

Hot Springs National Park
Hot Springs, Arkansas

**Rehabilitate Bathhouses
Buckstaff & Fordyce Bathhouses**

341 Central Avenue in Hot Springs, Arkansas 71901

PMIS 318915
Drawing No: 182951 Park No: 128

PROJECT SPECIFICATIONS



NATIONAL PARK SERVICE

Final Construction Document Submittal 10/27/2023

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PROJECT SPECIFICATIONS

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SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following:
 - 1. Work Covered by Contract Documents
 - 2. Contractor Use of Site
 - 3. Public Use of Site
 - 4. Occupancy Requirements for Buildings
 - 5. Conduct of Operations
 - 6. Work Restrictions
 - 7. Special Construction Requirements
 - 8. Additional Reports

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Location: The Buckstaff and Fordyce Bathhouses are located along Bathhouse Row on Central Avenue, located within the Hot Springs National Park. The park is located in downtown Hot Springs, Arkansas.
- B. The Work consists of:
 - 1. The work includes the removal and replacement of the Buckstaff and Fordyce Bathhouse roofs.
 - 2. Additional work for Buckstaff Bathhouse includes the removal and replacement of gutters, downspouts, counterflashing and flashing with in-kind materials. Limited exterior masonry repair to the coping caps. Installation of new equipment curb for equipment fan. Repair to original chimney caps.
 - 3. Additional work for Fordyce Bathhouse includes the removal and replacement of counterflashing and flashing with in-kind materials. Removal and replacement of select gutters and downspouts with in-kind materials. Limited exterior masonry repair to coping caps and repointing of select masonry.
- C. Project will be constructed under a single prime contract.
 - 1.

1.3 CONTRACTOR USE OF SITE

- A. General: Contractor shall have limited use of site for construction operations. Limit use of premises to areas within the Construction limits indicated on drawings. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine constructions operations to areas indicated on drawings. Elevators shall not be used by Contractor.

- B. Storage of Materials: Confine storage of materials to staging area shown on plans.
 - C. Parking: Parking on site is not permitted. Parking will be in public paid lots or public street parking only.
 - D. Stockpiling: Confine stockpiling to staging.
 - E. Preservation of Natural Features:
 1. Prevent damage to natural surroundings. Restore damaged areas, repairing or replacing damaged trees and plants, at no additional expense to the Government.
 2. Provide temporary barriers to protect existing trees and plants and root zones.
 3. Do not remove, injure, or destroy trees or other plants without prior approval. Consult with Contracting Officer (CO) and remove agreed-on roots and branches that interfere with construction.
 4. Do not fasten ropes, cables, or guys to existing trees.
 5. Carefully supervise excavating, grading, filling, and other construction operations near trees to prevent damage.
 - F. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Government employees, and emergency vehicles at all times. Do not use 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.
 3. A drop-off zone near the Fordyce and Buckstaff buildings may only be used to load/unload materials for brief periods of time. Contractors may not park or leave vehicles unattended in this drop-off area. This area serves as drop-off for adjacent bathhouse businesses and clients for loading and unloading materials and persons.
 - G. Construction Camp: Establishment of a camp within park will not be permitted.
 - H. Hauling Restrictions: Comply with legal load restrictions in hauling of materials. Load restrictions on park roads are identical to state load restrictions with such additional regulations as may be imposed by the Park Superintendent. Information regarding rules and regulations for vehicular traffic on park roads may be obtained from the Office of the Park Superintendent. A special permit will not relieve Contractor of liability for damage which may result from moving of equipment.
 - I. Bridge Restrictions: Identify jurisdictions, load restrictions, permit requirements, time and calendar restrictions as outlined.
 - J. Elevators:
- 1.4 PUBLIC USE OF SITE
- A. Contractor shall conduct his operations to ensure the least inconvenience to public. **Sidewalk** closures may be permitted, when required, upon specific approval of Contracting Officer for a maximum of two hours.

1.5 OCCUPANCY REQUIREMENTS FOR BUILDINGS

A. Existing Buildings

1. Full Government Occupancy: Government will occupy buildings under construction during the entire contract period. Cooperate with Government during construction operations to minimize conflicts and facilitate Government usage. Perform Work so as not to interfere with Government's day-to-day operations. Maintain existing exits, unless otherwise indicated.
 - a. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Contracting Officer.
 - b. Maintain existing building in weather tight condition throughout construction period. Repair damage caused by construction operations. Protect buildings and occupants during construction period.

1.6 CONDUCT OF OPERATIONS

- A. Contractor shall conduct his operations in conformance with rules and regulations promulgated by the Secretary of the Interior for the National Park Service, and applicable park rules and regulations prescribed by Park Superintendent.
- B. Work on Saturdays, Sundays, Federal holidays or at night may not be performed unless stated in the Work Restrictions below or without prior consent from the Contracting Officer. Submit requests 3 business/calendar days in advance of the work to the Contracting Officer for approval.
- C. No signs or advertisements (except those specified herein) shall be displayed on the construction site or within the park unless approved by the Contracting Officer.

