not exceed eighty percent (80%) proctor density for areas of stabilization, unless the Contractor can confirm by testing that the existing compaction within the Tree and Vegetation Protection Zones already exceeds eighty percent (80%).

F. If part of an approved plan, grading within the Tree and Vegetation Protection Zones shall be performed by hand or a method approved by the Contracting Officer. Any fill material that needs to be placed in the Tree and Vegetation Protection Zone in non-paved areas shall be limited to a maximum of four inches (4") of fill material over the area. Fill should consist of sandy loam topsoil. Clay soils shall not be used as fill. When using fill soil, the existing surface to receive fill should be scarified by hand, avoiding root damage and only to a depth to ensure proper incorporation of fill material to meet finished grade. Any filling operation shall not occur during water saturated soil conditions.

G. Concrete or chemicals spilled within Tree and Vegetation Protection Zones shall be completely removed at the time of the spill. Contaminated soil shall be completely removed by hand and/or approved methods to minimize disturbance to root systems. Approved soil shall be added as necessary to restore the grade and the Contractor shall provide remedial tree maintenance as outlined in section "Tree and Vegetation Maintenance During Construction." Contact the Contracting Officer immediately in the event of a spill within a Tree and Vegetation Protection Zone

3.5 TRENCHING

A. When trenching is approved within the Tree and Vegetation Protection Zones by the Contracting Officer, the Work shall be dug by hand, pneumatic air excavation, water excavation, or be done by directional boring in a matter to minimize root damage. Contractor shall receive approval of CO prior to use of pneumatic air excavation or use of water excavation.

B. Whenever trenching exposes roots, as called out in section "Pruning," extending through the trench wall, the Contractor shall contact the Contracting Officer or the Project Consulting Arborist immediately for inspection and evaluation. Refer to section "Pruning."

C. Directional Boring: Bore depth shall be as noted on the Drawings for site utilities, unless otherwise approved by the Contracting Officer. Bore depth shall be the minimum required to install site utilities. The bore shall have a locator to measure and maintain depth. The Contractor shall verify depth is accurate with the Contracting Officer.

3.6 UTILITY INSTALLATION

A. All Excavation or Utility installation occurring within the Tree and Vegetation Protection Zones as indicated on the Contract Documents shall be marked out in the field and reviewed in the field with the Contracting Officer and Project Consulting Arborist prior to installation.

3.7 PRUNING

A. Work Within Tree Disease Zones: Tree or soil work within known laminated root rot (LRR) pockets or in any area of downed green Douglas Fir trees shall be in consultation with MORA vegetation staff.
   1. Contractor shall follow BMPs to avoid spread disease in consultation with MORA vegetation staff.
   2. Contractor shall avoid damage and exposure of woody tissue on trees adjacent to LRR zones as a critical measure to prevent disturbance scars that act as pathways for fungal establishment and spread of disease.
   3. All trenching and falling equipment shall be cleaned of visible soil and woody root material when moving from a location affected by LRR location to others. Chemical sanitation of equipment is not required.
   4. LRR infected portions of trees shall be left in place (i.e. butt/roots/stumps). Any signs of LRR rot shall be removed prior to moving any aboveground portion of the tree. Unaffected tree boles may be used for walkways, LWD for stream habitat, or campsite delineation (on-site logs), etc.
   5. Contractor shall notify NPS vegetation staff or CO approved qualified staff to review and survey freshly cut stumps in LRR zones for LRR staining, to be done at done at time of cutting or shortly after.
   6. Contractor shall consult with park staff and CO on disease protection measures to prevent Douglas-fir beetle infestation.
   7. Under no circumstances should diseased or infected wood be left as mulch or taken to a wood processing mill.

B. Branch Pruning: Shall be identified in the pre-construction meeting and documented by the Contractor's Tree and Vegetation Protection Plan.
   1. Branch pruning shall be the responsibility of the Contractor for construction equipment access, specialty pruning required for the Project, and any damage caused by the Contractor during the Project and shall be done by a Licensed, and Insured Arborist.
   2. Pruning shall only be done with approval and at the direction of the Contracting Officer or Project Consulting Arborist.
   3. Tools used for branch pruning shall be disinfected between use on individual trees.
   4. Information on storm damage is found in section "Tree Maintenance During Construction".

C. Root Pruning: Shall be done in accordance with ANSI A300 Root Management Standard latest edition and in accordance with Best Management Practices and be performed by a Licensed, and Insured Arborist.
   1. The Contracting Officer or Project Consulting Arborist shall be notified prior to any Work operation known or suspected to involve cutting of roots within the Tree Protection Zone. Tree roots shall not be pruned or cut unless their removal is unavoidable and shall be authorized by the Contracting Officer.
      a. When contacting the Contracting Officer, provide the following information:
         1) Tree type and/or identification number.
         2) Condition of the tree.
         3) Percent of disturbance anticipated within the Tree Protection Zone.
         4) Size of roots.
   2. All roots needing to be pruned or removed shall be cut cleanly with sharp hand tools, with oversight by the Contracting Officer or the Project Consulting Arborist. No wound dressings shall be used. Backfill shall promptly be installed over the exposed roots, filling all voids.
   3. Recommended root pruning tools shall be free of defects and have sharp cutting edges

a. Scissor-type lopper.
b. Scissor-type pruner.
c. Pruning saws designed specifically for tree work.

4. After root-pruning, cover exposed roots within thirty (30) minutes to minimize desiccation. Roots may be covered with soil, mulch, or moistened burlap, and shall be kept moist until the final grade is established or roots are buried in soil.
5. Where appropriate, and under the direction of the Contracting Officer or the Project Consulting Arborist, root restricting barriers can be installed in accordance with manufacturer's recommendations.
6. If root pruning is authorized within the Tree Protection Zones, the Contractor shall provide remedial tree maintenance as identified in section "Tree Maintenance During Construction."

D. Water Exposed root zones (from ground disturbance) or cover those exposed roots to avoid drying. If construction occurs on hot days, any root zones exposed by trenching or grubbing shall be covered with loose, wet matting to avoid drying. Exposure shall be limited.

3.8 SURFACE AND EXPOSED ROOTS

A. When encountered, exposed roots shall be worked around in a manner that does not damage the outer layer of the root surface or bark
1. The Contracting Officer shall be notified should tree roots become exposed.
2. Exposed roots must be wrapped in burlap and kept moist. At or below forty degrees (40°) F, the excavation area shall be covered in concrete blankets or as directed by the Contracting Officer.
3. Exposed tree roots shall not be driven over. Plywood and/or mulch are not acceptable bridging materials for driving over exposed roots.

3.9 TREE MAINTENANCE DURING CONSTRUCTION

A. Common Tree Maintenance: Practices that maintain the health and vigor of the tree, such as: watering, mulching, remedial pruning (if needed, and approved by the Contracting Officer). The Contractor shall be responsible for all trees impacted by Construction throughout the Project.

B. Remedial Tree Maintenance: Practices such as soil remediation and soil/tissue sampling, and these practices are on an "as needed" basis, or as directed by the Contracting Officer. The Contractor shall be responsible for all trees and native vegetation impacted by Construction throughout the Project.

C. Tree and vegetation watering during Construction shall consist of the following minimum requirements for all trees within a Tree and Vegetation Protection Zone or otherwise impacted by Construction:
1. Watering Plan shall be submitted to the park and CO for approval prior to implementing watering.
2. Watering of trees shall occur throughout the year during Construction, including winter if construction activities impact root zones, exposed roots or otherwise impacted the tree or their access to water.
3. Watering shall occur when daytime temperatures are at or above forty degrees (40°) F.
4. Watering frequency shall be based on the visual indications, on the average soil moisture level and as directed by the park and CO.
a. The Contractor shall take soil moisture readings throughout the Project.

b. Soil moisture readings shall be taken every week, at a minimum, during the Construction period in areas of active construction to depth of twelve inches (12").
c. Readings shall be taken and recorded for twenty percent (20%) of the trees within the Limit of Construction and impacted by Construction and shall be indicated on the Tree and Vegetation Protection Work Plan.
d. All readings shall be recorded and submitted as outlined in Part 1 – Submittals.

5. Depending on weather conditions, the Contracting Officer or Project Consulting Arborist may approve less frequent watering.
6. The Contracting Officer will look for visual indications to determine if watering is adequate during Construction. If it appears that the trees are suffering based on visual indications, the Contracting Officer will check the soil moisture levels and determine the corrective action. Criteria includes:
   a. The surrounding soil and/or landscape is dry.
   b. The surrounding vegetation is dying or dead.
   c. The leaves on the trees are wilted.
   d. Color.
7. At the Contractor's expense, they may install a temporary irrigation system to water with the approval of the Contracting Officer.

D. Branch and Root Pruning: Refer to Section "Pruning."

E. Maintenance for Storm Damage or Emergencies: The Contractor shall coordinate trees affected by storm damage with the Contracting Officer. Guidelines for responsibilities are identified below:
1. Non-imminent threat or immediate threat that is not a danger to the public: Considered low priority clearing and will be removed as time allows by the Contracting Officer. If the Contractor needs access to the Limit of Work, the Contractor shall remove the damage at their expense.
2. Immediate threat that affects the public: Considered high priority clearing for the Contracting Officer and will be removed by the Contracting Officer inside the Limit of Work.

F. The timing duration and frequency of necessary maintenance practices shall be determined and approved by the Contracting Officer or Project Consulting Arborist, based on factors associated with the site and affected trees.

3.5 DAMAGE ASSESSMENT

A. If the Contractor destroys or seriously injures plant material designated for protection or outside of the work limits, damages will be assessed prior to final progress payment. Existing vegetation shall not be used to support temporary construction or permanent fencing.

A. A damage assessment process will be triggered by any of the following types of damage to vegetation outside of clearing or construction limits or inside fenced vegetation within the construction and clearing limits:

1. Removal of any undesignated plant material.
2. Pruning or removal of more than 30% of a tree or shrub canopy.
3. Removal or fracture of a limb or trunk that is one of the major structural entities of the plant.
4. Removal or fracture of any limb greater than 12 inches in diameter.
5. Bark damage or removal around more than 30% of the trunk circumference.

6. Trenching or soil disturbance within the drip line that is deeper than 6 inches.

END OF SECTION 32 40 00

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SECTION 32 92 00 – REVEGETATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes soil preparation, mulching, and placing downed timber, forrest litter and stones to revegetate areas disturbed but not otherwise built on as a part of this project. Areas are to also be hand seeded with seed mix provided by the Government.

B. Related Sections:

1. Section 31 10 00 – Site Clearing
2. Section 32 40 00 – Tree and Vegetation Retention and Protection

1.3 SUBMITTALS

A. No submittals are required.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Experience: Three years' experience in successful landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Project Representative Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

D. Measurements: Measure according to ANSI Z60.1.

E. Preinstallation Meeting: Conduct meeting at Project site prior to installation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Do not place forest litter or chipped wood in wet or muddy conditions.

B. Cover temporary stockpiles of forest litter and chipped wood.

C. Do not park vehicles or equipment on temporary stockpiles of forest litter and chipped wood.

D. Follow Government requirements for seed storage and handling.

PART 2 - PRODUCTS

2.1 Mulch:

A. Forest Litter – Native branches, twigs, leaves, needles, seeds and other non-living, loose organic material collected within limits of disturbance as part of Section 31 10 00 - Site Clearing. The forest litter shall be collected prior to construction activity and stored for use as mulch after seeding.

2.2 Native-Grass Seed – Seed and application rates to be provided by the Government.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine areas to receive seeding for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within the revegetation area.
2. Do not mix or place soils in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or dusty.

B. Proceed with seeding only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, do not remove any soil unless directed by the CO.

D. Field Measurements: Verify actual grade elevations and construction contiguous with new plantings by field measurements before proceeding with planting work.

E. Planting Restrictions: Plant between May 1 and September 30. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

F. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, other facilities, and existing plants from damage caused by soil preparation activities.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Stake perimeter of seeding locations. Obtain CO acceptance of layout before planting. Make layout adjustments as required.

D. Roughen embankments and fill areas by track walking.

3.3 INSTALLATION

A. Revegetate all areas defined on the drawings following all guidance in this specification sections and the following steps.
   1. Scarify soil to 12” depth, place conserved topsoil to 4” depth on top of scarified soil. Avoid compaction after soil preparation.
   2. Apply seed by hand at the rate defined by the Government.
   3. Scatter chipped wood over revegetation areas. Ensure consistent coverage, with no more than 1” depth or one layer of chipped wood.
   4. Scatter forest litter over chipped wood. Maintain 1”-2” depth in high visibility areas.
   5. Ensure that the average top surface of the forest litter adjacent to paved areas is equal to the elevation of the paved surface, or a maximum of 1” below adjacent the paved surface.

3.4 ESTABLISHMENT

A. Near facilities with high pedestrian use, as defined by CO, provide fencing for revegetation areas for one summer season.

3.5 CLEANUP AND PROTECTION

A. During seeding, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

END OF SECTION 32 92 00

SECTION 33 10 00 – WATER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. All water service work shall be in accordance with California Plumbing Code, current edition, Chapter 6 Water Supply and Distribution and other sections as specified or applicable.

1.2 SUMMARY

A. This Section includes a Fire Department Connection exterior to the building.

1.3 SUBMITTALS

A. Product data: Pipe, fittings, and FDC.

B. Manufacturer's Certification: That products meet or exceed specified requirements.

C. Pipe testing reports.

1.4 DELIVERY, STORAGE, AND HANDLING

a. Deliver and store valves in shipping containers with labeling in place.

b. Protect polyethylene tubing from direct and indirect UV exposure.

c. The manufacturer shall package product in a manner designed to deliver the pipe and fittings to the project neatly, intact and without physical damage. During transportation each pipe shall rest on suitable pads, strips skids, or blocks securely wedged or tied in place.

d. During loading, transportation, and unloading, every precaution should be taken to prevent damage to the pipe. The handling of the pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.

e. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2. All pipe and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid.

f. Materials, if stored, shall be kept safe from damage and shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe shall not be stored close to heat sources. The contractor shall be responsible for all security, damage and loss of pipe, excluding Acts of God.

g. The interior of the pipe as well as all sealing surfaces of mating components (i.e. flange faces) shall be kept free from dirt or foreign matter at all times. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged to prevent insects, animals, or foreign material from entering the pipe line or pipe section. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted. Use waterproof nightcaps to prevent the entrance of any type of natural precipitation into the carrier or containment pipe and will be secured to the pipe in such a manner that the wind cannot blow them loose. Where possible, the pipe shall be raised and supported at a suitable distance from the open end such that the open end will be below the level of the pipe at the point of support.

h. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are installed or lowered into the trench to be laid. Defective, damaged, or unsound pipe will be rejected. Cuts, punctures, or gouges that penetrate or reduce the wall thickness by 10% or more are not acceptable and must be removed and discarded.

PART 2 - PRODUCTS

2.1 PIPE

A. Polyethylene Pipe

1. Pipe shall be polyethylene pipe (not tubing) in accordance with AWWA C901, material designation code of PE4710, and all applicable ASTM Standards.

2.2 FITTINGS

A. Butt fusion fittings shall be made of HDPE material with a minimum material designation code of PE4710 and all applicable ASTM standards. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified on the project documents. All fittings shall meet the requirements of AWWA C901, C906 and all applicable ASTM standards. Markings for molded fittings shall comply with the requirements of ASTM D3261. Fabricated fitting shall be marked in accordance with ASTM F2206. Socket fittings shall meet ASTM D2683. Fabricated fittings shall be manufactured using a data logger to record fusion time, pressure and temperature, and shall be marked with a unique joint identifier that corresponds to the joint report. A graphic representation of the time and pressure data for all fusion joints made producing fittings shall be maintained for a minimum of five years as part of quality control and will be available upon request of CO.

B. Electrofusion fittings shall be made of HDPE material with a minimum material designation code of PE4710 and meet ASTM F1055. Electrofusion fittings shall have a pressure rating equal to the pipe unless otherwise specified on the project documents. All electrofusion fittings shall be suitable for use as pressure conduits and have nominal burst values of four times the working pressure rating of the fitting. Marking of electrofusion fittings shall comply with the requirements of ASTM F1055. All electrofusion fittings shall be properly stored in compliance with the manufacturer's recommendation.

C. Saddle fusion could be used to fuse branch saddles, tapping tees and other HDPE fittings onto the wall of the main pipe. Saddle fusion shall be done in accordance with ASTM F2620 or PPI TR-41 or the fitting manufacturer's recommendations. Saddle fusion joints shall be made by qualified fusion technicians. Qualification of the fusion technician shall be demonstrated by evidence of fusion training within the past two years on the equipment to be utilized on this project in accordance with ASTM F3190.

D. Flanges and Mechanical Joint Adapters (MJ) shall have a minimum material designation code of PE4710 and meet all applicable AWWA and ASTM standards. Flanged and MJ adapters can be made to ASTM D3261 or machined in compliance with ASTM F2206. Flanges and MJ adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Markings for molded or machined flange adapters or MJ adapters shall be per ASTM D3261. Fabricated (including machined) flange adapters shall be marked per ASTM F2206. Installation of all Flanged adapters shall follow the guidelines of the Plastics Pipe Institute TN-38.

E. Glands, bolts, and gaskets shall be manufactured in accordance with AWWA C153. Bolts and nuts shall be grade 2 or higher.

2.3 FIRE DEPARTMENT CONNECTION

A. Fire department connection shall meet the requirements of NFPA 13 and NFPA 14.

2.4 VALVES

A. Valves shall conform to the latest revision of AWWA Standard C509 covering resilient seated gate valves for water supply service.

B. The valves shall have an iron body, bonnet, and O-ring plate. The wedge shall be fully encapsulated with rubber.

C. The sealing rubber shall be permanently bonded to the wedge per ASTM D249.

D. Valves shall be supplied with O-ring seals at all pressure retaining joints. No flat gaskets shall be allowed.

E. The valves shall be non-rising stem (NRS), opened by turning left or right, and provided with 2" square operating nut. The operating nut shall be marked indicating the direction to open with the word "OPEN" and an arrow.

F. NRS stems shall be cast copper alloy with integral collars in full compliance with AWWA C509. All stems shall operate with copper alloy stem nuts independent of the wedge.

G. All NRS stems shall have two O-rings located above thrust collar and one below. The upper o-rings shall be replaceable with valve fully opened and subjected to full pressure. The stems on NRS valves shall have a low torque thrust bearing located both above and below the stem collar to reduce friction during operation.

H. The waterway shall be smooth, unobstructed and free of all pockets, cavities and depressions in the seat area. Valves made with a tapping flange shall accept a full-size tapping cutter.

I. The body, bonnet and O-ring plate shall be coated both on the interior and exterior with fusion bonded epoxy. Epoxy shall be applied in accordance with AWWA C550 and certified per NSF 61.

J. Each valve shall have the manufacturer's name, the pressure rating, country of origin and the year in which it was manufactured cast on the body. Prior to shipment from the factory, each valve shall be hydrostatically pressure tested according to the requirements of AWWA C509 (and UL/FM where applicable).

K. Valve Boxes

1. Cast iron or ductile iron, designed to accommodate HS-20 traffic loadings. The word "WATER" shall be stamped or cast into cover so it is plainly visible.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify that restroom service connection and water main size, location, and invert are as indicated.