1.7 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except when otherwise indicated.
 1. Weekend Hours: As approved by Contracting Officer.
 2. Early Morning Hours: As approved by Contracting Officer.
 3. Hours for Noisy Activities: 9 am to 5 pm. The Fordyce and Buckstaff Bathhouses are adjacent to several hotels, so the Contractor will be expected to respect the adjacent hotel quiet hours.
- B. Existing Utilities
 1. Existing Utilities: Notify Contracting Officer and utility companies of proposed locations and times for excavation.
 2. Contractor shall be responsible for locating and preventing damage to known utilities. If damage occurs, repair utility at no additional expense to the Government.
 3. If damage occurs to an unknown utility, repair utility. An equitable adjustment will be made in accordance with the Changes clause of the contract.

- C. Nonsmoking Building/Tobacco Use/Vaping: Smoking is not permitted within building or within 25 feet of entrances, operable windows, or outdoor air intakes.

1.8 SPECIAL CONSTRUCTION REQUIREMENTS

- A. Project Website: A project website administered by NPS will be used for purposes of managing communication and documents during construction stage.
- B. Contractor responsible for establishing fire sharing website for the purposes of managing communication and documents during construction stage.
 - 1. See Section 01 31 00 "Project Management and Coordination" for requirements for Contractor to establish a fire sharing website.

1.9 ADDITIONAL REPORTS

- A. The report Asbestos and Lead-Containing Paint Inspection Report Buckstaff Bathhouse - Roof, September 22, 2023 prepared by Terracon is in Appendix A with this package.
- B. The report Asbestos and Lead-Containing Paint Inspection Report Fordyce Bathhouse - Roof, September 22, 2023 prepared by Terracon is in Appendix B with this package.
- C. In case of conflict between report and drawings or specifications, 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. 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 of a contractor's projects and not attributable to a specific job. The cost for home office overhead is only allowed as a percentage of all direct work excluding profit. The following items represent allowable home office overhead costs identified in Part 31 of the Federal Acquisition Regulation (FAR):

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

- B. General Conditions (Field Office Overhead): Management and administrative costs incurred on site for the designated project. Costs associated with 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 actually present and working on 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; includes 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. Performance and Payment Bonds: A performance bond is a surety bond issued by an insurance company or bank to guarantee satisfactory completion of a project. The Payment Bond guarantees the Contractor will pay the labor and material costs incurred. Banks and Insurance companies charge a premium for individual project based on a sliding scale related to the size of the project. Include as a separate line item in modification proposals and provide current company bonding rates upon request.
- 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. 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 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 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 insurances, 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. 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 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 31 which have been applied to the specific type of work included in this project. Negotiated rates shall not exceed the following percentages for OH&P for contractor self-performed work:

Overhead.....10%
Profit.....10%

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 0001 Maurice Site and Utility Work
 - 1. This item consists of Maurice Bathhouse site and utility work.
 - 2. Payment will be made at the contract lump sum price.
- B. Contract Line Item Number 0002 Maurice Exterior Work
 - 1. This item consists of Maurice Bathhouse exterior work: shell repairs, rehabilitation, and painting; roofing replacement (and related hazmat abatement); sunporch windows and entrance replacement; west elevation window replacement; and installation of interior storm windows.
 - 2. Payment will be made at the contract lump sum price.
- C. Contract Line Item Number 0003 Maurice Interior Work
 - 1. This item consists of Maurice Bathhouse interior work: selective demolition; replacement of mechanical, electrical, plumbing, and fire alarm systems; installation of fire protection system; interior repairs; restoration of historic rooms.
 - 2. Payment will be made at the contract lump sum price.
- D. Option 1 – Fordyce Bathhouse Main Roof Replacement
 - 1. Contract Line Item Number 004
 - a. This item consists of Fordyce Bathhouse roofing replacement.
 - b. Payment will be made at the contract lump sum price.
- E. Option 2 – Fordyce Bathhouse Clay Roof Repairs
 - 1. Contract Line Item Number 005