B. All HDPE pipe and fittings shall be cut, joined, and installed in accordance with the manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe systems.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.3 FUSION AND JOINING

A. Fusion Joining Requirements:

1. All HDPE pipe shall be joined to itself by the heat fusion process which produces homogeneous, seal, leak tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.

2. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F 2620.Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the CO.

3. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290, PPI TN 34, and PPI Municipal Advisory Board (MAB) Generic Electrofusion

Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe. The electrofusion processor must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence electrofusion training within the past year on the equipment to be utilized for this project.

B. Fusion Operators:

1. The employer of the fusion machine operator is responsible for the fusion joint quality of the fusion weld made by that individual. The employer is responsible for documenting all training and qualification records for that individual, including compliance to any code requirements for fusion/bonder operators.

2. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.

3. For Projects with at least 5,000 feet or with pipe larger than 24 inches, operators or their supervisor must have a current McElroy Fusion Training Certificate for the equipment to be used on the project.

C. Butt Fusion Equipment:

1. For 6″ and larger pipe sizes, the pipe butt fusion machine shall be a hydraulic fusion machine capable of butt fusing HDPE pipe. The carriage must be removable from the chassis for in-ditch use. The machine must be compatible with an electronic data recording device, McElroy Data Logger or equal. Accessories will include all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for checking the surface temperature of the heater, extension cord of appropriate gauge (25' minimum), and hydraulic extension hoses (minimum of four). The butt fusion machine will be McElroy, or approved equivalent.

3.4 TRENCHING

A. See Utility Trenching in Section 31 20 00 and plan details for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil.

3.5 INSTALLATION – PIPE

A. Establish elevations of buried piping to ensure not less than 6 feet of cover.

B. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints.

D. Install access fittings to permit disinfection of water system performed.

E. Slope water pipe and position drains at low points.

F. Install trace wire 12 inches above top of pipe; coordinate with Section 31 20 00.

3.6 PIPE Joining

A. High density polyethylene pipe shall be heat fused and pressure tested as per manufacturer's guidelines before installation. During assembly and prior to installation, pipe must be laid out in such a way as to minimize interference to pedestrian and vehicular traffic.

B. Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out, discarded and the pipe rejoined.

C. Each butt fusion shall be recorded and logged by a datalogger affixed to the fusion machine. Joint data shall be submitted as part of the as-built documentation.

D. Mechanical joining – Polyethylene pipe and fittings may be joined together or to other materials by means of flanged connections or mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another pipe material. Mechanical couplings shall be fully pressure rated and fully thrust restrained and installed in accordance with manufacturer's recommendations.

3.7 DISINFECTION

A. Disinfection of the water service line shall be in conformance with California Plumbing Code Chapter 6, Section 609.9 Disinfection of Potable Water System.

1. New or repaired water potable water systems shall be disinfected prior to use. Prior to utilization of newly constructed or altered potable water piping systems, all affected potable water piping shall be disinfected using procedures prescribed in California Plumbing Code Sections 609.9(1) through 609.9(4). The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by it, the following:

   a) The pipe system shall be flushed with clean, potable water until potable water appears at the points of outlet.
   b) The system or parts thereof shall be filled with a water-chlorine solution containing not less than 50 parts per million of chlorine, and the system or part thereof shall be valved-off and allowed to stand for 24 hours; or, the system or part thereof shall be filled with a water-chlorine solution containing not less than 200 parts per million of chlorine and allowed to stand for 3 hours.
   c) Following the allowed standing time, the system shall be flushed with clean, potable water until the chlorine residual in the water coming from the system does not exceed the chlorine residual in the flushing water.
   d) The procedure shall be repeated where it is shown by bacteriological examination made by an approved agency that contamination persists in the system.

3.8 PRESSURE AND LEAKAGE TESTING

A. Conduct hydrostatic pressure testing of installed polyethylene pipe in accordance with ASTM F2164.

B. For HDPE mains, fill the main slowly ensuring fill rate does not exceed capacity of air release devices. Once air has been expelled from the system, gradually raise the pressure to 160 psi. Add makeup water as necessary to maintain this pressure as necessary for four hours. After four-hour period, reduce main pressure to the 150 psi test pressure and monitor for one hour. Do not increase pressure or add make-up water during this one-hour period. The test is passed and considered acceptable if the main pressure does not drop more than 5% (7.5 psi) during the one-hour period.

C. If any defects or leaks are revealed, they should be corrected, and the pipeline retested after a minimum 24-hour recuperation period between tests. Total testing conducted on a section of pipeline shall not exceed eight hours within a 24-hour period.

3.9 FIELD QUALITY CONTROL

A. See Section 01 40 00 – Quality Requirements, for additional requirements.

B. Perform field inspection and testing in accordance with Section 01 40 00.

C. Testing shall be conducted by Contractor or an independent testing and inspection agency employed by the Contractor.

D. Pressure and leak test water piping.

E. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Government.

END OF SECTION 33 10 00

SECTION 33 30 00 – SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes installation of new sewer service line to the new building and site improvements, installation of oil/water separators, replacement of sections of existing sewage line, installation of a grinder manhole, and rehabilitation of an existing lift station.

B. Related Sections:

1. Section 01 57 23 – Temporary Stormwater Pollution Prevention Earth Moving
2. Section 26 05 00 – Common Work Results for Electrical
3. Section 31 10 00 – Site Clearing
4. Section 31 20 00 – Earth Moving
5. Section 31 25 00 – Erosion and Sediment Control

1.3 SUBMITTALS

A. Product data: Pipe, fittings, cleanout, and accessories.

B. Manufacturer's Certification: That products meet or exceed specified requirements.

C. Record drawing as-builts.

1. Identify and accurately locate structures, inverts and line elevations, size and type of piping, location, size and inverts for services.

D. Pipe testing reports.

PART 2 - PRODUCTS

2.1 PIPE

A. PVC Pipe

1. PVC pipe shall conform to ASTM D3034, SDR-35.
2. Joints for PVC pipe shall conform to ASTM D3212 using elastomeric gaskets conforming to ASTM F477.

2.2 FITTINGS

1. Fittings for PVC pipe shall conform to ASTM D3034, SDR-35.

2.3 CLEANOUTS

1. Material for cleanouts shall meet the requirements for PVC pipe.

PART 3 - EXECUTION

3.1 INSTALLTION

A. Pipe

1. Pipe shall be of the type, class, and size called for on the plans. All pipe shall be protected during handling against impact shocks and free falls. No damaged or defective pipe shall be installed in the work. Pipe shall be kept clean at all times, and as the work progresses, the interior of the pipe shall be cleared of all dirt and superfluous materials of every description.
2. The laying of the pipe shall be in trenches free from water or debris, and shall commence at the lowest point, with the spigot ends pointing in the direction of the flow. Each pipe shall be laid firmly and true to line and grade, in such manner as to form a closed concentric joint with the adjoining pipe and to prevent sudden offsets of the flowline. Any adjustment to line and grade shall be made by scraping away or filling in under the body of the pipe, never by wedging or blocking under the pipe ends.
3. The alignment and grade of each length of pipe shall be checked after setting by measurement from the string line, laser beam target or other means approved by the CO.
4. At all times when work is not in progress, open ends of the pipe and fittings shall be securely closed to the satisfaction of the CO, so that no water, earth or other substance will enter the pipe or fittings.

B. Rubber Gasketed Joints

1. In laying pipe with rubber gaskets, the pipe shall be handled carefully to avoid knocking the gasket out of position or contaminating it with foreign material. Any gasket so disturbed shall be removed, cleaned, relubricated if required, and replaced before joining the sections.
2. The pipe shall be properly aligned before joints are forced home. Sufficient pressure shall be applied in making the joint to ensure that the joint is home, as defined in the standard installation instructions provided by the pipe manufacturer. The Contractor may use any method acceptable to the CO for pulling the pipe together, except that driving or ramming by hand or machinery will not be permitted. Any pipe damaged during joining and joint tightening shall be removed and replaced at no expense to the Owner.
3. Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling or

crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most gasketed joints tend to creep apart when the end of the pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.

4. Sufficient restraint shall be applied to the line to ensure that joints once home are held so by compacting backfill material under and alongside the pipe or by other acceptable means. At the end of the work day, the last pipe shall be blocked in such a manner as may be required to prevent creep.

C. Cleanouts

1. All cleanouts shall be extended to grade.
2. When extended to grade, cleanouts shall be full the sewer diameter and the Contractor shall install an approved casting to provide ready access to the cleanout stopper.

3.2 SEWER LINE CLEANING AND TESTING

A. General

1. Sewers and pipe lines shall be subject to acceptance testing after backfilling has been completed but prior to the placement of the finished surface material.
2. Cost of repairs or corrections necessary to conform to the following testing requirements will be borne by the Contractor at no additional cost to the Park.
3. Low Pressure Air Test

   a. Testing will be accomplished by the means of "Low Pressure Air Testing." Tests may be conducted by the Contractor or an independent testing firm. However, acceptance tests shall be made only in the presence of the CO.
   b. Test Procedure

      1) Before testing, the pipe shall be thoroughly cleaned.
      2) The Contractor shall seal off the section of pipe to be tested at each manhole connection. Test plugs must be securely braced within the manholes.
      3) A minimum of two connecting hoses to link the air inlet test plug with an above ground test monitoring panel must be provided.

         a) One hose is to induce air through the test plug and into the test chamber.

         b) The second hose is for the purpose of monitoring the test pressure from within the enclosed pipe.

      4) Under no circumstances are workers to be allowed in the connecting manholes while a pressure test is being conducted.

      5) Add air slowly into the test section. After an internal pressure of 4.0 psi is obtained, allow internal air temperature to stabilize.

      6) After stabilization period, adjust the internal air pressure to 3.5 psi, disconnect the air supply and begin timing the test.

7) Refer to table below to determine the length of time (minutes) the section under test must sustain while not losing in excess of 1 psi as monitored by the test gauge. If the section of line to be tested includes more than one pipe size, calculate the test time for each size and add the test times to arrive at the total test time for the section.

Sanitary Sewer Air Test –
Minimum Test Time for Various Pipe Sizes

Nominal Pipe Size, In.	T (time), min/100ft
3	0.2
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8

a) Sections so determined to have lost 1 psi or less during the test period will have passed the leakage test. Those sections losing in excess of 1 psi during the test period will have failed the leakage test.
b) Appropriate repairs must then be completed, and the line retested for acceptance.

4. Hydrostatic Test

a. Exfiltration Test: Sanitary sewer testing by means of exfiltration should only be considered when low pressure air testing cannot be used and only with the approval of the CO.

b. Testing Procedure

1) The Contractor shall furnish all equipment for testing.
2) Seal off the downstream end of the line and fill with water to a minimum head of 4 feet in a stand pipe at the high end.
3) A period of at least one hour will be allowed for absorption time before making the test.
4) A suitable meter or method of measuring the quantity of water used is necessary.
5) The allowable water loss for sanitary sewers shall not exceed 0.158 gallons per hour per 100 feet of pipe per inch of diameter of pipe under a minimum test head of 4 feet above the top of the pipe at the upper end.

5. Deflection Test for HDPE and PVC Pipe

a. In addition to the tests prescribed above, the Contractor shall perform a deflection test on the system as directed by the CO. Any part of the installation which shows deflection in excess of 5% of the nominal inside diameter per MAG Standard Specification Section 738 for HDPE pipe or in excess of 5% of the average inside diameter per ASTM D3034 for PVC pipe, shall be evaluated and appropriate remedy, if any, shall be performed.

b. After acceptance but prior to the termination of the warranty period, the Park may test the long-term deflection of the sewer. If the Park determines that the deflection has exceeded 7 ½% of the average inside diameter, that portion of the installation shall be corrected by the Contractor at no cost to the Park.

6. Closed Circuit TV Inspection

a. The Park reserves the right to visually inspect the interior of the sewer line using a television camera. Any defects in the pipe or construction methods revealed shall be corrected by the Contractor at no additional cost to the Park.

END OF SECTION 33 30 00

SECTION 33 40 00 – STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Installation of catch basins and associated storm drain.
2. Installation of trench drain.

B. Related Sections:

1. Section 01 57 23 – Temporary Stormwater Pollution Prevention
2. Section 31 20 00 – Earth Moving

1.3 SUBMITTALS

A. Product Data: For catch basins, frame, grate/lid, trench drain, outfall protection material, and storm drain pipe.

B. Manufacturer's Certification: Products meet or exceed specifications.

PART 2 - PRODUCTS

2.1 PIPE

A. Storm drain pipe shall be lined corrugated polyethylene pipe and shall meet the requirements of AASHTO M 294 Type S or D.

B. Corrugated polyethylene storm sewer pipe manufacturers shall participate in the National Transportation Product Evaluation Program (NTPEP) work plan for HDPE (High Density Polyethylene) Thermoplastic Pipe and be listed on the NTPEP audit website displaying they are NTPEP compliant.

C. Corrugated polyethylene couplings and fittings shall meet the requirements of AASHTO M 294 Type S or D.

D. All joints for corrugated polyethylene storm sewer pipe shall be made with a bell/bell or bell and spigot coupling and shall conform to ASTM D3212 using elastomeric gaskets conforming to

ASTM F477. All gaskets shall be factory installed on the pipe in accordance with the manufacturer's recommendations.

2.2 CATCH BASINS

A. Catch basins shall be precast and shall conform to the dimensions shown in the plans. All precast concrete items shall meet the requirements of AASHTO M199.

B. Catch basin reinforcement shall be as set forth in the Plans.

C. The knockout diameter shall not be greater than 20 inches. Knockouts shall have a wall thickness of 2 inches minimum to 2.5 inches maximum. Provide a 1.5" minimum gap between the knout wall and the outside of the pipe. After the pipe is installed, fill the gap with joint mortar.

D. The precast base section may have a rounded floor. The walls may be sloped at a rate of 1:24 or steeper.

2.3 FRAME AND GRATE

A. Castings for metal frames for catch basins shall be cast steel, gray iron, or ductile iron.

B. Castings for metal grates for catch basins shall be cast steel or ductile iron.

C. Grates shall be seated properly to prevent rocking.

2.4 TRENCH DRAIN

A. Channels

1. Trench drain channel shall be manufactured from polyester resin polymer concrete with integrally cast-in stainless steel edge rails. Polymer concrete shall be conform to the following:

Compressive Strength:	98 MPa
Flexural Strength	26 MPa
Tensile Strength	14 MPa
Water Absorption	0.07%
Frost Proof	YES
Coefficient of Expansion/Contraction	2.02x10-5/°C
Water Vapor Transmission	0.0364 g/m^2
Non-Flammable	YES
Manning's Roughness, n	0.011
Resistant to Weathering	YES
Dilute Acid and Alkali Resistant	YES
SF Sealant Groove	YES

2. Channels shall be 4 inches nominal interior width with an overall width of 6 inches.

3. Channel invert shall have a U-profile to allow efficient drainage. Sloped channels shall have a built-in slope of 0.5%.

4. All channels shall be interlocking with a male/female joint.

B. Grates

1. Grates shall be manufactured from weathering steel conforming to ASTM A 588.

2. Grate shall have an overall width of 6 inches.

3. Grate shall have maximum slot widths of ½".

4. Finish: Grates shall be uncoated, raw weathering still. No painting, galvanizing or surface coating shall be permitted.

C. Concrete: Concrete shall have a minimum strength of 4000 psi.

2.5 OUTFALL PROTECTION

A. Outfall protection shall be a porous, free draining material consisting of sand, gravel, cinders, slag, crushed stone, or other approved free draining material. This material shall meet the following gradation requirements:

Sieve Size	Percentage Passing
3 inch	100
No. 4	20-65
No. 200	0-10

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Excavation, Trenching, and Backfill

1. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings. Trenches must be of sufficient width in the pipe zone to permit proper installation and bedding of the pipe and to provide the required compaction of backfill.

2. Hand trim excavation for accurate placement of pipe to elevations indicated.

3. All ledgerock, boulders, and stones shall be removed to provide a minimum of 6 inches clearance under all portions of the pipe.

4. Placement of bedding material shall precede the installation of all pipe. This shall include necessary leveling of the native trench bottom or the top of the foundation material as well as placement and compaction of required bedding material to a uniform grade so that the entire length of pipe will be supported on a uniformly dense unyielding foundation.

5. When, after excavating to the foundation level, the material remaining in the trench bottom is determined to be unsuitable by the CO, excavation shall be continued to such additional depth and width as required by the CO. Unsuitable foundation materials shall be disposed of at an approved site. The trench foundation shall be backfilled to the bottom of the pipe zone with sand bedding, or other suitable material, and compacted to form a uniformly dense, unyielding foundation.

6. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

7. Pipe zone bedding material shall provide uniform support along the entire pipe barrel, without load concentration at joint collars or bells. All adjustment to line and grade shall be made by scraping away or filling in with bedding material under the body of the pipe and not by blocking or wedging. Bedding disturbed by pipe movement, or by removal of shoring movement of a trench shield or box, shall be reconsolidated prior to backfill.

8. Pipe zone bedding shall be placed in loose layers and compacted to 90 percent maximum density. Bedding shall be placed, spread, and compacted before the pipe is installed so that the pipe is uniformly supported along the barrel. Lifts of not more than 6 inches in thickness shall be placed and compacted along the sides of the pipe. Material shall be worked carefully under the pipe haunches and then compacted.

9. If the CO determines that the material existing in the bottom of the trench is satisfactory for bedding the pipe, the bedding material specified is not required, provided the existing material is loosened, regraded, and compacted to form a dense, unyielding base.

10. Before lowering and while suspended, inspect pipe and each fitting for defects. Installation of defective material is not permitted.

11. Where pipe, fittings or joint materials have been soiled by earth in handling, thoroughly clean soiled surfaces by wire brushing and wiping until all traces of earth are removed before joining pipe.

12. Maintain interior of all pipes thoroughly clean. After each line of pipe has been laid, carefully inspect, identify and remove dirt, trash, rags and other foreign matter from interior. Protect completed work.

13. Install pipe, fittings, and accessories at the locations indicated on layout drawings and in accordance with manufacturer's instructions. Seal watertight.

14. Trenches shall be backfilled as soon after the pipe laying as possible.

15. Pipe zone backfill material shall be clean earth or sand, free from clay, frozen lumps, roots, or moisture in excess of that permitting required compaction. Rocks or lumps larger than 3 inches maximum shall not be used for pipe zone backfill.

16. Pipe zone backfill shall be placed in loose layers and compacted to 90 percent maximum density. Backfill shall be brought up simultaneously on each side of the pipe to the top of the pipe zone. The pipe shall then be covered to the top of the pipe zone and the materials compacted in a manner to avoid damaging or disturbing the completed pipe.

17. Backfill above the pipe zone shall be accomplished in such a manner that the pipe will not be shifted out of position nor damaged by impact or overloading. If pipe is being placed under existing paved areas, or Roadways, backfill above the pipe zone shall be placed in horizontal layers no more than 6 inches thick and compacted to 95 percent maximum density. If pipe is being placed in non-traffic areas, backfill above the pipe zone shall be placed in horizontal layers no more than 6 inches thick and shall be compacted to 85 percent maximum density.

18. Protection

    a. Water is not permitted to run or stand in trench while pipe laying is in progress, before the joints are completely set, or before trench has been backfilled.

    b. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

3.2 CATCH BASIN INSTALLATION

A. The excavation for all catch basins shall be sufficient to leave 1 foot in the clear between their outer surfaces and the earth bank.