- a. This item consists of additional Fordyce Bathhouse clay roof repairs.
 - b. Payment will be made at the contract lump sum price.
- F. Option 3 – Buckstaff Bathhouse Roof Replacement
 - 1. Contract Line Item Number 006
 - a. This item consists of Buckstaff Bathhouse roofing replacement and related work.
 - b. Payment will be made at the contract lump sum price.
- G. Option 4 – Mothball Libbey Bathhouse
 - 1. Contract Line Item Number 007
 - a. This item consists of Mothballing the Libbey Bathhouse. Base scope includes temporary HVAC, and minimum egress lighting, power and fire alarm. Demolition of all non-historic interior full height walls. Hazardous material removal where work is being performed. Exterior utility replacement including underground storm, gas, fire service, sanitary, water supply, electrical, etc. Temporary attic insulation and ceiling patches. Structural reinforcement. Exterior door improvements.
 - b. Payment will be made at the contract lump sum price.
- H. Option 5 – Libbey Bathhouse Exterior Stone and Stucco Repairs
 - 1. Contract Line Item Number 008
 - a. This item consists of exterior stone and stucco repairs to the Libbey Bathhouse.
 - b. Payment will be made at the contract lump sum price.
- I. Option 6 – Libbey Bathhouse Roof Edge Drainage Repairs and Replacement
 - 1. Contract Line Item Number 009
 - a. This item consists of exterior roof edge drainage repairs and replacement at the Libbey Bathhouse.
 - b. Payment will be made at the contract lump sum price.

END OF SECTION 01 27 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Definitions
 - 2. Construction Coordination
 - 3. Submittals
 - 4. Coordination Drawings
 - 5. Requests for Information (RFIs)
 - 6. NPS/DSC Project Website
 - 7. Project Meetings
 - 8. Environmental Coordination
 - 9. Permits

- B. Related Requirements:
 - 1. Section 01 32 16 "Construction Schedule" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01 35 13.22 "Archeological Protection" for Contractor's responsibility for protecting archeological resources contained in soil deposits. Contractor is solely responsible for the scheduling, payment, and coordination of archeological monitoring and coordinating site visits with the Contracting Officer.
 - 3. Section 01 73 40 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 4. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.
 - 5. Section 01 91 14 "Total Building Commissioning" for coordinating the work with Owner's Commissioning Authority.
 - 6. All Specifications and Appendices in Project Manual related to abatement and safe work practices for hazardous materials.

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 with required Archeological Protection in Section 01 35 13.22.
 3. Coordinate with hazardous materials abatement, outlined in the Project Manual. Contractor to alert Contracting Officer if unforeseen suspect hazardous materials are discovered.
 4. Coordinate installation of different components with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.
 5. Make provisions to accommodate items scheduled for later installation.
 6. 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.
 7. Properly plan construction operations to include permit requirements. Allow enough time to execute permit provisions to maintain work schedule, site visits, inspections, and reporting deadlines.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to:
1. Preparation of Contractor's Construction Schedule
 2. Preparation of the Schedule of Values
 3. Installation and removal of temporary facilities and controls
 4. Delivery and processing of submittals
 5. Progress meetings
 6. Permit requirements
 7. Pre-installation conferences
 8. Project closeout activities
 9. Commissioning activities

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of Contract Documents or standard printed data. Include following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on 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.
 3. Follow NPS DSC Electronic Drawing Standards. See [CAD/BIM \(Computer Aided Design/Building Information Modeling\) & Drafting Standards](#) page DSC Requirements section.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural, structural, mechanical, plumbing, fire-protection, fire-alarm, and electrical 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.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches (32 millimeters) 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 Contractor's responsibility. If Contracting Officer determines coordination drawings are not prepared in scope or detail, or are otherwise deficient, Contracting Officer will inform 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."

C. 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 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.

D. Division 1 documents:

1. Letter designating Project Superintendent
2. Construction 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 or UPPP)
11. Indoor Air Quality (IAQ) Management Plan
12. Contractors 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 Government to complete permit application

E. 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 cancelled, 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 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, Contractor shall prepare and submit an RFI utilizing form created on NPS/DSC management software-website.

1. Contracting Officer will not respond to RFIs submitted by other entities controlled by Contractor.

2. Coordinate and submit RFIs in a prompt manner to avoid delays in the work.
- B. Content of 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. Contractor's suggested resolution: If Contractor's suggested resolution impacts Contract Time or Contract Sum, Contractor shall state impact in RFI.
 8. Contractor's signature
 9. Requested date for response
 10. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Form: Complete RFI Form on NPS/DSC Project Website as follows:
1. Enter general information at the top of the form.
 2. Under the "Action" section at the bottom of the form, select "Question" then select "CMR" in drop-down of "Send to" box.
 3. Enter details of question and attach related documents.
 4. Select "Submit Form" at bottom of page.
- D. Contracting Officer's Action: Contracting Officer will review each RFI, determine action required, and respond. Contracting Officer will determine 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 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 following terms and conditions of contract.

1.6 PROJECT ~~WEB SITE~~ FILE SHARING

- A. NPS to provide online SharePoint for file sharing or Contractor to provide management software website for communication throughout contract period. File sharing management software must

be able to be accessed by Government and approved by the Contracting Officer. Fire Sharing software must allow for the following:

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. Drawing and specification document hosting, viewing, and updating
12. Online document collaboration
13. Reminder and tracking functions
14. Archiving functions
15. Notification of submittal and RFI statuses and current responsible party
16. Permits and addendums
- 17.