B. The cover or grating of a catch basin shall not be grouted to final grade until the final elevation of the ditch in which it is to be placed has been established, and until permission thereafter is given by the CO to grout the cover or grating in place. Covers shall be seated properly to prevent rocking. Leveling and adjustment devices that do not modify the structural integrity of the metal frame, grate or cover, and do not void the originating foundry's compliance to these specifications and warranty are allowed. Leveling and adjusting devices that interfere with the backfilling, backfill density, and grouting will not be allowed. The hardware for leveling and adjusting devices shall be completely removed when specified by the CO.

C. Ladder rungs shall be grouted in the precast concrete walls. Rungs shall be uniformly spaced at 12 inches and be vertically aligned.

D. In the event any pipe enters the manhole through the precast concrete units, the Contractor shall make the necessary cut through the manhole wall and steel mesh. The steel shall be cut flush with the face of the concrete and shall be cut in such a manner that it will not loosen the reinforcement in the manhole wall.

E. The ends of all pipes shall be trimmed flush with the inside walls.

F. Rubber gaskets or flexible plastic gaskets may be used in tongue and groove joints of precast units. All other joints and all openings cut through the walls shall be grouted and watertight. Mortar must be composed of cement, sand, and water. The proportion of sand to cement measured by volume must be 2 to 1. Mortar must contain only enough water to allow placing and packing. Sand particles must be no larger than 1/2 the size of the recess or space in which the mortar is to be placed.

G. If gaskets are used, handling of the precast units after the gasket has been affixed shall be done carefully to avoid disturbing or damaging the gasket or contaminating it with foreign material. Care shall be exercised to attain proper alignment before the joints are entirely forced home. During insertion of the tongue or spigot, the units shall be partially supported to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.

H. Backfilling around the Work will not be allowed until the concrete or mortar has thoroughly set.

I. Catch basins shall be watertight.

J. Backfilling

1. Place structure backfill in uniform layers. Bring backfill up uniformly on all sides of structures. Backfill layers must be at most 0.67 foot thick before compacting.

1. Do not use compaction equipment or methods that may cause excessive displacement or damage structures.

2. Do not place structure backfill the catch basin has been inspected by the CO and authorized for backfilling.

4. Compact structure backfill to a relative compaction of at least 95 percent.

K. Catch basins shall be constructed on a compacted or undisturbed level foundation. If the Contractor elects to use a separate cast-in-place base, the concrete shall be Class 4000.

L. All excavations 4 feet or more in depth shall be shored with structural shoring or shall meet open-pit requirements.

3.3 TRENCH DRAIN INSTALLATION

A. Ensure ground conditions are compacted and suitable for construction.

B. Excavate trenches to sufficient dimensions to permit proper installation of stabilizing concrete and trench drain.

C. Concrete shall be placed to encase trench drain as shown in the Plans.

D. Install trench drain in accordance with manufacturer's instructions. The drain shall be finished 1/8 inch below finish grade while ensuring positive drainage of adjacent areas toward the drain.

E. The existing trench drain shall be cleaned of all debris.

3.4 PROTECTION

A. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 40 00

OAHP1403
Rev. 9/98

COLORADO CULTURAL RESOURCE SURVEY

Architectural Inventory Form

Official eligibility determination
(OAHP use only)
Date _____Initials _____
_____ Determined Eligible- NR
_____ Determined Not Eligible- NR
_____ Determined Eligible- SR
_____ Determined Not Eligible- SR
_____ Need Data
_____ Contributes to eligible NR District
_____ Noncontributing to eligible NR District

I. IDENTIFICATION

1. Resource number: **5GA.1285 (5GA.4538)**
2. Temporary resource number: **B-0392-N**
3. County: **Grand**
4. City: **Grand Lake vicinity**
5. Historic building name: **West Side Administration Building**
6. Current building name: **B-0392-N CRD Kawuneeche Visitor Center**
7. Building address: **16018 US 34, Grand Lake, CO 80447**
8. Owner name and address: **Rocky Mountain National Park, 1000 US Highway 36, Estes Park, CO 80517**

II. GEOGRAPHIC INFORMATION

9. P.M. **6th** Township **4N** Range **75W**
   SW ¼ of **NE** ¼ of section **31**
10. UTM reference
    Zone **13N; 429191** mE **4457722** mN
11. USGS quad name: **Grand Lake, 40105-C7**
    Year: **2021** Map scale: 7.5' **X** 15'____ Attach photo copy of appropriate map section.
12. Lot(s): **N/A** Block: **N/A**
    Addition: **N/A** Year of Addition: **N/A**
13. Boundary Description and Justification:

    The boundary is defined by U.S. Route 34 (US 34)/Trail Ridge Road to the west, the gravel access road for the Colorado River District (CRD) water tank to the north and northeast, and a 250-foot buffer along the east and south edges of pavement for the parking lot to encompass the parking lots, sidewalks, picnic areas, landscaping, water features, lights, flagpole, and objects associated with the Kawuneeche Visitor Center.

III. ARCHITECTURAL DESCRIPTION

14. Building plan (footprint, shape): **Irregular plan**
15. Dimensions in feet: Length **approx. 155** x Width **approx. 100**
16. Number of stories: **One**

Resource Number: 5GA.1285
Temporary Resource Number: B-0392-N

17. Primary external wall material(s):
    - **Stone**
    - **Wood/T1-11 plywood siding**
18. Roof configuration:
    - **Flat roof**
    - **Gabled roof/Front-gabled roof**
19. Primary external roof material:
    - **Asphalt roof/Asphalt roll roof**
    - **Metal**

20. Special features: **See discussion of character-defining features under General Architectural Description.**

21. General architectural description:

B-0392-N CRD Kawuneeche Visitor Center (KVC) is a one-story Park Service Modern style building constructed in 1968–1969 with additions constructed in 1989 and 1999. The building originally consisted of three sections: the central lobby, the office wing to the north, and the comfort station wing to the south. The office wing is connected to the lobby via the information corridor; a covered walk extends from the south entrance of the lobby and connects to the comfort station. In 1989, an auditorium addition was constructed along the east (rear) elevation of the lobby. An original storage closet at the southeast corner of the office wing was expanded south into the open bay to create a larger closet, an alteration that may have occurred at about this time. In 1999, the comfort station was expanded with an addition to its east elevation, and a gable roof was added in 2008 (Anderson Hallas Architects 2018:7). The employee parking lot was expanded between 2011 and 2013.

Lobby

As first constructed, the lobby of the KVC measured 28′ x 28′ and had curtain walls on all four elevations, with exterior doors for the main entrance centered on the south, an open corridor accessing the administrative wing centered on the north, and exterior doors accessing an outdoor auditorium and natural area centered on the east. The 1989 addition removed the east exterior curtain wall and added 28′ x 22′ of floor space to the lobby interior for a total floor plan expansion to 28′ x 50′. The new lobby space featured a windowless exterior wall to the north and exterior wall with a line of clerestory windows to the south. An indoor auditorium measuring 28′6″ x 40′6″ was joined to the east elevation of the expanded lobby and separated by an interior wall. Together, the expanded lobby and new auditorium created a reverse L-shaped addition extending for a total length of 46′6″east (including roof overhang), and the auditorium leg extending south for a length of 40′6. Today, the lobby stands on original poured concrete foundations. Extant original glass curtain walls on three sides are accented by inverted corners clad in uncoursed native natural stone. The roof is supported by four steel columns clad in wood at each of the inverted corners.

The flat roof is supported by an open web joist system, with steel strut webbing connecting the top and bottom joist chords. The roof is covered in tar and gravel with a tall fascia covered in T1-11 plywood siding; the height of the fascia was altered from the original roof design in 1999. Throughout the exterior of the lobby, the T1-11 plywood siding is painted NPS brown. The trim, header beams, four post columns, and windowsills and mullions, are painted a lighter gray-tan color, possibly Copley Gray. According to the as-constructed drawings (1969) and as-built photographs, all exterior and interior wood surfaces of the lobby and information corridor were finished with stain and were not painted. Stain colors included Bondwood Domino Walnut on the floor, Olympic semi-transparent stain #719 on the baseboards and walls, Olympic semi-transparent stain #902 on the wood ceiling, Olympic semi-transparent stain #711 on the doors, Rusco 70103 black on the window frames, and Olympic semi-transparent stain #902 on the trim.

The west elevation of the lobby faces the parking lot and Trail Ridge Road; it is a glass curtain wall consisting of vertically oriented, rectangular fixed aluminum sash windows placed above alternating over one-by-one square fixed sash windows and one-by-one square sliding windows. A continuous wood beam separates these windows from a band of rectangular clerestory windows directly below the overhanging eaves. The

eaves are clad in wood boards that are a continuation of the interior ceiling treatment, further emphasizing the connection between interior and exterior space. The junctions of the north and south elevations cut into the building; the corners are clad in uncoursed native stone. Columns are constructed of four Douglas fir posts and spacers that are bolted on a concrete pier in each inverted corner.

The entrance to the lobby is in the south elevation. Glass curtain walls are on either side of a glass-enclosed entrance vestibule that is below the covered walk connecting to the comfort station. The original inverted corner at the southeast corner creates a space for an exterior post, which is mirrored on the adjoining southwest corner of the new addition. At the joint, the south exterior wall of the auditorium addition reflects the uncoursed stone veneer of the lobby. The remainder of the auditorium addition is clad in T1-11 plywood siding.

The east elevation of the lobby, originally a glass curtain wall, was removed for the auditorium addition. The auditorium sits at grade on a concrete slab foundation, and a concrete sidewalk (termed a patio walk on plans) extends from it to access the exterior door on the east elevation. Except where the auditorium addition joins the lobby, the exterior is clad in T1-11 plywood siding with wood trim at the corners and a wood band extending around the perimeter of the building approximately three-quarters of the way up the exterior wall. The flat roof also features widely overhanging, boxed eaves; the soffit and fascia are T1-11 plywood siding. There are no windows in the auditorium addition.

The north elevation of the lobby consists of glass curtain walls on either side of the information corridor that connects to the office wing.

Information Corridor

The west elevation of the information corridor is a glass curtain wall and contains an additional entrance. The east elevation of the corridor is also a glass curtain wall. The 1989 auditorium addition was constructed into the terrace and obscures views of the landscape to the southeast. Although not in the original plans, the 1989 drawings show a curved walkway leading from a non-original exterior door on the east elevation to the east terrace, with notations to “remove exg door” and “remove exg conc walks & benches.” The door that was formerly on the east elevation was moved to the west, where it remains to this day (ROMO Visitors Center Vertical Control and Location of Improvements, Floor Plan Sheet A-1, 1989). The same plans document a non-original partition wall and cabinetry separating the original information counters in the lobby and the corridor. The wall was scheduled for removal but appears to remain in place today. Also in 1989, a secured office door into the office wing was added.

Office Wing

The office wing is rectangular in plan measuring 98’8” x 30’ with the long axis predominantly oriented east-west. The principal elevation faces north toward the employee section of the parking lot, and the information corridor connected to the lobby is adjoined to the south elevation. The foundation is poured concrete and is elevated in places due to fluctuating topography. The exterior walls are clad in T1-11 plywood siding with regularly spaced pairs of applied vertical wood posts delineating the wall below the exposed roof beams and the window openings in the north, east, and south elevations. The flat roof is an open web joist system consisting of two wood members with steel struts forming a truss. It is covered with rolled asphalt roofing and features widely overhanging eaves with exposed roof beams and fascia clad in T1-11 plywood siding. Ca. 1999, the eaves were heightened with a 1” × 12” board altering the original proportion and appearance of the roof. This alteration was further extenuated in 2020 when the roof was replaced and at which time the fascia was reclad in T1-11 plywood siding and metal flashing was installed. The soffit is plywood. Throughout the office wing, the T1-11 plywood siding is painted either NPS brown or Coffee brown. The trim, header beams, vertical posts, sills, and soffit are painted a lighter gray-tan color, presumably Copley Gray. According to the as-constructed drawings (1969) and as-built photographs, all exterior wood surfaces of the office wing were finished with stain and were not painted.

The north elevation features 16 bays delineated by the paired vertical wood beams with a wood beam header below the eave. The outer bays (five on the east end and six on the west end) contain vertically oriented one-by-one aluminum sash sliding windows corresponding to the offices and the naturalist work room. From the east end of the office wing, the sixth and seventh bays have large vents corresponding to the mechanical room. The main entrance is recessed into the eighth bay; it features the original glazed wood double doors with an undivided single-lite transom. A flush wood door is in the east wall of the recessed entrance for access into the mechanical room. The ninth and tenth bays feature horizontally oriented one-by-one aluminum sash sliding windows at the top of the bay corresponding to the restrooms. There are two motion sensing lights attached to the soffit below the eave. Drainage and attached downspouts (non-original) have been added between the second and third bays, the seventh and eighth bays, and the fourteenth and fifteenth bays.

The west elevation features a partial-width, broad unperforated wall clad in uncoursed native stone. A secondary entrance is recessed into the building behind the wall and is set in the west elevation, which is clad in T1-11 plywood siding. The secondary entrance features the original glazed single door with an undivided sidelight and an undivided transom. There are no windows in the west elevation. Below the southwest corner of the roof is a four-column steel post sheathed with wood spacers.

The south elevation is delineated into 16 bays similar to the north elevation. From the west, the first bay is open and features the recessed secondary entrance. The second through ninth bays contain vertically oriented one-by-one aluminum sash sliding windows corresponding to the offices. The information corridor is connected at the tenth and eleventh bays. East of the information corridor, the twelfth through fifteenth bays also contain vertically oriented one-by-one aluminum sash sliding windows corresponding to offices and the conference room. The sixteenth bay was originally open with a four-post column at the southeast corner of the roof. The bay was enclosed at an unknown date and an interior storage room, visible in the 1968 as-constructed drawings, was expanded. Evidence of the original exterior wall of the storage room remains on the floor of the current closet (see Figure 21 and Figure 22).

There are no windows or doors in the east elevation, but there are utility connections.

Covered Walk

The covered walk extends south from the south elevation of the lobby. It is a flat roof open-air corridor supported by regularly spaced four-post columns. The columns are steel clad in Douglas fir posts and spacers that are bolted on concrete piers. Wide exposed beams span the length of the walk and are supported within the columns. The eaves overhang the columns and are boxed with wood board fascia and the tongue and groove wood ceiling below. The flat roof is covered with rolled asphalt. Two low wood benches are integrated between three columns in the west side of the walk. As originally built, the covered walk ceiling also featured a centered line of five lights with glazed cylindrical globes. These were replaced at some point with five noncompatible square light fixtures.

Originally, immediately south of the lobby entrance, a succession of columns set on a ground-level wood rail created an open-air exterior foyer and a connection to the covered walk. This area has since been enclosed with glass and a second pair of glazed steel doors.

Comfort Station

The comfort station is rectangular in plan and measures 24’4” × 22’8”, including the addition to the east elevation constructed in 1999. It is connected to the lobby by the covered walk that is attached to and spans the full width of the west elevation. The foundation of the comfort station is a concrete slab at grade. The exterior cladding is uncoursed native stone veneer on the west and east elevations and T1-11 plywood siding on the north and south elevations and in the gable ends. The eaves of the original flat roof overhang the exterior walls and are clad boxed with T1-11 plywood siding fascia and plywood soffit. The front-gabled roof was constructed on top of the original flat roof in 2008; it is covered with standing seam metal.

The west elevation is accentuated by the four-post columns of the covered walk at each end. There are no windows or doors in the west elevation; a drinking fountain is offset to the south end. Informational signage is attached to west elevation.

In the south elevation, the entrances to the men's restroom and storage addition are recessed below the roof and offset to the east end of the building. The entrance to the restroom was shifted east of the original portion of the comfort station and enters into the 1999 expansion of the restroom. The doors are flush metal doors with vents and metal kick plates at the bottom. An undivided fixed sash transom is above the restroom door. The entrances are separated by partition wall that extends approximately 5′ beyond the south elevation and is covered with uncoursed native stone veneer.

The east elevation is that of the utility addition constructed in 1999; there are no windows or doors. The addition removed a rear door to the original storage room and two flanking sets of square sliding clerestory windows that provided light into the restrooms.

In the north elevation, the entrances to the women's restroom and storage addition are recessed below the roof and offset to the east end of the building. The entrance to the restroom was shifted east of the original portion of the comfort station and enters into the 1999 expansion of the restroom. The doors are flush metal doors with vents and metal kick plates at the bottom. An undivided fixed sash transom is above the restroom door. The entrances are separated by the original east elevation of the comfort station, which extends approximately 5′ 2″ beyond the north elevation and is covered with uncoursed native stone veneer.

Character-Defining Features

The KVC possesses all character-defining features of visitor centers designed in the Park Service Modern style identified by Carr et al. (2015) in the multiple property listing "National Park Service Mission 66 Era Resources," including the following:

- Situated for optimal regional "visitor flow" at the west entrance of the park just off Trail Ridge Road
- The separation of administrative and public areas, exemplified by the original design in which the administrative wing is separated from the central public lobby and later theater addition
- The centralization of park services such as information, interpretation, restrooms, and offices, all of which are located at the KVC for the west entrance
- Use of the formal vocabulary and materials of Park Service Modern style, including flat roofs window walls, unorthodox fenestration, and exposed structural support systems
- Single level, overlapping functional space
- Integration of interior and exterior public spaces through the use of window walls and windows
- Wide doorways sheltered by an original entry porch and the covered walkway, with nearby restrooms accessed through separate outdoor entrances
- Emphasis on spatial procession through a series of landscape views through window walls
- Siting of the visitor center in a characteristic park landscape
- Low-profile, horizontal building elevations
- Harmonization with the natural setting through horizontal massing, use of wood and stone, and neutral color palette
- L-shaped plan creating several patio and courtyard areas that are incorporated into the visitor complex
- Naturalistic plantings and landscape features

More specifically, character-defining architectural features of the KVC consist of the following:

- Vertical steel and wood clad columns at the corners of the office wing, lobby, and covered walk that mimic the surrounding lodgepole pine forest
- Inverted corners of the lobby clad in native stone

- Glass curtain walls and visual transparency through the lobby and information corridor that integrate the interior space and the exterior landscape
- Use of wood and natural stone that relate to the natural environment and T1-11 plywood siding that is characteristic of the period
- Broad, windowless stone wall at west end of the office wing that is characteristic of Park Service Modern style architecture
- Flat roofs and open web joist system roofs that contrast the verticality of the columns and emphasize the sense of shelter
- Although no longer intact, much of the exterior wood surfaces of all component buildings and corridors and the interior of the lobby were finished with translucent stain that conveyed the natural appearance of the wood. These have since been painted.
- The "pod" or wing layout of individual component buildings for designated uses (i.e., administration in the office wing, visitor orientation in the lobby, and services in the comfort station) that are connected with visually transparent corridors
- Integrated interior and exterior spaces with the covered walk, terrace and patio, bench seating, and meandering rock-lined stream
- Mission 66 era wood post and beam light poles with globe lights in the parking lot
- Low benches from the Mission 66 era that are integrated in the covered walk and are freestanding along the east side of the parking lot and sidewalk

22. Architectural style/building type: **Modern Movement/Park Service Modern**

23. Landscaping or special setting features:

As drawn on Robert D. Newcomb's 1967 plans, the original landscape plan specified a relatively clear area around the visitor center, to be surrounded by thick stands of lodgepole pine on the ridge to the north and east and in the area between the parking lot and Trail Ridge Road. Small stands of trees were to be grouped west of the lobby, east of the information corridor, and east and south of the comfort station, separated by open areas of natural grasses and other low vegetation. Programmed but naturalistic public space was concentrated east of the lobby and covered walkway, and contained a concrete and stone terrace, bench seating, an open lawn at the bottom of a graded amphitheater, and a rock-lined stream fed by the Harbison Ditch. The stream meandered through the landscaping behind the comfort station, into a pool behind the lobby, beneath the covered walkway, and into the landscaping west (in front) of the lobby (see Figure 2). The diverted water flow ultimately rejoined the Harbison Ditch west of the visitor center.