- B. Some documents are not suitable to be shared using the management software website. Documents containing Personal Identifying Information (PII) (i.e. certified payrolls) shall not be shared using management software website and shall be coordinated with Project team as appropriate.
- C. Submit to Contracting Officer a list of employees who will need access to the website.
- D. Contractor shall provide computers and online access for all project management and project engineers and superintendents, for them to access the online shared files.

1.7 PROJECT MEETINGS

- A. Preconstruction Conference: Before start of construction, Contracting Officer will arrange an on-site meeting with Contractor. Meeting agenda will include the following as a minimum:
1. Roles & Responsibilities / Lines of Authority
 2. Park rules and regulations
 3. Jobsite Safety
 4. Resolution of comments on required Division 1 documents
 5. Coordination of Subcontractors
 6. Labor law application
 7. Modifications
 8. Payments to Contractor
 9. Payroll reports
 10. Contract time
 11. Liquidated damages
 12. Contractor Performance Evaluation
 13. Display of Hotline posters
 14. Notice to proceed
 15. Correspondence procedures
 16. NPS/DSC Project website
 17. Acceptance/rejection of work
 18. Progress meetings
 19. Submittal procedures

20. NPS Final Accessibility Inspection
21. Environmental requirements
22. Permit requirements
23. As-constructed drawings/operation and maintenance (O&M) manuals.
24. Saturday, Sunday, holiday and night work.
25. Reference materials
26. Value engineering
27. Schedule of Values

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

1. Attendees: In addition to Government Representatives, each Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented. Participants at meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. 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 meeting. Advise 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. Sustainable design requirements.
 - i. Review of mockups
 - j. Possible conflicts
 - k. Compatibility requirements
 - l. Time schedules

- m. Weather limitations
 - n. Manufacturer's written instructions
 - o. Warranty requirements
 - p. Compatibility of materials
 - q. Acceptability of substrates
 - r. Temporary facilities and controls
 - s. Space and access limitations
 - t. Regulations of agency(ies) with jurisdiction
 - u. Testing and inspecting requirements
 - v. Installation procedures
 - w. Coordination with other work
 - x. Required performance results
 - y. Protection of adjacent work
 - z. Protection of construction and personnel
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene conference at earliest feasible date.

1.8 ENVIRONMENTAL COORDINATION

- A. Contractor's Environmental Manager: Designate on-site party responsible for overseeing 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; [familiarity with Environmental Management Systems (EMSs) such as International Organization for Standardization (ISO) 14001]; 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 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. Contractor's Environmental Training Program: 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 Contractor 40 CFR (Code of Federal Regulations) employee training records upon request of Contracting Officer.
- D. Provide documentation for environmental procedures as specified herein and in accordance with approved Waste Management Plan, IAQ Management Plan, and Storm Water Pollution Prevention Plan.

1.9 PERMITS

A. General:

1. Permits and Responsibilities: 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. Contractor shall also be responsible for damages to persons or property that occur as a result of 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, Contractor will not be considered an agent of the Government. Contractor shall comply with appropriate Federal, State and local laws.

- B. 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 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 Contractors' responsibility to determine means and methods and obtain required permits. Contractor shall obtain all permits required to legally conduct work.

1. Electrical Utility Hookup – **Entergy Arkansas, Inc.**
2. Gas Utility Hookup – **Summit Utilities**
3. Sewer Hookup – **City of Hot Springs**
4. New Water Meter - **City of Hot Springs**
5. Construction trailer, Utilities hookup permit – **N/A**
6. New Stationary Air Pollution Source – **N/A**
7. Street Closure – **N/A**
8. Stormwater Pollution Prevention Permit – **City of Hot Springs**
9. MS4 Stormwater Permit – **N/A**
10. Dewatering Permit – **Covered under #8**

- C. Coordination with Agency(ies) with Jurisdiction Issuing Permits

1. Coordination: Contact the Agency(ies) with Jurisdiction as needed and sufficiently in advance to avoid delaying work: Coordinate meetings, reporting requirements, inspections, and other requirements.

D. Administrative Procedures:

1. Coordinate scheduling and timing of required administrative provisions of project permits with Agency(ies) with Jurisdiction, Construction Manager, and Park to avoid conflicts.
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/DSC management software website when permits are obtained.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 16 – CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section consists of Construction Schedule requirements including:
 - 1. Schedule of Values
 - 2. Construction Schedule Requirements.
 - 3. Construction Schedule Updates.
 - 4. Time Impact Analysis.
- B. Purpose: The Construction Schedule ensures adequate planning, coordination, scheduling, testing, and reporting during execution of the work by the Contractor. It shall assist the Contractor and Contracting Officer (CO) in monitoring the progress of the work, evaluating proposed changes, and processing Contractor's monthly progress payments. It shall include the dates in the contract, phases, milestones, occupancies, holidays, weather consideration, a critical path, and the requirements of this section.