Extant original landscaping features consist of the rock-lined stream channel that remains behind the comfort station, below the covered walkway, and in the landscaping in front of the lobby. The amphitheater and terrace, in addition to portions of the stream channel and pool, were removed for the construction of the 1989 auditorium addition.

Increased vegetation has compounded the loss of constructed features in altering the historic designed landscape, particularly overgrowth of native lodgepole pine, aspen, and nonnative spruce trees. Photographs from directly after the construction of the KVC show that the west side of the visitor center was largely free of trees, whereas the east side of the visitor center was somewhat more vegetated, with several retained mature lodgepole pines and a directed stream (Figure 6 and Figure 7). A treeless buffer was also maintained directly east of the visitor center lobby (Figure 8). However, original trees have matured and new trees have encroached over the years. For example, a comparison of Figure 9 and Figure 17, which were taken from a similar vantage point, demonstrates heavy tree growth directly in front of the lobby over time. In recent years, some trees have been thinned as part of forestry and fire management plans implemented in the early 1990s and into the 2000s. However, trees continue to obscure the intended views to and from the lobby and the information corridor.

24. Associated buildings, features, or objects:

The visitor center was constructed with low wood benches integrated between the columns of the covered walk. There are additional benches in an L-shaped arrangement at the entrance to the covered walk and where the Harbison Ditch has been concrete lined and manipulated into a cascading water feature. This is also the location of a flagpole. Three wood light poles with globe lights line the east edge of the parking lot; these are also original to the construction of the KVC.

Two single picnic areas with modern concrete picnic tables have been added into the associated landscape of the visitor center. One is in the wooded area between the parking lot and Trail Ridge Road, and the other is east of the parking lot. A trailhead has also been constructed at the southeast corner of the parking lot for a short spur trail to the KVC segment of the Livery Trail (Tonahutu Spur Trail).

IV. Architectural History

25. Date of Construction: Actual: **1968–1969, 1989 (auditorium addition), 1999 (restroom addition)**

Source of information:

National Park Service (NPS)

1968. As-Constructed Drawings. West Side Administrative Building, Grand Lake Entrance, Rocky Mountain National Park. Prepared by the San Francisco Planning and Service Center, National Park Service, U.S. Department of the Interior. Project No. RM-S 251 (Drawing No. NP-RM 3643-B).

1989. Kawuneeche Visitor Center Addition, West Entrance, Rocky Mountain National Park. National Park Service, U.S. Department of the Interior (Drawing No. 121-80091).

1999. Comfort Station Improvements, Kawuneeche Visitor Center, Colorado River District, Grand Lake, Colorado. Prepared by the Rocky Mountain Regional Office, National Park Service, U.S. Department of the Interior (Drawing No. 121-60419).

2022. Images and plans from the National Park Service Electronic Technical Information Center. Available at: https://pubs.nps.gov. Accessed May 9, 2022.

26. Architect: **Robert D. Newcomb**

Source of information:

National Park Service. 1968. As-Constructed Drawings. West Side Administrative Building, Grand Lake Entrance, Rocky Mountain National Park. Prepared by the San Francisco Planning and Service Center, National Park Service, U.S. Department of the Interior. Project No. RM-S 251 (Drawing No. NP-RM 3643-B).

27. Builder/Contractor: **John W. Strahan Construction Company**

Source of information:

National Park Service. Narrative Statement for the West Side Administrative Building on file at Rocky Mountain National Park under ACC ROMO-01192, CAT ROMO 20916 "Folder 242 Series 2.3: D-3415 - Administration Building - West Side - 1964-1972."

Estes Park Trail. 1968. New RMNP headquarters building for west slope. *Estes Park Trail* 8 November 1968:13. Estes Park, Colorado. Available at: Coloradohistoricnewspapers.org.

28. Original owner: **National Park Service**

Source of information:

National Park Service. 1968. As-Constructed Drawings. West Side Administrative Building, Grand Lake Entrance, Rocky Mountain National Park. Prepared by the San Francisco Planning and Service Center, National Park Service, U.S. Department of the Interior. Project No. RM-S 251 (Drawing No. NP-RM 3643-B).

29. Construction history (include description and dates of major additions, alterations, or demolitions):

- By 1958, the parking lot for the visitor center was graded and completed (see Figure 1).
- The KVC was constructed between July 1968 and February 1969 by the John W. Strahan Construction Company and according to the designs of Robert D. Newcomb, an architect in the San Francisco Planning and Service Center of the National Park Service (NPS).
- In 1989, the 2,800-square-foot auditorium addition was constructed along the east (rear) elevation of the lobby. The lobby originally featured window walls in all elevations to integrate the interior and exterior spaces; visitors were able to view the surrounding landscape through the window walls. The addition removed the east window wall of the lobby. Construction of the addition also removed the exterior terrace and seats originally constructed and designed east of the lobby.
- In 1999, a storage addition was constructed along the east (rear) elevation of the comfort station.
- Ca. 1999, the roof of the office wing and lobby were altered with a 1″ × 12″ board attached at the crest of the original fascia, altering the profile of the roof.
- The east (rear) entrance in the south elevation of the office wing was removed and enclosed at an unknown date.
- In the early 2000s, the lodgepole pine surrounding the visitor center were removed as part of continued work under the 1992 Rocky Mountain Fire Management Plan and Environmental Assessment aimed at reducing the risk of fire by systematic forest thinning around major park developments.
- Ca. 2006, the employee parking lot north of the office wing was expanded to the north.
- Ca. 2007, the trailhead for the South Tonahutu Trail was constructed.
- In 2008, a gable roof was constructed over the flat roof of the comfort station and extended over the entrances into the restrooms.
- In 2008, mitigation for a pine beetle outbreak removed dead trees to reduce the risk of “tree failure” or hazards from falling or wind-thrown trees.
- Ca. 2014, vegetation was cleared alongside the two-track access road to the CRD water tank for the replacement and realignment of the CRD water distribution system. The road was further graded and laid with gravel.
- Ca. 2016, the gravel pad and picnic tables were placed east of the parking lot.
- In 2020, office wing and lobby roofs were replaced and the fascia was replaced with uniform T1-11 plywood siding retaining the heighted parapet profile of the roof from 1999.
- Since constructed, the landscaping around the visitor center has overgrown the building that was intended to be a visual centerpiece, particularly west of the office wing and the lobby.

30. Original location __X__ Moved ____ Date of move(s):

V. Historical Associations

31. Original use(s): **Government; Recreation and Culture**

32. Intermediate use(s): **Government; Recreation and Culture**

33. Current use(s): **Government; Recreation and Culture**

34. Site type(s): **Visitor center/Administration offices**

35. Historical background:

The extant Grand Lake Entrance area (GLE III), consisting of the KVC, Grand Lake Entrance station, employee residential area, and maintenance/utility area, is the third iteration of an entrance area to the west side of

Rocky Mountain National Park (the park). The first entrance area (GLE I) was located farther south near the intersection of the old Trail Ridge Road alignment with County Road (CR) 49. The second entrance area (GLE II), constructed in 1937, was at the intersection of Trail Ridge Road and Grand Lake Lodge Road. In the 1940s and early 1950s, the park explored several options for expanding GLE II in its location near Grand Lake Lodge Road. Coinciding with the launch of the Mission 66 program, concepts to improve GLE II were abandoned. Since the 1950s, iterations of drawings for GLE III have conceptualized expanded housing areas and visitor services that were not fully executed or were not executed as planned. As it stands, GLE III represents the initial spatial layout of the Mission 66 plan with designated areas for visitor services, maintenance and utilities, and employee housing. However, the majority of the buildings were constructed or placed in the GLE III area between the 1980s and 2010s without comprehensive planning in an ad hoc manner as needs arose or funding became available.

The Mission 66 program was a congressionally funded, NPS-wide initiative that launched in 1956 and was intended to update national parks by the fiftieth anniversary of the NPS in 1966. In 1957, the Preliminary Master Plan for Rocky Mountain National Park called for constructing an entirely new Grand Lake Entrance (GLE III) at the intersection of CR 491 and Trail Ridge Road. The Mission 66 edition of the master plan for the park cited concern over limited space at GLE II as the primary reason for relocating GLE III (Adams 1968:2). In 1958, roads were graded and constructed to the sub-base for the GLE III residential and maintenance areas as was the extant parking lot for the visitor center east of Trail Ridge Road. The overall site plan of GLE III continued to evolve between 1957 and 1964. The final plans drafted during the Mission 66 program, the 1964 site developments plan for the Western District (now CRD) Headquarters, were never fully constructed as conceptualized. Only two single-family residences (Q-0461-N [5GA.1286] and Q-0462-N [5GA.1287]) were constructed in 1964 of the 10 single-family and four multifamily residences that were conceptualized. The utility building (B-0473-N [5GA.1288]) was completed in 1965. The visitor center was constructed in 1968.

Since the 1970s and into the 2010s, the GLE III area has continued to evolve through numerous demolition, relocation, new construction, utility, and forestry management projects aimed at improving employee housing, park operations, and the visitor experience. During the 1970s, little new construction occurred in the GLE III area. This decade was instead marked by the expansion of the park's boundaries, and by the end of the 1970s, the NPS had acquired nearly all of the private land within the Kawuneeche Valley, including Never Summer Ranch, the Phantom Valley Ranch property at the upper end of the valley, Onahu Ranch, and Green Mountain Ranch. Following these acquisitions, the park administration selectively dismantled and moved existing buildings on the ranch properties and repurposed them for employee housing and storage. In the GLE III area, these consisted of Q-0874-N (5GA.1289) and Q-0875-N (5GA.1293) from Green Mountain Ranch and Q-0876-N (5GA.1294) from Phantom Valley Ranch that were moved to their current locations at the west end of the residential area ca. 1980.

Between 1980 and 2000, new construction in the GLE III area predominantly occurred in the residential area, to address insufficient employee housing, and at the visitor center, to accommodate increased visitor services. Between the 1970s and the early 1980s, the park placed 15 mobile trailer residences in the residential area on the north and south sides of Grand Lake Entrance Road as a temporary solution to in-park housing. The mobile trailer residences were removed and replaced intermittently in the late 1980s and 1990s as permanent residences were constructed. The first of these permanent residences were two modular double-wide residences (Q-0878-N and Q-0888-N) placed in the residential area in 1986 and 1988, respectively. In 1987, Congress requested that the NPS analyze its housing needs in response to concern about the condition of existing housing. The analysis revealed an estimated $267 million backlog in housing needs. The estimate was re-analyzed in 1991, at which time the NPS found that the backlog had more than doubled. The NPS began repairing, rehabilitating, and replacing housing units in 1989 under the Employee Housing Initiative. To service existing housing and to accommodate proposed new housing in the GLE III area, the park installed natural gas lines and replaced the overhead power lines with underground telephone and electrical utilities in the residential area in the mid-1990s. Subsequently, the park constructed two single-family and four multifamily residences between 1994 and 1998. Q-0463-N, a single-family residence, was constructed ca. 1994. Q-0464-N and Q-0465-N were constructed in 1997. And Q-0466-N, Q-0467-N, and Q-0468-N were constructed in 1998. The park later embarked on several cyclical roof and painting projects to

unify the appearance of residences placed and constructed in the residential area prior to 1990 with those constructed between 1994 and 1998 with green standing seam metal roofs, exterior siding and wall trim painted NPS brown, and window and door casings painted Copley Gray.

During this same period, the KVC (B-0392-N) was also expanded to accommodate increased visitation and improved visitor services. In 1989, the 2,800-square-foot auditorium addition was constructed along the east (rear) elevation of the lobby. The auditorium addition expanded the interior space for interpretive displays, removed the east curtain wall, and eliminated views and use of the outdoor space east of the lobby. Based on Robert D. Newcomb's 1967 plans, the 1968 as-constructed drawings, and historic photographs, this outdoor area contained a terrace, seating, an open lawn at the bottom of the graded amphitheater, and a rock-lined pool. These features were removed or infilled by the auditorium. In 1999, the comfort station was likewise expanded with an addition to its east (rear) elevation. Underground utility work was also implemented at the visitor center to connect with underground lines as far north as Timber Creek Campground. The overhead telephone and electric utilities were replaced by underground utilities at the KVC circa 1997.

Between 2000 and 2014, the park replaced, relocated, or constructed several support buildings in the GLE III area. In 2003, the B-1170-N CRD Roads Shed was moved to the maintenance area from the Youth Conservation Camp. It was originally constructed in 1979 and was recorded in 1985 as B-852 YCC Pump Shed (5GA.1332). Subsequently, between 2006 and 2011, eight other buildings were removed from the GLE III maintenance area for the construction of the extant B-1138-N CRD Maintenance Storage Facility: B-0187-N (Fire Truck Shed; 5GA.1277), B-0889-N, B-0835-N (sign storage or "Banana Shed"), B-0865-N (equipment shed), B-0991-N (shed), B-0912-N (privy/shed), B-0913 (privy/shed), and B-0918-N (hay barn). In 2007, B-1138-N was constructed in the maintenance area on the footprint of B-865-N. Finally, B-1190-N CRD Sand Storage was constructed in 2012.

In 2010, the park reconstructed the entrance station to the west side of the park to accommodate an increasingly high volume of traffic and larger, modern vehicles. The previous entrance kiosks and a small ranger station, constructed during the Mission 66 program, were demolished. The new entrance station was constructed approximately 90' north of the previous entrance station and consisted of two identical kiosks—B-1142-N CRD GLE Kiosk West (B-1142) and B-1143-N CRD GLE Kiosk East (B-1143)—as well as B-1141-N CRD GLE Remit Office (B-1141). The project also reconstructed the approach to the entrance station with additional inbound lanes and a pullout and connected the buildings into new water, sewer, and electrical utilities. B-1141 was later destroyed in the East Troublesome Fire of 2020.

Between 2012 and 2014, the park initiated a project to replace and realign the CRD water distribution system. The project replaced the high-density polyethylene (HDPE) pipe that distributes water from the buried concrete water tank in the hillside northeast of B-0392-N KVC to the buildings and hydrants in the Grand Lake Entrance area. To avoid disrupting visitor services, the water distribution system was realigned along the existing two-track road to the water tank north and east of the visitor center. The realignment required the clearing of vegetation and boulders to excavate the trench for the pipe; these alterations to the landscape remain visible north of the visitor center and in the residential area. The project included construction of B-1182-N CRD Filtration Plant (B-1182-N) at the west end of the residential area; B-1182-N was completed in 2014. The building also functions as a laundry facility for park employees.

36. Sources of information:

Adams, John S. 1968. Developed Area Narrative to Accompany Drawing No. NP-RM-3415-E Grand Lake Entrance. Master Plan for Rocky Mountain National Park, Mission 66 Edition. U.S. Department of the Interior, National Park Service, Denver, Colorado.

Anderson Hallas Architects. 2018. *Kawuneeche Visitor Center Comprehensive Condition Assessment, Rocky Mountain National Park*. Task Order #P17D02322. Anderson Hallas Architects, Golden, Colorado. January 10. On file at Rocky Mountain National Park, Estes Park, Colorado.

Bzdek, Maran, and Janet Ore. 2010. *The Mission 66 Program at Rocky Mountain National Park: 1947-1973*. Colorado State University, Public Lands Research Center, Fort Collins, Colorado.

Carr, Ethan, Elaine Jackson-Retondo, and Len Warner. 2015. *Multiple Property Listing National Park Service Mission 66 Era Resources*. U.S. Department of the Interior, National Park Service, Washington, D.C. Available at: https://npgallery.nps.gov/nrhp. Accessed December 13, 2021.

Daniels, Megan, and Trevor Mark. 2022. *Intensive Level Architectural Survey of the Grand Lake Entrance in Rocky Mountain National Park, Grand County, Colorado*. Prepared by SWCA Environmental Consultants for the U.S. Department of the Interior, National Park Service, Rocky Mountain National Park. On file at Rocky Mountain National Park, Estes Park, Colorado.

VI. SIGNIFICANCE

37. Local landmark designation: Yes ____ No __X__ Date of designation: ____

    Designating authority:

38. Applicable National Register Criteria:

    __X__ A. Associated with events that have made a significant contribution to the broad pattern of our history;

    ____ B. Associated with the lives of persons significant in our past;

    __X__ C. Embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or that possess high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; or

    ____ D. Has yielded, or may be likely to yield, information important in history or prehistory.

    ____ Qualifies under Criteria Considerations A through G (see Manual)

    ____ Does not meet any of the above National Register criteria

39. Area(s) of significance: **Entertainment/Recreation; Architecture**

40. Period of significance: **1968–1969**

41. Level of significance: National ____ State ____ Local __X__

42. Statement of significance:

The period of significance for the KVC is 1968–1969, during which time the visitor center and its contributing features were constructed under the Mission 66 program. Site preparation had begun by 1958, when the visitor parking lot was constructed to the sub-base and site grading began for a visitor center. The visitor center itself was constructed between July 1968 and February 1969 according to the designs of Robert D. Newcomb, an architect then employed by the NPS Western Office of Design and Construction in San Francisco.

In the *Multiple Property Listing National Park Service Mission 66 Era Resources* (MPDF) prepared by Carr et al. (2015), the registration requirements or guidelines for determining National Register eligibility refer to the guidelines established in Sarah Allaback's *Mission 66 Visitor Centers: The History of a Building Type* 2000). Allaback states,

> Criterion A would apply because the property is associated with events (the Mission 66 program as part of the development of the National Park System) that made a significant contribution to the broad patterns of our history. Criterion C would apply because the property embodies the distinctive characteristics of a type, period, or method of construction; represents the work of a master; or possesses high artistic values. Eligibility under Criterion A relates to significance in one or several of the following areas: Community Planning and Development (park), Conservation, Ethnic Heritage, Entertainment/Recreation, Politics/Government, and Social History. Eligibility under Criterion C relates to significance in one or several of the following areas: Architecture, Landscape Architecture, and Community Planning and Development (park). (Carr et. al 2015:F-65)

The KVC is locally significant under Criterion A in the area of Community Planning and Development for its association with the Mission 66 program in the Park and the redevelopment of staff and visitor facilities in a centralized location near the park entrance.

The Mission 66 program was a congressionally funded, NPS-wide initiative that launched in 1956 and was intended to update national parks by the fiftieth anniversary of the NPS in 1966. The plan was conceived by Conrad Wirth, landscape architect and director of the NPS from 1951 to 1964. In *The Mission 66 Program at Rocky Mountain National Park: 1947–1973,* Bzdek and Ore cite the Mission 66 era (1950–1973) as one of the two most significant periods of development activity in the park and one that "transformed Rocky Mountain National Park for visitors and staff alike" (Bzdek and Ore 2010:2).

Following World War II, increased automobile ownership, affluence, and greater leisure time in the economic recovery period fueled increased visitation in the national parks. At the park, visitation more than doubled between 1945 and 1946, and in 1948, visitation first topped 1 million. Redevelopment plans conceptualized under the Mission 66 program anticipated continued rises in annual visitors and increased day use visitation via personal automobiles. For this reason, the plans conceptualized under the Mission 66 program developed visitor accommodations at centralized locations that would, per Wirth's vision, restore the natural environment and landscape previously disturbed by scattered concessioner-operated lodges and cabins (Bzdek and Ore 2010:3).

During the Mission 66 program, visitor center design evolved from small museum-exhibit buildings into multi-functional facilities with interpretive exhibits, rest areas, and visitor orientation services as well as administrative offices for Park staff. A memorandum sent on April 6, 1964, from the superintendent of the park to the regional director of the Midwest Region justifies the park's decision to combine a visitor center and the administration building on the west side of the park as it would reduce the number of major developments in the park; an auditorium in this location would be able to serve Grand Lake Village and Grand Lake Lodge; and it would provide orientation for visitors prior to entering the park.

A separate memorandum sent on February 18, 1966, from the acting regional director to the superintendent of the park regarding the interpretive planning of the "West Side Administration Building-Visitor Center" confirms the park's desire for a multi-phase, multifunctional facility:

> The lobby of this building will provide an information counter and orientation exhibits including a relief map of the Park region. The building will serve as the administration center for the operation of the West Side and Shadow Mountain Recreation Area with pertinent staff offices, work rooms, and storage facilities. Eventually, an exhibit room and an auditorium to seat 300 should be added. Consequently, the building should be ingeniously designed so that it can be expanded to include those two interpretive facilities. Public restrooms will be required.

As it was designed and constructed, the KVC embodies the evolution of visitor centers under the Mission 66 program and the specific intentions of the park to have a multifunctional visitor center to orient visitors entering the west side of the park. The first phase of construction consisted of the lobby, offices, and comfort station constructed in 1968–1969 with designated space for a future exhibit room and auditorium.

Resource Number: 5GA.1285
Temporary Resource Number: B-0392-N

The KVC is locally significant under Criterion C in the area of Architecture and meets the guidelines for National Register eligibility under this criterion as presented in Carr et al. (2015) for the following reasons:

- The KVC is a centralized facility serving multiple visitor and administrative functions.
- Programming elements of the KVC include interpretive displays, space for audiovisual presentations, visitor contact, and restrooms.
- The KVC is intended to serve the public by interpreting scenery, natural resources, and cultural sites.
- The KVC is a major point of visitor arrival, orientation and services.

The KVC also exhibits all the distinctive characteristics of Park Service Modern style for visitor centers designed by the NPS under the Mission 66 program. Key among these characteristics are its prominent siting in relation to visitor flow through the park; segregation of public and administrative areas linked by a central lobby; use of flat roofs, window walls, and exposed structural support systems; and harmonization with the natural setting through massing, materials, color, and the use of naturalistic plantings. As Allaback notes in *Mission 66 Visitor Centers*, NPS architects were responsible for the design of most new visitor centers under the Mission 66 program. She also notes that at Rocky Mountain National Park, the three Mission 66 visitor centers together "represent the culmination of a decade of planning and designing modern visitor facilities" (Allaback 2000:181).

Robert D. Newcomb worked as an architect in the NPS Western Office of Design and Construction in San Francisco (also known as the San Francisco Planning and Service Center) from at least 1963 to 1972, when the office closed. At that time, he transferred to the NPS Denver Service Center as chief architect. Newcomb designed at least eight facilities for the NPS under the Mission 66 program that showcase the influence of modernism in NPS architecture during that period: the KVC; the Jewel Cave Visitor Center at Jewel Cave National Monument, South Dakota; the Coronado National Memorial Visitor Center, Arizona; and, at Lake Mead National Recreation Area, Nevada, the Temple Bar Visitor Center, the non-extant Willow Beach Ranger Station, and three Boulder Beach housing units. In each of these buildings, Newcomb manipulated modernist architectural ideals to mimic the surrounding natural environment, such as the verticality of lodgepole pine at the KVC or the cavernous environment at the Jewel Cave Visitor Center.

43. Assessment of historic physical integrity related to significance:

According to the guidelines for determining eligibility in the MPDF (Carr et al. 2015), the KVC must possess the following characteristics to be eligible for the National Register:

- The visitor center should be within the period of significance for the Mission 66 era (1945–1972)
- The visitor center should retain *most or all of* the physical characteristics listed in the property type description under the MPDF.
- The visitor center should possess physical integrity to the period of significance. Under this requirement, the MPDF notes that "major exterior alterations that transforms the outward appearance of the building" may impair the historical integrity of the visitor center.

The KVC retains integrity of location, materials, workmanship, and association; however, the aspects of design, setting, and feeling have been reduced, predominantly by the auditorium addition, in addition to alterations to the original roof design.

The integrity of design as originally conceived and constructed has been reduced as the massing and profile of the roofs have been changed. In 1999, the roof of the lobby and office wing were altered with a 1" × 12" board extension to the fascia, altering the profile of the roof and the proportionality of the buildings. In 2008, a front-gabled roof was constructed on top of the flat roof of the comfort station, which destroyed the character-defining flat roof profile of the building and destroyed the uniformity between the three component buildings. The lobby and the office wing do retain flat roofs, albeit of different proportions, and the characteristic T1-11 plywood siding on the eaves. These alterations are also reversible.

Integrity of design and setting have been reduced as the east curtain wall has been removed, the transparency of the lobby and information corridor has been diminished, and the integration of interior and exterior spaces has changed due to the auditorium addition. The materials and concept are compatible with the original design of the visitor center. However, the placement and connection to the lobby has removed character-defining features of the lobby, the landscape, and "pod" design of the original building. As conceptualized and constructed, the visitor center integrated interior and exterior spaces by providing views through the transparent lobby, information corridor, and covered walk to the landscape in nearly all directions. The auditorium addition removed the east curtain wall and obstructed views through the building. The 2,800-square-foot auditorium addition is almost four times larger than the 784-square-foot lobby and significantly alters the massing and spatial relationship of the lobby, office, wing, and comfort station. Based on Newcomb's 1967 preliminary drawings and 1968 as-constructed drawings, the landscape east of the lobby was a continued experiential space with a terrace, seating, and a rock-lined pool. The future auditorium conceptualized by Newcomb was intended to be a fourth component building connected to the lobby via a transparent corridor similar to the information corridor or the covered walk. While the addition provides an auditorium and exhibit space as the park administration and the design intended, it has resulted in an irreversible loss of character-defining features.

The floor plan no longer also emphasizes efficient "visitor flow" through the building as a result of the auditorium addition, exhibits, and merchandise displays. Inside the visitor center, the open interior plan of the lobby has been infilled with interpretive exhibits and near ceiling height display cases in the extended lobby exhibit area that connects to the auditorium. The integrated space and connection between the lobby and the information corridor has been disrupted and infilled with merchandise shelving. The original information desk has been removed and replaced in front of the west window wall with a larger cashier and information desk. The original vinyl asbestos floor has been replaced or covered with carpet. The original glazed wood doors have been replaced with glazed steel doors. These changes, however, are reversible. Further, the interior retains the original ceiling that was replicated in the extended lobby exhibit area.

Integrity of setting and the characteristic naturalistic planting has also been diminished by the overgrowth of trees in front (west) of the lobby, which was intended to be visually prominent and transparent, and utility projects that have removed trees north and east of the visitor center. These changes are, however, reversible.

As a result of these changes, the KVC no longer retains the following character-defining features of a Park Service Modern visitor center constructed under the Mission 66 program:

- The floor plan and spatial organization of services does not emphasize efficient visitor flow through the building. Temporary information tables set up daily by NPS staff have become the arrival point for information and orientation. The visitor then proceeds to the lobby for merchandise, exhibits, and interpretation.
- Integration of interior and exterior public spaces, often separated by windows, window walls, glass doors, or wooden doors with windows has impacted use and flow between those spaces. As a result of the auditorium addition and the extended exhibit area of the lobby, much of the exterior public spaces have been removed or closed off.
- The building does no longer emphasizes the visitor experience as a spatial procession through a sequence of spaces featuring ramps and significant views of Park landscapes either from terraces or through large windows.

Despite these changes, the KVC retains most of its character-defining features of a Park Service Modern visitor center constructed under the Mission 66 program:

- The building is sited in relation to an overall plan of visitor flow in the park near the park entrance
- The floor plan continues to separate public areas from administrative areas.
- The building's program centralizes numerous park services, including information, interpretation, restrooms and administrative offices.

- The building does still exhibit forms and materials of modern architecture, including flat roofs, window walls or curtain walls, and exposed structural support systems.
- The entrance is sheltered by the covered walk and the restrooms (comfort station) are nearby with separate outdoor entrances.
- The building's elevations create a mostly low-profile, horizontal effect.
- The building harmonizes with its setting through horizontality of the massing, color, and texture of materials. The visitor center features textured plywood, Douglas fir, and native stone veneers on its facades.
- The building footprint does incorporate a central courtyard although it is largely underutilized.

For this reason, the KVC retains integrity sufficient to convey its significance under Criteria A and C. The KVC was determined eligible for the National Register in 2017.[1] under Criteria A and C and remains eligible under the same criteria.

VII. National Register Eligibility Assessment

44. National Register eligibility field assessment:

    Eligible __X__ Not Eligible ____ Need Data ___

45. Is there National Register district potential? Yes ___ No X

    Discuss:

The GLE III area was evaluated for the National Register of Historic Places (NRHP) as a potential historic district under Criterion A in the area of Community Development and Planning and under Criterion C in the area of Architecture for its association with the Mission 66 program in the park. The area was designed in this location with distinct areas for the public (the visitor center and entrance station) and support services and park staff (maintenance/utility and residential areas). Initial construction began in 1958 with the alignment and grading of roads and the visitor center parking lot and continued through 1968, when the visitor center was completed. For this reason, the period of significance for the Grand Lake Entrance as a historic district is 1958–1968.

However, the Grand Lake Entrance area was never completed as conceptualized under the Mission 66 program. Since the 1950s, iterations of drawings for GLE III have conceptualized expanded housing areas and visitor services that were not fully executed or were not executed as planned. As it stands, GLE III represents the initial spatial layout of the Mission 66 plan with designated areas for visitor services, maintenance and utilities, and employee housing. However, the majority of the buildings were constructed or placed in the GLE III area between the 1980s and 2010s without comprehensive planning in an ad hoc manner as needs arose or funding became available.

Of the 22 extant buildings in the Grand Lake Entrance area, only four (the KVC, the CRD Utility Building, and the two Mission 66 ranch residences) were constructed within the period of significance and would contribute to a potential historic district. Within the past 50 years, the GLE III area has been continually altered by demolition, relocation, new construction, and utility installation projects. Research did not indicate that these projects were part of a comprehensive plan or conceptual design. Three buildings were moved to the Grand Lake Entrance in the early 1980s, have lost integrity, and do not meet requirements to be significant under Criteria Consideration B for Moved Properties. These would be considered noncontributing to a potential historic district. Fifteen buildings were constructed after 1985. These were constructed outside the period of significance for the Grand Lake Entrance; they do not meet requirements to be significant within the 50-year threshold under Criteria Consideration G. These would also be considered noncontributing to a historic district. Only four buildings (18 percent) contribute to the Grand Lake Entrance area's significance as a development of the Mission 66 program, whereas most buildings (82 percent) are modern intrusions into the Grand Lake Entrance area that do not contribute to its significance.

[1] During this evaluation, the Kawuneeche Visitor Center was assigned a duplicate Smithsonian Trinomial number: 5GA4538.

As a result, the contributing buildings do not represent a significant concentration of interrelated buildings and because they are spatially and visually separated, they are not able to convey their relationship and significance as a distinctive entity constructed under the Mission 66 program. For these reasons, the Grand Lake Entrance area is not eligible for the NRHP as a historic district.

If there is National Register district potential, is this building: Contributing ___ Noncontributing ____

46. If the building is in existing National Register district, is it: Contributing ___ Noncontributing ____

VIII. Recording Information

47. Photograph numbers:

    Negatives filed at: **Rocky Mountain National Park Museum Facility**

48. Report title: ***Intensive Level Architectural Survey of the Grand Lake Entrance Area in Rocky Mountain National Park, Grand County, Colorado***

49. Date(s): **September 2021**

50. Recorder(s): **Megan Daniels and Trevor Mark (SWCA). Edited by Dan Jackson (NPS).**

    Park Contact is Cheri Yost, Park Planner, 970-586-1320

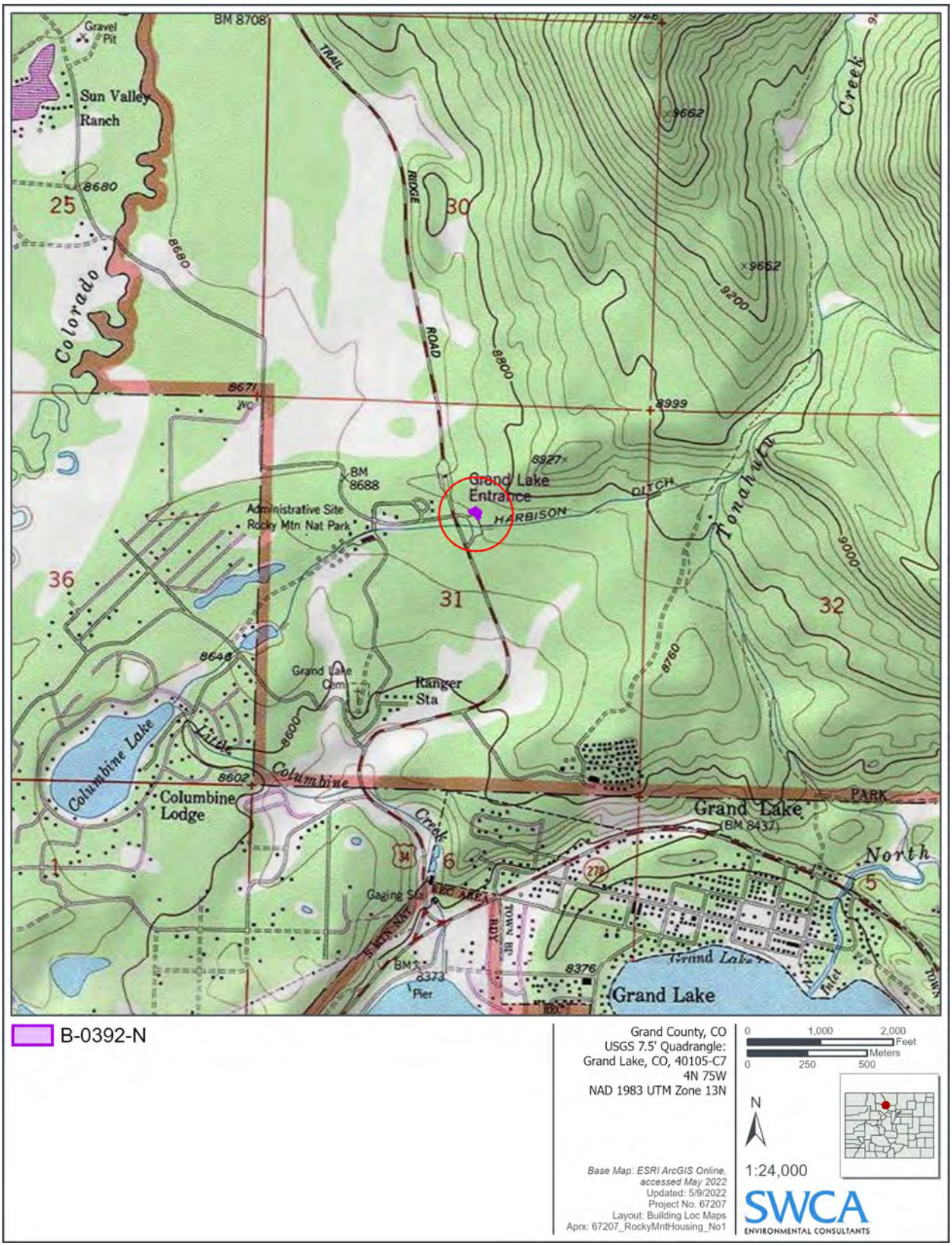
51. Organization: **SWCA Environmental Consultants**

52. Address: **257 East 200 South, Suite 200, Salt Lake City, Utah 84111**

53. Phone number(s): **801-322-4307**

NOTE: Please include a sketch map, a photocopy of the USGS quad map indicating resource location, and photographs.

Resource Number: 5GA.1285
Temporary Resource Number: B-0392-N



Location map.

Resource Number: 5GA.1285
Temporary Resource Number: B-0392-N

Sketch map.

Resource Number: 5GA.1285
Temporary Resource Number: B-0392-N

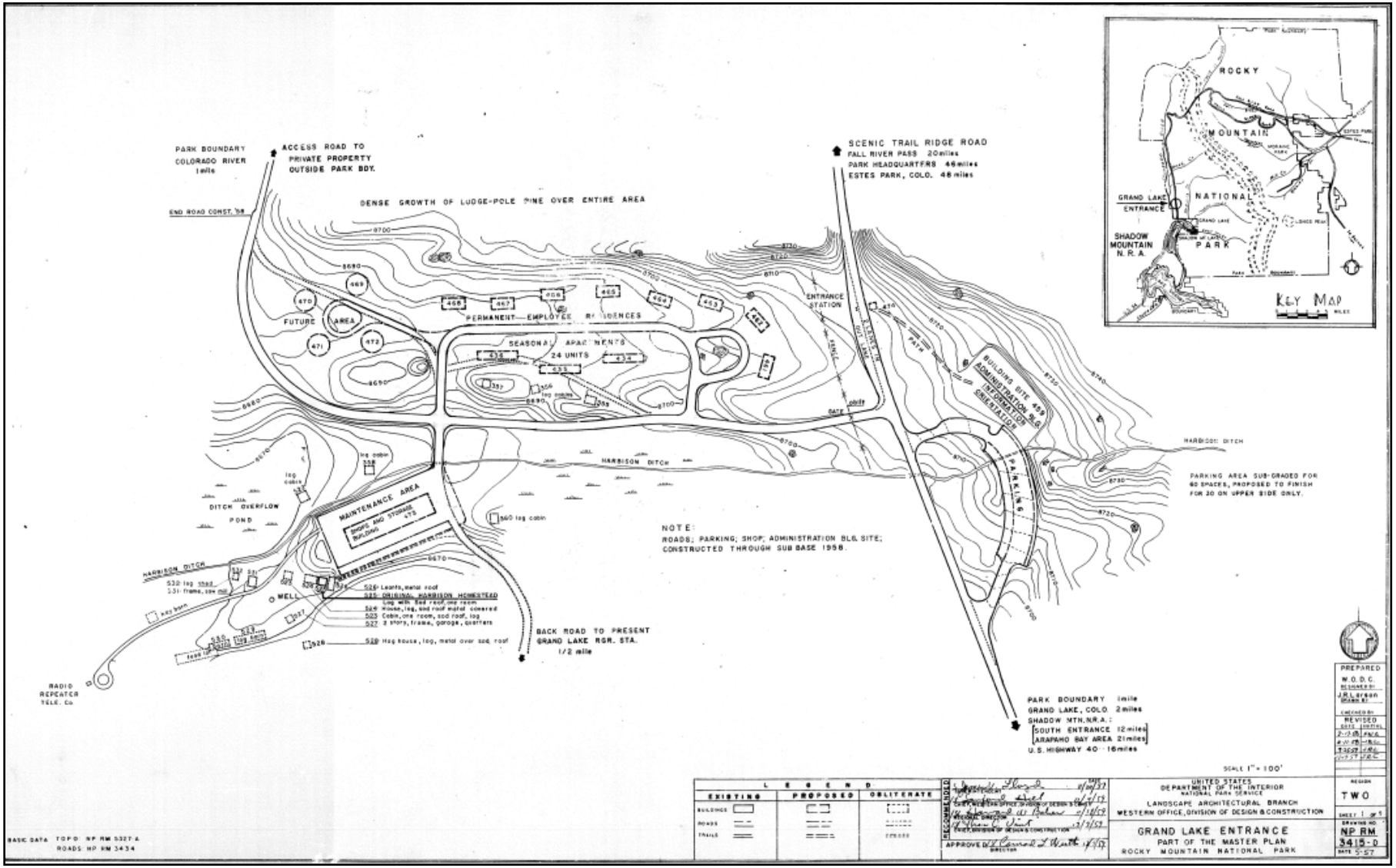


Figure 1. The note at center reads "Roads, parking, shop, administrative bld site constructed through sub-base 1958," indicating site preparation was underway in that year. 1957 ROMO GLE Entrance Plan 3415 D (NPS 2022).