1.2 DEFINITIONS

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

- F. Resource Loading: Allocation of manpower and equipment necessary for completion of an activity as scheduled.
- G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

1.3 SUBMITTALS

- A. Electronic Copies: Schedules and reports submitted shall be posted on the **selected file sharing** management software website in native electronic file formats. The intent of the Government is to limit the number of printed reports to those determined by the project team as essential.
- B. Schedule of Values: After contract award and before Pre-Construction conference, submit schedule of dollar values based on Contract Price Schedule.
- C. Construction Baseline Schedule: After contract award and before Pre-Construction conference, submit electronic copy of the baseline schedule, large enough to show entire schedule for entire construction period. Utilize Schedule of Values in preparation of Construction Baseline Schedule.
- D. Critical Path Method (CPM) Reports: Concurrent with CPM schedule, submit electronic copy of the following computer-generated reports. For each activity, include activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of predecessor and successor tasks for activities sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of activities sorted in ascending order of total float.
- E. Construction Schedule Updates: On or before 7th day preceding progress payment request date, submit estimates of percent completion of each schedule activity and necessary supporting data. Provide two paper copies.
- F. Construction Schedule Revisions and Time Impact Analysis: For each Construction Schedule revision, submit electronic copy of a Time Impact Analysis. Incorporate a Fragmentary Network (Fragnet) into currently accepted Construction Schedule that demonstrating how Contractor proposes to incorporate a modification, change, delay, or Contractor request.

1.4 QUALITY ASSURANCE

- A. Contractor shall meet with Contracting Officer on day of the preconstruction conference to go over:
 - 1. Review software limitations, content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including work interim milestones, ground disturbing activities, and critical utility work, including shutdowns.
 - 4. Review delivery dates for Government-furnished products.
 - 5. Review schedule for work of separate Government contracts.
 - 6. Review time required for review of submittals and re-submittals.

7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review time required for obtaining and activating permits.
10. Review and finalize list of construction activities to be included in schedule.
11. Review baseline schedule comments, resolve issues and progress on incorporating them
12. Review procedures for updating schedule.
13. Discuss reporting requirements and establish protocol for naming and transmitting electronic schedules.
- 14. Discuss requirements for archeological monitoring during all ground-disturbing activities.**

- B. Contractor's Schedule Representative: Before the preconstruction conference, designate an authorized representative to be responsible for preparing and maintaining the Construction Schedule. Submit resume outlining qualifications of Scheduler to Contracting Officer for acceptance. Scheduler shall have prepared and maintained at least 5 previous schedules of similar size and complexity similar to this Contract, demonstrating proficiency of using scheduling software. Authorized representative will be responsible for preparing the Baseline Schedule, required updates, revisions, Time Impact Analyses, and reports.

1.5 COORDINATION

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

PART 2 - PRODUCTS

2.1 SCHEDULE OF VALUES

- A. Breakdown each lump-sum item into component work activities used in the schedule for which progress payments may be requested. Work activities broken out within schedule of values shall be integrated into and made a logical part of the construction baseline schedule. Total costs for the component work activities shall equal contract price for that lump-sum item. Contracting Officer may request data to verify accuracy of dollar values. Include mobilization, general condition costs, overhead and profit in the total dollar value of unit price items and in the component work activities for each lump-sum item. Do not include mobilization, general condition costs, overhead or profit as a separate item.
- B. Do not break down unit price items. Use only the contract price for unit price items.
- C. Total cost of all items shall equal the contract price. The Schedule of Values will form the basis for progress payments and the Construction Schedule.

2.2 CONSTRUCTION SCHEDULE REQUIREMENTS

- A. Construction Baseline Schedule: Prepare Construction Baseline Schedule using a computerized, cost and resource-based, time-scaled Critical Path Method network analysis diagram for the Work.
1. Develop and finalize Construction Baseline Schedule so it can be accepted for use no later than **30** days after date established for the Notice of Award.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing work within applicable completion dates, regardless of Governments acceptance of schedule.
 2. Establish procedures for monitoring and updating Construction Baseline Schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
- B. Construction Baseline Schedule Preparation: Prepare a list of all activities required to complete the Work. Using preliminary Critical Path Method network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate estimated duration, sequence requirements, and relationship of each activity in relation to other activities.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the Critical Path Method schedule within the limitations of the Contract Time.
 4. Show sequence and interdependence of activities required for completion of work. Ensure work sequences are logical and Construction Baseline Schedule shows a coordinated plan of the work.
 5. Resource loading of each activity shall include personnel by labor category and equipment type and capacity proposed to complete the activity in duration shown.
 6. Consider seasonal weather conditions in planning and scheduling work influenced by high and low ambient temperatures, wind, or precipitation to ensure completion of work within contract time.
 7. Time Frame: Proposed duration assigned to each activity shall be Contractor's best estimate of time required to complete activity considering the scope and resources planned for activity.
 - a. An early finish date may be shown but the late finish date shall be same date as last day of contract period. An early completion schedule shall contain:
 - 1) Insert an activity titled "Project Float" as a successor to last activity in early project completion schedule network.
 - 2) Add a milestone titled "Contract End Date" as a successor to the activity "Project Float".
 - 3) Add duration to the activity "Project Float" as required so the milestone "Contract End Date" equals the last day of Contract Period.
 - b. Contract completion date shall not be changed by submission of a schedule that shows an early completion date.
 - c. Contractor shall limit use of lead or lag duration's between schedule activities.
 - d. Project Calendars: Develop and incorporate the following calendars:

- 1) Administrative Calendar: Include calendar based on a 7-day week to be used on activities based on calendar days. Apply this calendar to administrative tasks or other tasks not affected by non-working days (Federal Holidays, weather, etc.).
 - 2) Project Calendar: Include calendar based on planned work week for the project. Include Federal Holidays, weekends, and non-workdays indicated in contract documents. Apply this calendar to activities not anticipated to be affected by weather. Be clear when identifying number of work days in work week.
 - 3) Weather Calendar: Utilize Project Calendar and show anticipated normal downtime related to weather as non-working time. Weather days shall be based on data for local area from a reliable source like the National Oceanic and Atmospheric Administration (NOAA), National Park Service records, or source acceptable to Contracting Officer. Apply this calendar to activities anticipated to be affected by weather.
- e. Activity Duration: Define so no activity is longer than 14 days, except for non-construction activities including mobilization, shop drawings and submittals, fabrication and delivery of materials and equipment.
 - f. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 calendar days, as separate activities in the schedule. Procurement cycle activities can include submittals, approvals, purchasing, fabrication, and delivery.
 - 1) Chiller
 - 2) Boilers
 - 3) Air Handling Units
 - 4) Electrical Panelboards
 - g. Submittal Review Time: Include review and re-submittal times indicated. Coordinate submittal review times in Construction Baseline Schedule.
 - h. Startup and Testing Time: Include not less than 30 days for startup and testing and commissioning activities.
 - i. Substantial Completion: Allow time for Government administrative procedures necessary for certification of Substantial Completion. (For more information, refer to Specification 01 77 00 "Closeout Procedures.")
8. Constraints: Include constraints and work restrictions indicated in Contract Documents and as follows in schedule and show how the sequence of Work is affected.
 - a. Phasing: Arrange list of activities on schedule by phase.
 - b. Work under More Than One Contract: Include a separate activity for each contract.
 - c. Work Restrictions: Show effect of the following on the schedule:
 - 1) Coordination with existing construction
 - 2) Limitations of continued occupancies
 - 3) Uninterruptible services
 - 4) Partial occupancy before Substantial Completion
 - 5) Use of premises restrictions
 - 6) Provisions for future construction
 - 7) Seasonal variations
 - 8) Environmental control
 - 9) Permit provisions
 - d. Other Constraints: Archeological monitoring required for all ground-disturbing activities.

e. Work Stages: Indicate important stages of construction for each major portion of the Work.

- 1) Subcontract awards
- 2) Submittals
- 3) Purchases
- 4) Mockups
- 5) Fabrication
- 6) Sample testing
- 7) Deliveries
- 8) Installation
- 9) Tests and inspections
- 10) Adjusting
- 11) Curing
- 12) Building flush-out.
- 13) Building commissioning activities.

9. Milestones: Include milestones indicated in Contract Documents in schedule, including, but not limited to, Notice to Proceed, Substantial Completion.

C. Joint Review, Revision, and Acceptance:

1. Within seven calendar days of receiving Contractor's proposed Construction Baseline Schedule, Contracting Officer shall review initial Construction Baseline Schedule.
2. Within seven calendar days after review, Contractor shall revise and resubmit Construction Baseline Schedule in accordance with comments presented from review.
3. In the event the Contractor fails to define any element of work, activity, or logic, and the Contracting Officer review does not detect this omission or error, such omission or error, when discovered by Contractor or Contracting Officer, shall be corrected by Contractor within seven calendar days and shall not affect contract period.
4. Upon acceptance of the Construction Baseline Schedule, Contracting Officer saves schedule as a baseline and updates on a monthly basis. Construction schedule update will be used to evaluate Contractor's monthly applications for payment based upon information developed at monthly Construction Schedule update meeting.

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

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

E. Recovery Schedule: When periodic schedule update indicates Work is 14 or more calendar days behind current accepted schedule, a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule shall also be submitted. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery shall be accomplished.

- F. Computer Software: Prepare schedules using a program developed specifically to manage construction schedules.
 - 1. Use Microsoft Project or Primavera, or program approved by Contracting Officer.