Resource Number: 5GA.1285
Temporary Resource Number: B-0392-N

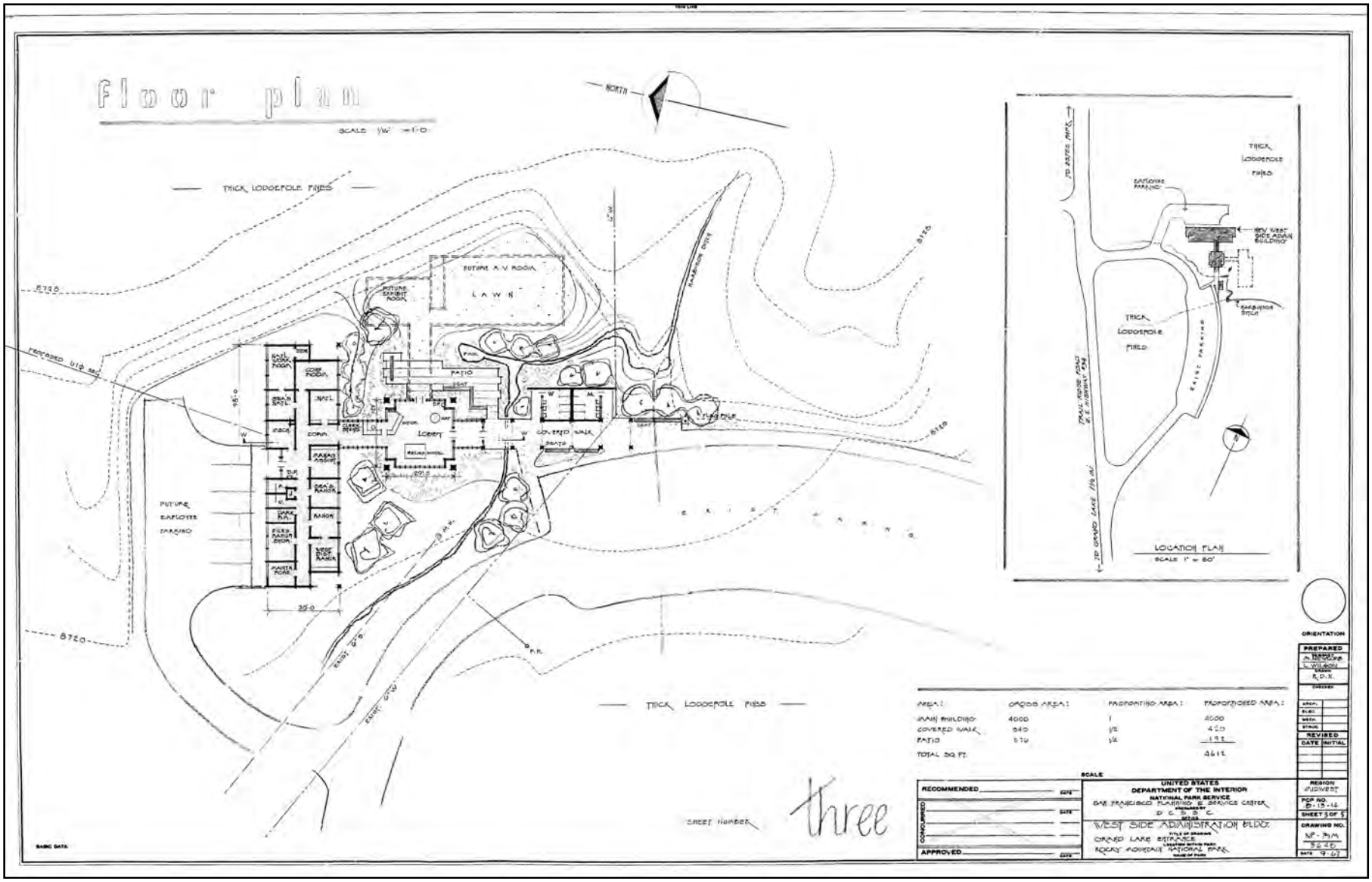


Figure 2. Site and floor plan for the Kawuneeche Visitor Center from preliminary drawings (1967) that also shows the designated space for a future auditorium and exhibit additions. Floor Plan, West Side Administration Bldg. 1967 72350-ROMO_121_3648 (NPS 2022).

Resource Number: 5GA.1285
Temporary Resource Number: B-0392-N

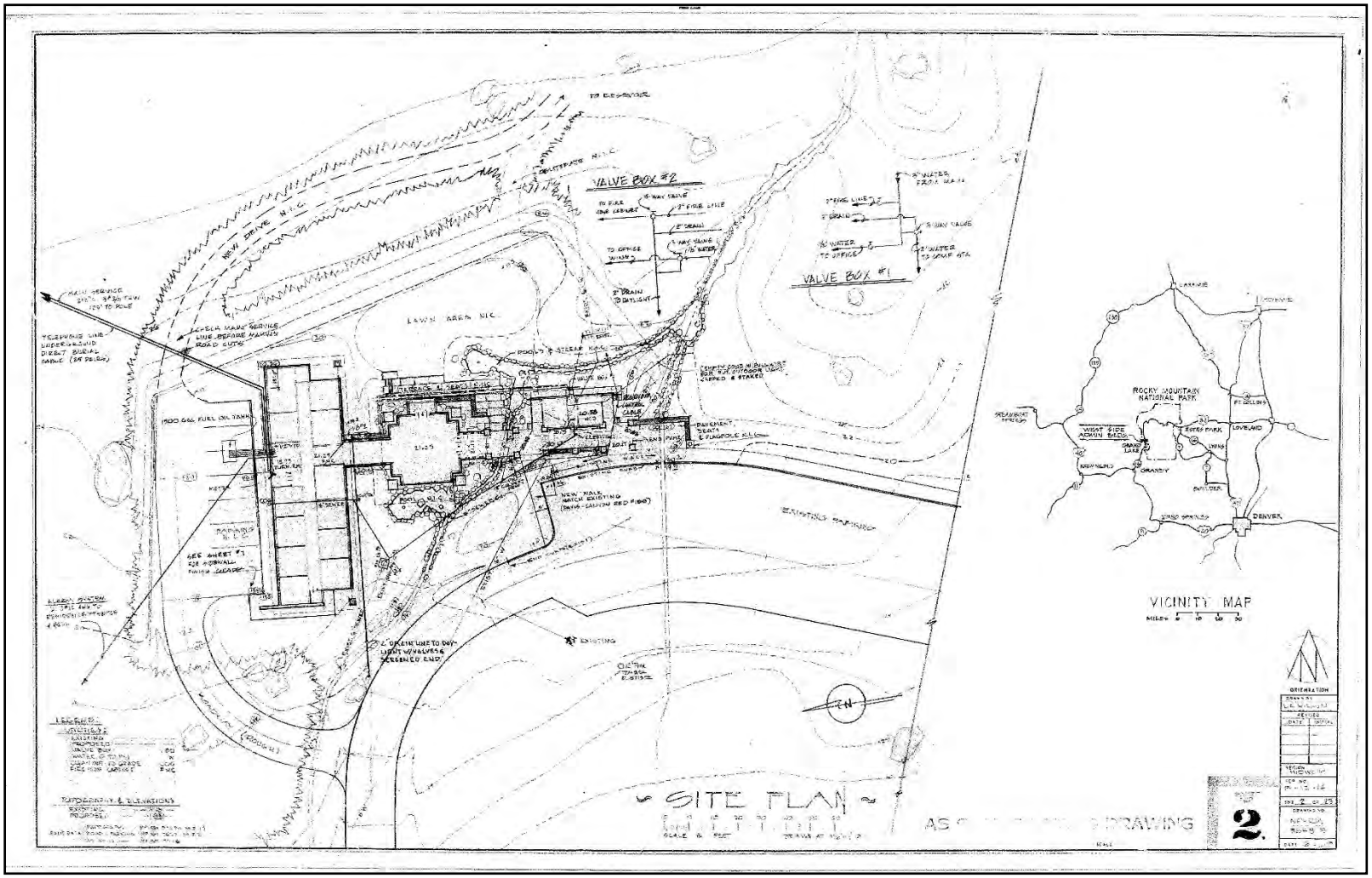


Figure 3. Site plan for the Kawuneeche Visitor Center from as-constructed drawings (1969). West Side Administration Bldg. Site Plan, 1968 76738-ROMO_121_3648_B (NPS 2022).

Figure 4. Interior, Kawuneeche Visitor Center, ca. 1969, view facing south. ROMO_121_P9 (NPS 2022).

Figure 5. West elevation looking east, ca. 1969, from ROMO_121_P9 (NPS 2022).

Figure 6. Ca. 1969 view of the south elevation of the building documenting absence of vegetation in front of the building, from ROMO_121_P9 (NPS 2022).

Figure 7. East elevation and naturalistic landscaping, ca. 1969, from ROMO_121_P9 (NPS 2022).

Figure 8. View of the east elevation in 1968 with central lobby as it originally appeared. Entrance walkway and comfort station are to the left, and administration wing is to the right. ROMO_121_P9 (NPS 2022).

Figure 9. View of the west elevation in 1968 with administrative wing to the left, lobby at center, and covered walk at right. ROMO_121_P9 (NPS 2022).

Figure 10. Overview of the Kawuneeche Visitor Center, view facing northeast. The view of the lobby from the parking lot is obscured by overgrown vegetation. As a result, the comfort station appears as the most visually prominent component of the visitor center.

Figure 11. Overview of the Kawuneeche Visitor Center, view facing north. The view of the lobby from the parking lot is predominantly obscured by the overgrown vegetation. As a result, the comfort station appears as the most prominent component of the visitor center.

Figure 12. Overview of the Kawuneeche Visitor Center, view facing east from the north entrance to the visitor center parking lot. The office wing is in the center and the lobby is to the right, although they are visually obscured by overgrown trees.

Figure 13. Overview of the Kawuneeche Visitor Center, view facing southeast from the north entrance to the visitor center parking lot. The view of the lobby is obscured by overgrown vegetation.

Office Wing

Figure 14. Office wing east and north elevations, view facing southwest.

Figure 15. Office wing, north elevation, view facing southwest.

Figure 16. Office wing, north elevation, view facing southeast.

Figure 17. Stone wall at the west end of the office wing, west elevation, view facing east.

Figure 18. Secondary entrance into the west elevation of the office wing, view facing north. The stone wall and the four-post column are character-defining features of the visitor center.

Figure 19. Office wing, south elevation, view facing northeast.

Figure 20. Office wing, south and east elevations, view facing northwest. The southeast corner was originally open on either side of the four-column post that is now embedded in the adjacent walls. The area was enclosed and the existing storage closet was expanded in the late twentieth century.

Figure 21. Office wing interior of southeast corner storage closet addition with the raised portion of concrete demonstrating the former location of the exterior wall before the closet expansion.

Figure 22. Office wing interior. Another view of the closet addition with the raised portion of concrete demonstrating the former location of the exterior wall before the closet expansion.

Figure 23. Office wing, naturalist workroom, view facing east.

Figure 24. Office wing, naturalist workroom, view facing west.

Figure 25. Office wing, main corridor to offices, view facing west.

Information Corridor

Figure 26. Information corridor between the office wing (left) and the lobby (right), west elevation, view facing east.

Figure 27. Information corridor between the office wing (right) and the lobby (left), east elevation, view facing west.

Figure 28. The information corridor serves as the backcountry permit office. The original transparency through the corridor has been obscured by the partition between the permit desk and the merchandise area of the lobby.

Lobby

Figure 29. Overview of the lobby, view facing east. Overgrown vegetation, predominantly aspen and one large spruce tree (not pictured), obstructs the view of the lobby, which was intended to be the centerpiece of the visitor center and visually transparent.

Figure 30. Lobby (right) and information corridor (left), north and west elevations, view facing southeast.

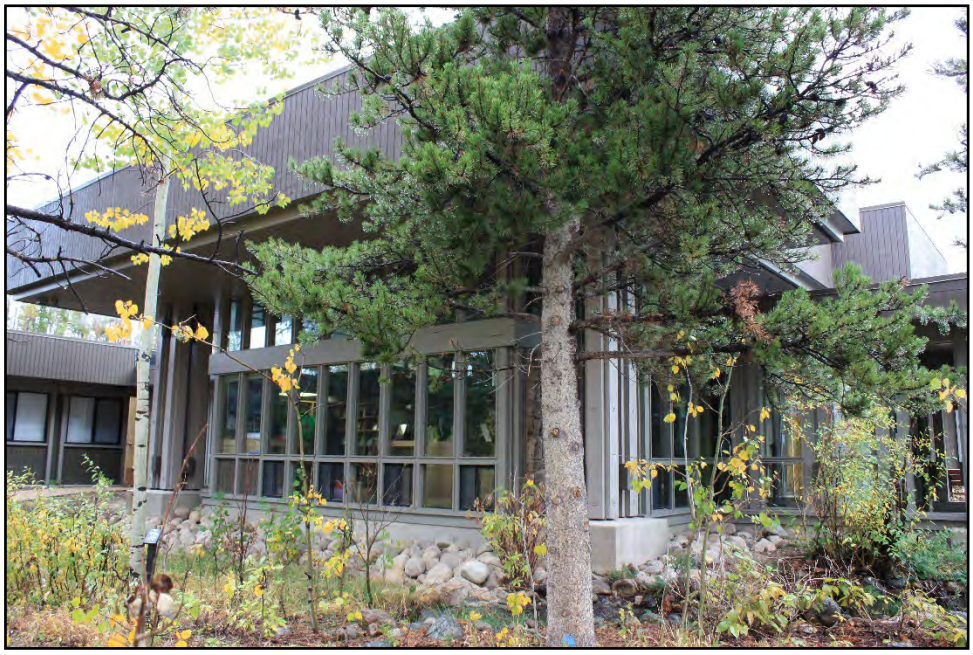


Figure 31. Lobby, west and south elevations, view facing northeast.

Figure 32. Main entrance into the north elevation of the lobby that is accessed via the covered walk, view facing north. The enclosed entrance vestibule is an alteration to the original construction.

Figure 33. Lobby interior, view facing northwest. The uninterrupted ceiling boards that span between exterior and interior, clerestory windows and glass curtain walls are character-defining features that have been retained. The cashier counter is in a different location than the original information desk and partially obscures the intended view to the landscape through the curtain wall.

Figure 34. Lobby interior, ceiling detail.

Figure 35. View of the courtyard between the comfort station, the auditorium addition, and the lobby, view facing northwest.

Figure 36. Auditorium addition, south elevation, view facing north.

Figure 37. Auditorium addition, south and east elevations, view facing northwest.

Figure 38. Auditorium addition, east and north elevations, view facing southwest.

Figure 39. Auditorium addition, north elevation, view facing south.

Figure 40. Information corridor and courtyard between the lobby (obscured by the auditorium addition, left) and the office wing (right), view facing west. Note completely filled bay at corner of office wing, which was originally open.

Figure 41. Exhibit space in the auditorium addition, view facing east from the original space in the lobby. Note the perpendicular beam that delineates the original and replicated ceilings. The tall display cases obscure the view to the landscape from the northeast and southeast corners of the lobby.

Covered Walk

Figure 42. Covered walk with the comfort station in the background, view facing northeast. The four-post columns are character-defining features of the visitor center. The interpretive signage outside the covered walk and on the exterior of the comfort station are noncontributing landscape features.

Figure 43. The covered walk provides access from the parking lot to the comfort station (right) and the lobby, view facing north. The wood benches are examples of original features designed with the visitor center.

Comfort Station

Figure 44. Comfort station, south elevation, view facing north. The portion of the building from the restroom door (left) to the rear of the building was added in 1999. The gable roof was constructed on the original flat roof in 2008. Harbison Ditch is in the foreground.

Figure 45. Comfort station, east elevation, view facing northwest.

Setting

Figure 46. Trailhead for the South Tonahutu Spur Trail installed ca. 2007. This is a noncontributing landscape feature.

Figure 47. Picnic area constructed east of the visitor center parking lot ca. 2016. This is a noncontributing landscape feature.

Figure 48. Example of a freestanding Mission 66 era bench. These are contributing landscape features.

Figure 49. Freestanding Mission 66–era benches at the south end of the covered walk. These are contributing landscape features.

Figure 50. Example of a Mission 66–era wood light pole with globe light along the east side of the parking lot and sidewalk. These are contributing landscape features.

Figure 51. Concrete and rock-lined stream meandering in front (west) of the lobby. This is a contributing landscape feature.

October 16, 2017

Ms. Elizabeth Hallas
Anderson Hallas Architects, PC
715 14th Street
Golden, Colorado 80401
elizabethhallas@andarch.com

Subject: Hazardous Material Survey Report for Kawuneeche Visitors Center, Rocky Mountain National Park, Grand Lake, Colorado, 80447. Landmark Project No. 17075.001.001

Dear Ms. Hallas:

Landmark Environmental, Inc. (Landmark) has completed a non-destructive-level survey for asbestos containing material (ACM), lead-containing paint (LCP), regulated building material (RBM), and biological hazards at the Kawuneeche Visitors Center at Rocky Mountain National Park, located at 16018 US-34, Grand Lake, Colorado 80447 (the Site). It is our understanding that this project is in the programming and planning stage. Accordingly, our screening-level survey was designed to provide appropriate information to support project planning and budgeting for eventual renovation.

Scope of Work

Landmark's Industrial Hygienist, U.S. Environmental Protection Agency (EPA) Asbestos Hazard and Emergency Response Act (AHERA), and Colorado Department of Public Health & Environment (CDPHE) Certified Asbestos Building Inspector (CABI) performed the site survey. Landmark personnel surveyed the site for the following materials, features, and/or conditions:

1. Asbestos containing material (ACM).
2. Lead-containing paint (LCP) in buildings and soil.
3. Other regulated building material (RBM).
4. Biohazards.

Landmark performed the field portion of this work on October 4, 2017.

Asbestos Containing Materials Survey

Sampling was conducted in accordance with EPA AHERA and U.S. Occupational Safety and Health Administration (OSHA) Chapter 29 Code of Federal Regulations (CFR) 1926.1101 requirements, as well as generally accepted industry standards. Asbestos inspection activities were conducted by AHERA accredited personnel. Bulk samples of accessible suspect ACMs were collected in a representative manner as determined by the inspector. Bulk material samples were collected by taking representative samples that included all layers within the suspect ACM. Sampling was limited to materials that were visible and readily accessible to the inspector.

The bulk suspect ACM samples were submitted to Reservoirs Environmental, Inc. (REI), located in Denver, Colorado. REI is a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory, which is also accredited by the American Industrial Hygiene Association (AIHA). The samples were analyzed using Polarized Light Microscopy (PLM) to determine asbestos type and percent. Applicable regulations require that if any one sample of a homogenous material contains greater than one percent asbestos, the entire homogenous material is considered asbestos-containing.

Asbestos Regulatory Criteria

Applicable asbestos regulations define ACM as material containing greater than one percent asbestos by weight, volume or surface area, and distinguish between friable and non-friable forms of ACM. Friable ACMs can be crumbled or reduced to powder by hand pressure when dry, while non-friable materials cannot. Regulations stipulate that if any one sample of a homogenous material contains greater than one percent asbestos, the entire homogenous area is considered asbestos-containing.

Asbestos Survey Findings

Landmark collected 26 bulk samples from a total of 16 different suspect ACMs. The samples were submitted for laboratory analysis and the following results were exhibited:

- Of the 16 suspect ACMs that were sampled and analyzed, samples from three building materials resulted in concentrations of greater than one percent asbestos.
- Two materials were presumed to contain asbestos based on historical sampling, abatement or records at the site.
- One material was presumed to contain asbestos based on the building owner requesting non-disturbance of the material.
- Two materials were confirmed to contain trace amounts of asbestos.

Detailed information such as homogeneous material description, estimated quantities, friability, condition, sample number, sample location description and percent type of asbestos for each homogeneous material listed below is presented in Attachment A.

Confirmed ACMs:

1. Flooring Tile & Mastic Composite (FTC01): 9"X9" cream floor tile with tan mottling and black mastic is confirmed ACM. This material is located on floors throughout the areas of 1963 construction era in the main building.

2. Textured Surfacing (TS01): Light knock down texture is confirmed ACM. This material is located on the walls in the 2005 office bathroom renovation area of the building.

3. Textured Surfacing (TS02): Light knock down texture is confirmed ACM. This material is located on the walls in the 2005 office bathroom renovation area of the building.

Presumed ACMs:

4. Pipe Insulation Fittings (PI/PF): Site personnel confirmed that historical renovations had included the abatement of PI/PF. Historical renovations have not included wall or ceiling cavities. It is presumed that there is remaining PI/PF in wall and ceiling cavities, and if discovered that material contains asbestos.

1. Cementitious Transite Pipes (CB): Site personnel and building specification drawings indicated that the pipe and duct chases that were encased in the building slab were CB. This material is known to contain asbestos. It is presumed that the CB in the building slab contains asbestos.

2. Roofing Material (RM)*:* Site personnel requested that the roof of the building not be impacted during this inspection. It is presumed that the RM on the roof contains asbestos.

Confirmed Trace-ACMs:

1. Composite Drywall and Joint Compound (CDW01): This material is located throughout the main building, 1963 construction era. Laboratory results with composite analysis confirmed that the material contains trace amounts of asbestos.

3. Composite Drywall and Joint Compound (CDW02): This material is located in the main building, 2005 office bathroom renovation area. Laboratory results with composite analysis confirmed that the material contains trace amounts of asbestos.

Lead Containing Paint and Soil Survey

The LCP survey was conducted concurrently with the ACM survey. Bulk paint chip samples of suspect LCP were collected in a representative manner as determined by the inspector based on identified testing combinations where the surface color, substrate or building component were visibly different. Sampling was limited to materials that were visible and readily accessible to the inspector.

Areas of exposed soil adjacent to typical painted external building surfaces (e.g., window frames, trim and siding, soffits and fascia boards, etc.) were visually inspected for paint chips. In addition, representative composited soil samples were collected from the perimeter of each structure and analyzed for total lead content. The sampling strategy consisted of collecting a composite sample from the drip line of each structure.

The paint chip and soil samples were submitted to REI, which is an Environmental Lead Laboratory Accreditation Program (ELLAP) accredited laboratory that uses procedures developed in compliance with the guidelines established by the National Institute of Occupational Safety and Health (NIOSH) Method 7420. The samples were analyzed by Atomic Absorption (AA) / Inductively Coupled Plasma (ICP) protocol to determine lead content. The total lead concentration reported is the average of all paint layers in the sample. Lead content for paint sample results are reported as a percent lead by weight. Lead content for soil samples is reported as milligrams per kilogram (mg/kg).

<u>LCP Regulatory Criteria</u>

The EPA and Department of Housing and Urban Development (HUD) regulate LBP abatement activities in target housing and child occupied facilities. Childcare facilities fall under this definition. OSHA regulates worker exposure to lead for coatings with any detectable lead. The EPA and HUD regulations related to LBP abatement do not apply to the project site unless abatement activities occur (specifically designed to permanently remove LBP hazards). LBP is defined as paint containing 0.5 percent lead by weight or 1.0 milligram per cubic centimeter by both the EPA and HUD. LCP is paint containing any detectable concentrations of lead.

The EPA also developed a program for renovation activities in child-occupied / target housing and child-care facilities called the Lead Renovation, Repair, and Paint Rule (RRP Rule). This rule requires that firms performing renovation, repair, and painting projects that disturb lead-based paint in homes, child care facilities and pre-schools built before 1978 have their firm certified by EPA (or an EPA authorized state), use certified renovators who are trained by EPA-approved training providers and follow lead-safe work practices. The surveyed buildings are not considered child-occupied facilities.

The OSHA lead in construction standard 29 CFR 1926.62 addresses requirements for sites where the employer has reason to believe that any employee may be exposed to lead in excess of OSHA's action level (AL) of 30 micrograms per cubic meter (30 µg/m3) over an 8-hour time weighted average. The OSHA standard applies to all construction activities that may impact LCP (any detectable lead).

The EPA has established screening and cleanup criteria for lead in soils based on direct contact in residential scenarios of 400 mg/kg for high contact play areas and 1200 mg/kg for residential yard areas. These limits are conservative values as this facility is not a residential facility.

LCP Sampling Findings

For this inspection, bulk paint samples are correlated to testing combinations using substrate, component, and color. The substrate is the material from which the component is fabricated. Substrates are classified as plaster or wood. A component is defined as a particular item, such as a door, a wall, or a cabinet.

Ten samples were collected from suspect LCP testing combinations. None of these samples resulted in detections of lead above 0.5 percent. Four of the samples resulted in measured lead concentrations below 0.5 percent by weight, but with detectable lead.

Laboratory analysis identified paint with lead concentration of less than 0.5 percent, but above the detection limit, in the following samples:

- SVC-A-EXT-LBP07, Dark green/brown exterior wall paint collected at the southeast corner of room 121's exterior in the 1963 construction era section of the building.
- SVC-A-EXT-LBP08, Light green/grey exterior trim paint collected at the southeast corner of room 121's exterior in the 1963 construction era section of the building.
- SVC-C-EXT-LBP09, Dark green/brown exterior wall paint collected at the southwest corner of room B1's exterior in the 1963 construction era section of the building.
- SVC-C-EXT-LBP10, Light green/gray grey exterior trim paint collected at the southwest corner of room B1's exterior in the 1963 construction era section of the building.

Analytical lead results and field forms can be found in Attachment B.

Lead in Soils Sample Findings

One soil sample was also collected to determine if lead was present at concentrations above applicable regulatory screening levels in soils at the drip line of the building.

The analytical result for this sample was 13.4 mg/kg. Based on the measured soil concentrations, it does not appear that lead based paint has caused soil contamination, and soil remediation is not expected to be necessary.

Other Regulated Building Materials Survey

Landmark conducted a limited survey for regulated building materials (RBM) that were observed at the site. This limited investigation included the identification and quantification of RBM that must be managed and appropriately disposed of during demolition or renovation. This survey was limited to materials that were visible and readily accessible to the inspector, and additional RBM may be discovered during renovation or demolition.

The following RBMs were observed:

Equipment / Device	Potentially Regulated Material Present	Approximate Quantity
4' Fluorescent Lamp Tube	Mercury	68
Lightbulbs (Fluorescent)	Mercury	24
Florescent Ballasts	PCBs	20
Smoke detector	Radiation Source	6
Air conditioner	Refrigerant	0
Thermostat	Mercury	3

Observations of Biological Hazards

Landmark conducted limited observations for biological hazards based on observations during the site walk through. Significant amounts of rodent droppings were observed during the field work at the attic access hatch in the main building. Live rodents and spiders were also discovered to be occupying the site. These conditions may pose health risks and will need to be addressed prior to renovation activities.

Conclusions and Recommendations

The identified asbestos-containing drywall, flooring, textured surfacing, pipe insulation, Transite pipes and roofing material must be removed in accordance with Local, State, and Federal Regulations if renovation activities will disturb these materials or if demolition is planned for the structure.

Renovation activities that will impact LBP/LCP will require OSHA trained workers and safety programs. Personal protective equipment (PPE) will be required to handle these items until negative exposure assessment is completed that shows work activities do not result in exposures above the OSHA permissible exposure limit (PEL). Additionally, an appropriate waste management plan should be developed for the disposal of these materials.

Renovation activities that will impact RBM will require proper disposal and management. These items must be disposed of and handled in accordance with applicable regulations. While light ballasts were not observed during this limited survey, all light ballasts without the "No PCBs" label are considered RBM, and must be managed in accordance with applicable regulations.

Biological hazards, including animal droppings and ongoing infestations, were observed during the site survey. PPE is recommended when conducting work in this building and it is recommended that workers are trained on applicable hazards and exposure prevention.

Limitations

It should be noted that no destructive investigation of wall interiors and below grade structures was performed. In the event of demolition or renovation, asbestos could be discovered that was not identified during this investigation. Limited destructive investigation of building materials to be impacted by renovation or demolition is recommended prior to conducting such work.

This document is not intended to be used as a bid document for the removal, repair, encapsulation, enclosure, or Operations and Maintenance (O&M) of asbestos-containing materials. Quantities of identified asbestos-containing materials should be field verified by the contractor prior to bidding on any and all work associated with this inspection report. Landmark can prepare a Scope of Work / Project Design, bid documents, removal and repair methods / procedures, specifications and O&M Plans if desired by the Customer. These documents, if requested, will be prepared by EPA accredited and state certified individuals.

Landmark performed asbestos response services in a manner consistent with the level of care and expertise exercised by members of the asbestos inspection and assessment profession. Landmark does not imply or guarantee that every suspect ACM / LCP on or in the building has been identified or sampled.

Landmark appreciates the opportunity to provide our services on this important project. Please feel free to contact us if you have any questions or if we can provide any additional assistance.

Respectfully,
Landmark Environmental, Inc.

Brandy Howard

Brandy Howard, CIH
Senior Industrial Hygienist

CC: Anne Cutrell

Attachment A – Asbestos Containing Materials Sample Information & Analytical Results
Attachment B – Lead Containing Paint Sample Information & Analytical Results
Attachment C – Photographs

Attachment A

ASBESTOS CONTAINING MATERIALS SAMPLE INFORMATION & ANALYTICAL RESULTS

LANDMARK ENVIRONMENTAL INC.
7881 Shaffer Parkway
Littleton, Colorado 80127 ♦ 720-283-8974 ♦ Fax: 720-283-8666

ACM Building Inspection Form

Client: National Parks Service Rocky Mountain National Park	Project: Kawuneeche Visitors Center	Date: 10/4/17 Inspector(s): Fitzpatrick

Homogeneous Material Description: BBA01		**Friable:**	**Material Type:**	**Quantity Estimate:**
Baseboard Adhesive (BBA).		I – II - F	S – T -M	100 LF
Detached Bathroom / Comfort Building, ~1963 Construction Era		**Photo:**	**Condition:**	
Cream/yellow on beige baseboard.		Yes	G – F – P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-C-M3-BBA01-01	M3, west wall, at half wall floor			Non- Detect

Homogeneous Material Description: CDW01		**Friable:**	**Material Type:**	**Quantity Estimate:**
Composite Drywall and Joint Compound (CDW)		I – II – F	S – T – M	12,000 SF
Main Building, ~1963 Construction Era		**Photo:**	**Condition:**	
White, chalky and granular		Yes	G – F – P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-A-109-CDW01-01	North wall at east door jam, 4' up			Non- Detect
SVC-A-122-CDW01-02	East wall at south corner, 5' up			Trace (<1%) by composite

Homogeneous Material Description: CDW02		**Friable:**	**Material Type:**	**Quantity Estimate:**
Composite Drywall and Joint Compound (CDW)		I – II – F	S – T – M	3,500 SF
Detached Bathroom / Comfort Building, ~1963 Construction Era		**Photo:**	**Condition:**	
White, chalky and porous		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-C-M3-CDW02-01	M3, east wall, at half wall corner, 3' up			Non- Detect
SVC-C-B1-CDW02-02	B1, south wall, at corner, 6' up			Non- Detect

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ACM Building Inspection Form

Client: National Parks Service Rocky Mountain National Park	Project: Kawuneeche Visitors Center	Date: 10/4/17 Inspector(s): Fitzpatrick

Homogeneous Material Description: CDW03		**Friable:**	**Material Type:**	**Quantity Estimate:**
Composite Drywall and Joint Compound (CDW)		I – II - F	S – T - M	10,000 SF
Visitors Center Addition, ~1989 Construction Era		**Photo:**	**Condition:**	
Pink, chalky and porous, limited with wood paneling		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-B-102-CDW03-01	North wall at west corner, 5' up			Non- Detect
SVC-B-106-CDW03-02	South wall at west corner, 2' up			Non- Detect

Homogeneous Material Description: CDW04		**Friable:**	**Material Type:**	**Quantity Estimate:**
Composite Drywall and Joint Compound (CDW)		I – II - F	S – T - M	664 SF
Main Building, ~2005 Office Bathroom Renovation		**Photo:**	**Condition:**	
Light pink, chalky		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-A-113-CDW04-01	South wall, at west door jam, 3' up			Trace (<1%) by composite
SVC-A-114-CDW04-02	South wall, at east door jam, 2' up			Trace (<1%) by composite

Homogeneous Material Description: DS01		**Friable:**	**Material Type:**	**Quantity Estimate:**
Duct Sealant (DS).		I – II - F	S – T - M	2 EA
Detached Bathroom / Comfort Building, ~1963 Construction Era		**Photo:**	**Condition:**	
Pale green, associated with HVAC/water-heater vent		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-C-AT-DS01-01	Attic, north of east attic hatch, on metal duct			Non- Detect

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Homogeneous Material Description: FM01		**Friable:**	**Material Type:**	**Quantity Estimate:**
Flooring/Carpet Mastic (FM).		I – II - F	S – T - M	3,000 SF
Main Building, ~1963 Construction Era		**Photo:**	**Condition:**	
Grey/green, noted over historical wood floor		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-A-101-FM01-01	Floor, under removable case section			Non- Detect

Homogeneous Material Description: FM02		**Friable:**	**Material Type:**	**Quantity Estimate:**
Flooring/Carpet Mastic (FM).		I – II - F	S – T - M	1,440 SF
Visitors Center Addition, ~1989 Construction Era		**Photo:**	**Condition:**	
Bright yellow, over white/grey concrete		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-B-102-FM02-01	Floor, at north-west corner of addition			Non- Detect

Homogeneous Material Description: FTC01		**Friable:**	**Material Type:**	**Quantity Estimate:**
Flooring Tile Composite & Mastic (FTC). Main Building,		I – II - F	S – T – M	3,000 SF
~1963 Construction Era. Observed and told around building,		**Photo:**	**Condition:**	
Under carpet. 9" X 9" Cream with tan mottling, black mastic		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-A-109-FTC01-01	Floor, center of room, 5' from north door			3% Chr (Tile), 3% Chr (Mastic)
SVC-A-122-FTC01-02	Floor, 1' out from south west corner			3% Chr (Tile), 7% Chr (Mastic)

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ACM Building Inspection Form

Client: National Parks Service Rocky Mountain National Park	Project: Kawuneeche Visitors Center	Date: 10/4/17 Inspector(s): Fitzpatrick

Homogeneous Material Description: FTC02		**Friable:**	**Material Type:**	**Quantity Estimate:**
Flooring Tile Composite & Mastic (FTC).		I – II - F	S – T – M	100 SF
Visitors Center Addition, ~1989 Construction Era		**Photo:**	**Condition:**	
12" X 12" Red,		Yes	G – F – P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-B-106-FTC02-01	Floor, south west corner of room			Non- Detect

Homogeneous Material Description: IB01		**Friable:**	**Material Type:**	**Quantity Estimate:**
Insulation Board (IB).		I – II – F	S – T – M	100 SF
Main Building, ~1963 Construction Era		**Photo:**	**Condition:**	
Heavy canvas over fiberglass, thick white sealant w/ tan paint		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-A-112-IB01-01	Center-north of the room on duct			Non- Detect
SVC-A-112-IB01-02	North-east of the room on duct			Non- Detect

Homogeneous Material Description: LIP01		**Friable:**	**Material Type:**	**Quantity Estimate:**
Lay-in Ceiling Panel (LIP), 24" X 24"		I – II - F	S – T – M	720 SF
Visitors Center Addition, ~1989 Construction Era		**Photo:**	**Condition:**	
White, rough / acoustical, deep pockets		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-B-103-LIP01-01	Ceiling, north east corner of room			Non- Detect

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ACM Building Inspection Form

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Homogeneous Material Description: RM01		**Friable:**	**Material Type:**	**Quantity Estimate:**
Roofing Material (RM), in attic, historical, under roof addition		I – II - F	S – T - M	300 SF
Detached Bathroom / Comfort Building, ~1963 Construction Era		**Photo:**	**Condition:**	
Layered roof, foam, tar paper, brown gravel asphaltic sheeting		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-C-AT-RM01-01	Attic, north of east attic hatch, on historical flat roof			Non- Detect

Homogeneous Material Description: TS01		**Friable:**	**Material Type:**	**Quantity Estimate:**
Textured Surfacing (TS), associated with CDW04, walls only		I – II - F	S – T -M	544 SF
Main Building, ~2005 Office Bathroom Renovation		**Photo:**	**Condition:**	
Light knock-down, appears to be original to renovation		Yes	G – F – P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-A-113-TS01-01	West wall, 3' from south, 3' up			Non- Detect
SVC-A-113-TS01-02	East wall, 1' north of wall trash/towel dispenser, 3' up			Non- Detect
SVC-A-114-TS01-03	West wall, at trash/towel dispenser, 4' up			2% Chrysotile

Homogeneous Material Description: TS02		**Friable:**	**Material Type:**	**Quantity Estimate:**
Textured Surfacing (TS), associated with CDW04, ceilings only		I – II – F	S – T -M	120 SF
Main Building, ~2005 Office Bathroom Renovation		**Photo:**	**Condition:**	
Heavy knock-down, appears to be additive / leak repair		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-A-114-TS02-01	Ceiling, at west wall, above stall door			<1% Chrysotile
SVC-A-114-TS02-02	Ceiling, at corner above sitting stool			Non- Detect
SVC-A-113-TS02-03	Ceiling, at north-west of ceiling vent, above stall door			Non- Detect

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ACM Building Inspection Form

Client: National Parks Service Rocky Mountain National Park	Project: Kawuneeche Visitors Center	Date: 10/4/17 Inspector(s): Fitzpatrick

Homogeneous Material Description: UC01		**Friable:**	**Material Type:**	**Quantity Estimate:**
Sink/Pan Undercoating (UC).		I – II - F	S – T - M	1 EA
Main Building, ~1963 Construction Era		**Photo:**	**Condition:**	
Grey, associated with metal pan sink in kitchen area		Yes	G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**
SVC-A-110-UC01-01	Under sink at west wall			Non- Detect

Homogeneous Material Description:		**Friable:**	**Material Type:**	**Quantity Estimate:**
		I – II - F	S – T -M	
		Photo:	**Condition:**	
			G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**

Homogeneous Material Description:		**Friable:**	**Material Type:**	**Quantity Estimate:**
		I – II - F	S – T -M	
		Photo:	**Condition:**	
			G – F - P	
Sample Number:	**Sample Location:**			**Analytical Data:**

Report for:

Brandy Howard, CIH
Landmark Environmental, Inc.
7881 Shaffer Parkway
Littleton, CO 80127

Regarding: Project: 17075.001.001; Moraine Park Discovery Ctr. RMNP
EML ID: 1808578

Approved by:

Approved Signatory
Noah Lazarte

Dates of Analysis:
Asbestos PLM: 10-09-2017

Service SOPs: Asbestos PLM (EPA Methods 600/R-93/116 & 600/M4-82-020, SOP EM-AS-S-1267)

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. The results relate only to the items tested. The results include an inherent uncertainty of measurement associated with estimating percentages by polarized light microscopy. Measurement uncertainty data for sample results with >1% asbestos concentration can be provided when requested.