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE UPDATES

- A. Progress Meeting Updates: Provide a 2 week look-ahead schedule, derived from the currently accepted schedule, before each weekly progress meeting. Utilize look-ahead schedule to facilitate and take notes on discussions held during progress meeting.
- B. Monthly Schedule Updates:
 - 1. General: Update Construction Schedule on monthly basis to reflect construction progress and activities throughout entire contract period and until project substantial completion. The status date of each schedule update shall be the 7th day preceding the progress payment request date.
 - 2. Procedure: Contractor shall meet with Contracting Officer each month at Construction Schedule update meeting to review progress made through the status date of the Construction Schedule update, including dates activities were started or completed and percentage of work completed on each activity started or completed.
 - 3. Reports: Concurrent schedule revisions, prepare tabulated reports showing:
 - a. Identification of activities that have changed
 - b. Changes in early and late start dates
 - c. Changes in early and late finish dates
 - d. Changes in activity durations in workdays
 - e. Changes in the critical path
 - f. Changes in total float or slack time
 - g. Changes in the Contract Time
 - 4. Narrative: Report shall include a brief description of actual progress made during update period; actual and potential delaying activities; impediments to progress; issues related to inclement weather; progress toward established milestones and project float. Report shall include a brief description of work anticipated to be performed in the next month. Minor revisions to the schedule should be identified for evaluation and acceptance or rejection.
 - 5. As Work progresses, indicate Actual Completion percentage for each activity.
 - 6. If schedule update shows a late finish date after contract completion date, include:
 - a. Known delays
 - b. Actions to get back on schedule
 - c. Pending modifications
 - d. Impediments or constraints affecting progress
 - 7. Progress Payments: Monthly updating of the currently accepted Construction Schedule shall be an integral part of the process upon which progress payments will be made. If Contractor fails to provide schedule updates or revisions, a portion of the monthly payment may be retained until corrections have been made.
- C. Distribution: Distribute copies of accepted schedule to Contracting Officer, Contracting Officers Representative, Construction Management Representative, Subcontractors, testing and

inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to same parties and post in same locations. Delete parties from distribution when they have completed their assigned portion of the Work.

D. Construction Schedule Revisions:

1. Required Revisions: If, as a result of the monthly schedule update, it appears the currently accepted Construction Schedule no longer represents actual prosecution and progress of the work, Contracting Officer will request, and Contractor shall submit, a revision to the Construction Schedule. Contractor may also request reasonable revisions to currently accepted Construction Schedule in event the Contractor's planning for the work is revised. If Contractor desires to make changes, Contractor shall notify Contracting Officer in writing, stating reason for proposed revision. Accepted revisions shall be incorporated into currently accepted Construction Schedule for next monthly schedule update.
2. Procedure: If revision to currently accepted Construction Schedule is contemplated, Contractor or Contracting Officer shall advise the other in writing at least seven calendar days prior to next monthly schedule update meeting, describing revision and reasons for the revision. Government-requested revisions will be presented in writing to the Contractor, who shall respond in writing within seven calendar days.
3. Reports: Concurrent with making revisions to schedule, prepare tabulated reports showing:
 - a. Identification of activities changed
 - b. Changes in early and late start dates
 - c. Changes in early and late finish dates
 - d. Changes in activity durations in workdays
 - e. Changes in critical path
 - f. Changes in total float or slack time

3.2 TIME IMPACT ANALYSIS FOR CONTRACT MODIFICATIONS CHANGES DELAYS AND CONTRACTOR REQUESTS:

1. Requirements: When contract modifications or changes are initiated, delays experienced, or Contractor desires to revise currently accepted Construction Schedule, Contractor shall submit to Contracting Officer a written time impact analysis illustrating the influence of modification, change, delay, or Contractor request on contract time.
2. Time Extensions: Activity delays, resulting in a late completion date projection, shall not automatically mean an extension of contract time is warranted or due to Contractor. It is possible a modification, change, or delay will not affect existing critical path activities or cause non-critical activities to become critical. A modification, change, or delay may result in absorbing a part of available total float that may exist within an activity chain of the Schedule, not causing any effect on contract time. Time extensions will be granted in accordance with terms of contract.
3. Extension of contract time will be granted only to the extent the equitable time adjustments to activity or activities affected by modification, change, or delay exceeds total (positive or zero) float available on a particular activity.
4. Procedure: Each time impact analysis shall be submitted within time period stated in a request for proposal, or time period designated under the clauses entitled Changes or Default. In cases where Contractor does not submit a written request for extension of time and a time impact analysis within the designated time, it is mutually agreed that the particular modification, change, delay, or Contractor request does not require an extension

of the contract time. Upon acceptance, time impact analysis shall be incorporated into currently accepted Construction Schedule at next monthly schedule update.

5. Contract Modifications: Prepare time-impact analysis using fragnets to demonstrate effect of proposed change on overall Construction Schedule for each proposed contract modification concurrent with submission.