EMLab P&K ("the Company") shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

EMLab P&K
4955 Yarrow Street , Arvada, CO 80002
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Landmark Environmental, Inc.
C/O: Brandy Howard, CIH
Re: 17075.001.001; Moraine Park Discovery Ctr. RMNP

Date of Sampling: 09-27-2017
Date of Receipt: 10-06-2017
Date of Report: 10-09-2017

ASBESTOS PLM REPORT: EPA-600/M4-82-020 & EPA METHOD 600/R-93-116

Total Samples Submitted:	26
Total Samples Analyzed:	26
Total Samples with Layer Asbestos Content > 1%:	6

Location: SVC-C-M3-BBA01-01, Baseboard Adhesive

Lab ID-Version‡: 8463407-1

Sample Layers	Asbestos Content
Off-White Baseboard	ND
Yellow Mastic	ND
White Compound	ND
Sample Composite Homogeneity:	Poor

Location: SVC-109-CDW01-01, Composite Drywall / Joint Compound

Lab ID-Version‡: 8463408-1

Sample Layers	Asbestos Content
Pink Drywall with Brown Paper and Paint	ND
Composite Non-Asbestos Content:	10% Cellulose
Sample Composite Homogeneity:	Moderate

Location: SVC-122-CDW01-02, Composite Drywall / Joint Compound

Lab ID-Version‡: 8463409-1

Sample Layers	Asbestos Content
Pink Drywall with Brown Paper	ND
Off-White Joint Compound	2% Chrysotile
Cream Tape	ND
Off-White Texture with Paint	< 1% Chrysotile
Composite Asbestos Fibrous Content:	< 1% Asbestos
Composite Non-Asbestos Content:	15% Cellulose
Sample Composite Homogeneity:	Poor

Comments: Composite asbestos content provided is only for Drywall/Joint compound. Composite content provided does not follow the guidelines set forth by NVLAP. This analysis was performed by following the NESHAP guidelines.

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Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. ND means no fibers were detected. When detected, the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.
‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".

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Re: 17075.001.001; Moraine Park Discovery Ctr. RMNP

Date of Sampling: 09-27-2017
Date of Receipt: 10-06-2017
Date of Report: 10-09-2017

ASBESTOS PLM REPORT: EPA-600/M4-82-020 & EPA METHOD 600/R-93-116

Location: SVC-M3-CDW02-01, Composite Drywall / Joint Compound Lab ID-Version‡: 8463410-1

Sample Layers	Asbestos Content
Pink Drywall with Brown Paper	ND
Off-White Joint Compound	ND
Cream Tape	ND
Off-White Texture with Paint	ND
Composite Non-Asbestos Content:	15% Cellulose
Sample Composite Homogeneity:	Poor

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Client: Landmark Environmental, Inc.
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Re: 17075.001.001; Moraine Park Discovery Ctr. RMNP

Date of Sampling: 09-27-2017
Date of Receipt: 10-06-2017
Date of Report: 10-09-2017

ASBESTOS PLM REPORT: EPA-600/M4-82-020 & EPA METHOD 600/R-93-116

Location: SVC-B1-CDW02-02, Composite Drywall / Joint Compound

Lab ID-Version‡: 8463411-1

Sample Layers	Asbestos Content
Pink Drywall with Brown Paper	ND
Off-White Joint Compound	ND
Cream Tape	ND
Off-White Texture with Paint	ND
Composite Non-Asbestos Content:	15% Cellulose
Sample Composite Homogeneity:	Poor

Location: SVC-B-102-CDW03-01, Composite Drywall / Joint Compound

Lab ID-Version‡: 8463412-1

Sample Layers	Asbestos Content
Pink Drywall with Brown Paper	ND
Off-White Joint Compound	ND
Cream Tape	ND
Off-White Texture with Paint	ND
Composite Non-Asbestos Content:	15% Cellulose
Sample Composite Homogeneity:	Poor

Location: SVC-B-106-CDW03-02, Composite Drywall / Joint Compound

Lab ID-Version‡: 8463413-1

Sample Layers	Asbestos Content
Pink Drywall with Brown Paper	ND
Off-White Joint Compound	ND
Cream Tape	ND
Off-White Texture with Paint	ND
Composite Non-Asbestos Content:	15% Cellulose
Sample Composite Homogeneity:	Poor

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Date of Receipt: 10-06-2017
Date of Report: 10-09-2017

ASBESTOS PLM REPORT: EPA-600/M4-82-020 & EPA METHOD 600/R-93-116

Location: SVC-A-113-CDW04-01, Composite Drywall / Joint Compound Lab ID-Version‡: 8463414-1

Sample Layers	Asbestos Content
Pink Drywall with Brown Paper	ND
Off-White Joint Compound	2% Chrysotile
Cream Tape	ND
Off-White Compound with Paint	< 1% Chrysotile
White Texture with Paint	ND
Composite Asbestos Fibrous Content:	< 1% Asbestos
Composite Non-Asbestos Content:	15% Cellulose
Sample Composite Homogeneity:	Poor

Comments: Composite asbestos content provided is only for Drywall/Joint compound. Composite content provided does not follow the guidelines set forth by NVLAP. This analysis was performed by following the NESHAP guidelines.

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‡ A "Version" indicated by -"x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".

EMLab P&K
4955 Yarrow Street , Arvada, CO 80002
(800) 651-4802 Fax (623) 780-7695 www.emlab.com

Client: Landmark Environmental, Inc.
C/O: Brandy Howard, CIH
Re: 17075.001.001; Moraine Park Discovery Ctr. RMNP

Date of Sampling: 09-27-2017
Date of Receipt: 10-06-2017
Date of Report: 10-09-2017

ASBESTOS PLM REPORT: EPA-600/M4-82-020 & EPA METHOD 600/R-93-116

Location: SVC-A-114-CDW04-02, Composite Drywall / Joint Compound

Lab ID-Version‡: 8463415-1

Sample Layers	Asbestos Content
Pink Drywall with Brown Paper	ND
Off-White Joint Compound	2% Chrysotile
Cream Tape	ND
Off-White Compound with Paint	2% Chrysotile
White Texture with Paint	ND
Composite Asbestos Fibrous Content:	< 1% Asbestos
Composite Non-Asbestos Content:	15% Cellulose
Sample Composite Homogeneity:	Poor

Comments: Composite asbestos content provided is only for Drywall/Joint compound. Composite content provided does not follow the guidelines set forth by NVLAP. This analysis was performed by following the NESHAP guidelines.

Location: SVC-C-AT-DS01-01, Duct Sealant

Lab ID-Version‡: 8463416-1

Sample Layers	Asbestos Content
Semi-Transparent Sealant	ND
Sample Composite Homogeneity:	Good

Location: SVC-A-101-FM01-01, Flooring Mastic

Lab ID-Version‡: 8463417-1

Sample Layers	Asbestos Content
Yellow Mastic	ND
Gray Leveling Compound	ND
Sample Composite Homogeneity:	Moderate

Location: SVC-B-102-FM02-01, Flooring Mastic

Lab ID-Version‡: 8463418-1

Sample Layers	Asbestos Content
Yellow Mastic	ND
Composite Non-Asbestos Content:	5% Synthetic Fibers
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT: EPA-600/M4-82-020 & EPA METHOD 600/R-93-116

Location: SVC-A-109-FTC01-01, Floor Tile and Mastic

Lab ID-Version‡: 8463419-1

Sample Layers	Asbestos Content
Gray Floor Tile	3% Chrysotile
Black Mastic	3% Chrysotile
Sample Composite Homogeneity:	Moderate

Location: SVC-A-122-FTC01-02, Floor Tile and Mastic

Lab ID-Version‡: 8463420-1

Sample Layers	Asbestos Content
Gray Floor Tile	3% Chrysotile
Black/Yellow Mastic	7% Chrysotile
Sample Composite Homogeneity:	Moderate

Location: SVC-B-106-FTC02-01, Floor Tile and Mastic

Lab ID-Version‡: 8463421-1

Sample Layers	Asbestos Content
Red Floor Tile	ND
Black/Yellow Mastic	ND
Sample Composite Homogeneity:	Moderate

Location: SVC-A-112-IB01-01, Insulation Board with Sealant

Lab ID-Version‡: 8463422-1

Sample Layers	Asbestos Content
Yellow Insulation with Coating	ND
Composite Non-Asbestos Content:	80% Glass Fibers 10% Cellulose
Sample Composite Homogeneity:	Moderate

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ASBESTOS PLM REPORT: EPA-600/M4-82-020 & EPA METHOD 600/R-93-116

Location: SVC-A-112-IB01-02, Insulation Board with Sealant

Lab ID-Version‡: 8463423-1

Sample Layers	Asbestos Content
Yellow Insulation with Coating	ND
Composite Non-Asbestos Content:	60% Glass Fibers 25% Cellulose
Sample Composite Homogeneity:	Moderate

Location: SVC-B-103-LIP01-01, Lay-In Ceiling Panel

Lab ID-Version‡: 8463424-1

Sample Layers	Asbestos Content
Gray Ceiling Tile with Foil	ND
Composite Non-Asbestos Content:	60% Glass Fibers 5% Cellulose
Sample Composite Homogeneity:	Good

Location: SVC-C-AT-RM01-01, Asphaltic Roofing Material

Lab ID-Version‡: 8463425-1

Sample Layers	Asbestos Content
Brown Fiberboard	ND
Black Roofing Shingle with Tan Pebbles	ND
Composite Non-Asbestos Content:	50% Cellulose
Sample Composite Homogeneity:	Poor

Location: SVC-A-113-TS01-01, Texture Wall Surfacing

Lab ID-Version‡: 8463426-1

Sample Layers	Asbestos Content
White Texture with Paint	ND
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT: EPA-600/M4-82-020 & EPA METHOD 600/R-93-116

Location: SVC-A-113-TS01-02, Texture Wall Surfacing

Lab ID-Version‡: 8463427-1

Sample Layers	Asbestos Content
White Texture with Paint	ND
Sample Composite Homogeneity:	Good

Location: SVC-A-113-TS01-03, Texture Wall Surfacing

Lab ID-Version‡: 8463428-1

Sample Layers	Asbestos Content
Off-White Compound with Paint	2% Chrysotile
White Texture with Paint	ND
Sample Composite Homogeneity:	Moderate

Location: SVC-A-113-TS02-01, Texture Wall Surfacing

Lab ID-Version‡: 8463429-1

Sample Layers	Asbestos Content
Off-White Compound with Paint	< 1% Chrysotile
White Texture with Paint	ND
Sample Composite Homogeneity:	Moderate

Location: SVC-A-113-TS02-02, Texture Wall Surfacing

Lab ID-Version‡: 8463430-1

Sample Layers	Asbestos Content
White Texture with Paint	ND
Sample Composite Homogeneity:	Good

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ASBESTOS PLM REPORT: EPA-600/M4-82-020 & EPA METHOD 600/R-93-116

Location: SVC-A-113-TS02-03, Texture Wall Surfacing Lab ID-Version‡: 8463431-1

Sample Layers	Asbestos Content
White Texture with Paint	ND
Sample Composite Homogeneity:	Good

Location: SVC-A-110-UC01-01, Undercoating on Sink Pan Lab ID-Version‡: 8463432-1

Sample Layers	Asbestos Content
Gray Sink Undercoating	ND
Sample Composite Homogeneity:	Good

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CHAIN OF CUSTODY

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S. San Francisco, CA: 6000
Shorline Ct. Ste 203, S. San Francisco, CA 94080 * (866) 888-6653

WEATHER	Fog	Rain	Snow	Wind	Clear
LEVEL: None					
Light					
Moderate					
Heavy					

CONTACT INFORMATION

Company: Landmark Environmental	7881 Shaffer PKWY, Littleton, CO 80127
Contact: Brandy Howard	Special Instructions:Email results to bhoward@landmarkenviro.com
Phone/Email:720-878-6475	

PROJECT INFORMATION

Project ID:17075.001.001	
Project Desc.:Moraine Park Discovery Ctr. RMNP	
Project Zip Code:	Sampling9-27-2017/ 0930 Date & Time:
PO Number:	

TURN AROUND TIME CODES - (TAT)

STD - Standard (DEFAULT)

ND - Next Business Day

SD - Same Business Day Rush

WH - Weekend/Holiday

Rushes received after 2pm or on weekends, will be considered received the next business day. Please alert us in advance of weekend analysis needs.

REQUESTED SERVICES (✓ Boxes)

Sample ID	Description	Sample Type (Below	TAT (Above)	Total Volume/Area (as	NOTES (Time of day, Temp, RH, etc.)	Non-Culturable: Spore Trap: Fungi - Spore Trap Analysis	Spore Trap: Spore Trap Analysis - Other particles	Tape Swab Bulk: Direct Microscopic Exam (Qualitative)	Tape Swab Bulk: Quantitative Spore Count Direct Exam	Culturable: BioCassette Andersen, SAS, Swab, Water, Bulk, Dust, Soil: 1-Media Surface Fungi (Genus ID + *Asp.* spp.)	2-Media Surface Fungi (Genus ID + *Asp.* spp.)	3-Media Surface Fungi (Genus ID + *Asp.* spp.)	Culturable Air Fungi (Genus ID + *Asp.* spp.)	Gram Stain and Counts (Culturable Air and Surface Bacteria)	*Legionella* culture	Total Coliform, *E.coli* (Presence/Absence)	Membrane Filtration (Please specify organism)	MPN Bacteria (Please specify organism)	QuantiTray - Sewage Screen	Other Requests: Asbestos Analysis - PCM Airborne Fiber Count (NIOSH 740	Asbestos Analysis - PLM (EPA method 600/R-93-116)	PCR (please specify test)
SVC-C-M3-BBA01-01	Baseboard Adhesive	B	ND	N/A	N/A																X	
SVC-A-109-CDW01-01	Composite Drywall / Joint Compound	B	ND	N/A	N/A																X	
SVC-A-122-CDW01-02	Composite Drywall / Joint Compound	B	ND	N/A	N/A																X	
SVC-C-M3-CDW02-01	Composite Drywall / Joint Compound	B	ND	N/A	N/A																X	
SVC-C-B1-CDW02-02	Composite Drywall / Joint Compound	B	ND	N/A	N/A																X	
SVC-B-102-CDW03-01	Composite Drywall / Joint Compound	B	ND	N/A	N/A																X	
SVC-B-106-CDW03-02	Composite Drywall / Joint Compound	B	ND	N/A	N/A																X	
SVC-A-113-CDW04-01	Composite Drywall / Joint Compound	B	ND	N/A	N/A																X	
SVC-A-114-CDW04-02	Composite Drywall / Joint Compound	B	ND	N/A	N/A																X	
SVC-C-AT-DS01-01	Duct Sealant	B	ND	N/A	N/A																X	
SVC-A-101-FM01-01	Flooring Mastic	B	ND	N/A	N/A																X	
SVC-B-102-FM02-01	Flooring Mastic	B	ND	N/A	N/A																X	
SVC-A-109-FTC01-01	Floor Tile and Mastic	B	ND	N/A	N/A																X	
SVC-A-122-FTC01-02	Floor Tile and Mastic	B	ND	N/A	N/A																X	
SVC-B-106-FTC02-01	Floor Tile and Mastic	B	ND	N/A	N/A																X	
SVC-A-112-IB01-01	Insulation Board with Sealant	B	ND	N/A	N/A																X	
SVC-A-112-IB01-02	Insulation Board with Sealant	B	ND	N/A	N/A																X	
SVC-B-103-LIP01-01	Lay-in Ceiling Panel	B	ND	N/A	N/A																X	
SVC-C-AT-RM01-01	Asphaltic Roofing Material	B	ND	N/A	N/A																X	
SVC-A-113-TS01-01	Textured Wall Surfacing	B	ND	N/A	N/A																X	
SVC-A-113-TS01-02	Textured Wall Surfacing	B	ND	N/A	N/A																X	
SVC-A-114-TS01-03	Textured Wall Surfacing	B	ND	N/A	N/A																X	
SVC-A-114-TS02-01	Textured Wall Surfacing	B	ND	N/A	N/A																X	
SVC-A-114-TS02-02	Textured Wall Surfacing	B	ND	N/A	N/A																X	
SVC-A-113-TS02-03	Textured Wall Surfacing	B	ND	N/A	N/A																X	
SVC-A-110-UC01-01	Undercoating on Sink Pan	B	ND	N/A	N/A																X	
		B	ND	N/A	N/A																X	
		B	ND	N/A	N/A																X	
		B	ND	N/A	N/A																X	
		B	ND	N/A	N/A																X	

SAMPLE TYPE CODES

BC - BioCassette™	**ST** - Spore Trap: Zefon, Allergenco, Burkard…	**T** - Tape	**D** - Dust
A1S - Andersen		**SW** - Swa	**SO** - Soil
SAS - Surface Air Sam	**P** - Potable Water	**B** - Bulk	
CP - Contact Plate	**NP** - Non-Potable Water	**O** - Other:	

RELINQUISHED BY	DATE & TIME	RECEIVED BY	DATE & TIME

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Attachment B

LEAD CONTAINING PAINT SAMPLE INFORMATION & ANALYTICAL RESULTS