END OF SECTION 01 32 16

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 77 00 "Closeout Procedures" for a complete listing of closeout documents.
- C. See Section 01 79 00 "Demonstration and Training" for submitting videotapes 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) and on the project's file sharing website in a separate zipped folder.
 - 1. Provide index as separate. 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. Media: DVD-R Archival Gold
- B. Media Labels: Archival DVD labeling markers, archival labels, or direct print.
- C. 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).

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 starting construction, take color digital images of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
 - 1. Flag/stake excavation areas before recording construction images.
 - 2. Take enough images to accurately reflect all of the existing conditions of the building site within the construction limits. A minimum of 200 separate images will be acceptable.
 - 3. Also provide separate images to show existing conditions adjacent to properties before starting Work. Provide a minimum of 50 separate images.
- C. Periodic Construction Images: Take a minimum of fifty (50) color, digital images weekly, with timing each month adjusted to coincide 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.
- E. Progress Payment Requirements:
 - 1. With each Application for Payment, submit photo documentation, per the requirements in this Section.
 - 2. Payments may be withheld if requirements are not met. Progress payment applications may be rejected if requirements are not met.

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.
- B. Contractor is responsible for all testing costs, coordination, and corrective action for all work performed as part of this project.

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. Fire Sharing Website: Communications protocol that enables transfer of electronic files and photographs from one user to another over a network that serves as the basis for standard internet usage. A fire sharing website 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 time for submittal review, including time for re-submittals, as follows. Time for review shall commence when e-mail notification is received by Contracting Officer (or designee) indicating submittal has been posted on NPS management software website and is ready for review. When Contracting Officer has completed review, e-mail notification will be sent to Contractor indicating submittal has been processed. No extension of Contract Time will be authorized because of failure to transmit submittals in advance of Work to permit processing, including re-submittals.
1. **Action Submittals**
 - a. **Initial Review:** Allow 21 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.
 - b. **Re-submittal Review:** Allow 21 days for review of each re-submittal.
 2. **Informational submittals**
 - a. **Review:** Allow 10 days for review of each submittal.
- E. **Approved Equals:**
1. For each item proposed as an "approved equal," submit supporting data, including:
 - a. Drawings and samples as appropriate.
 - b. Comparison of the characteristics of the proposed item with that specified.
 - c. Changes required in other elements of the work because of the substitution.
 - d. Name, address, and telephone number of vendor.
 - e. Manufacturer's literature regarding installation, operation, and maintenance, including schematics for electrical and hydraulic systems, lubrication requirements, and parts lists. Describe availability of maintenance service, and state source of replacement materials.
 2. A request for approval constitutes a representation that Contractor:
 - a. Has investigated the proposed item and determined that it is equal or superior in all respects to that specified.
 - b. Will provide the same warranties for the proposed item as for the item specified.
 - c. Has determined that the proposed item is compatible with interfacing items.
 - d. Will coordinate 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. **Electronic Submittals:** Identify and incorporate information in each electronic submittal file as follows:
1. **Transmittal Form (CM-16):** All submittals shall be transmitted using National Park Service Transmittal Form (CM-16). The form can be downloaded from the DSC Workflows website's [Submittal Review](#) page and completed on the NPS/DSC management software website. No action will be taken on a submittal item unless accompanied by this

Transmittal Form.

- a. Complete the general information at the top of form.
 - b. Provide all required information based on submittal type
 - c. Attach all related documents.
 - d. Sign the Contractor section at bottom of the Transmittal Form (CM-16).
2. Physical samples: Complete Transmittal Form (CM-16) on the NPS/DSC management software website as described above. Deliver physical sample to the Contracting Officer (or designee) on site for processing. All comments and actions will be documented on the Transmittal Form (CM-16) on the NPS/DSC management software website.
- G. Identification: Submittal number or other unique identifier, including revision identifier.
1. Submittal number shall use a sequential number (e.g. .001). Re-submittals shall include 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 "Approved" or "Approved with notations".
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and others as necessary for performance of construction activities.
- J. Use for Construction: Use only final submittals with mark indicating "Approved" or "Approved with notations". Ensure notations have been incorporated and, at a minimum, keep one copy of final approved submittal on site for use during construction.
- 1.4 CONTRACTOR'S USE OF CAD/BIM FILES
- A. General: At Contractor's written request, copies of CAD (Computer Aided Design)/BIM (Building Information Modeling) files will be provided to Contractor for Contractor's use in connection with Project, subject to:
1. Files are to be provided as is; no format or other changes to files or changes to objects in the drawing will be done by the Government or Designers.

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.
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/DSC management 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 **two** 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 two sets of Samples. Contracting Officer will retain one Sample sets; remainder will be returned. Retain Sample set as a Project Record Sample.
- D. Construction Materials: Contractor is encouraged to submit products made out of recycled or environmentally responsible material. Every effort will be made by National Park Service to approve these materials.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by individual Specification Sections.
 1. Post informational submittals as PDF electronic files directly to the NPS management software website.
 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. Coordination Drawings: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."
- C. Contractors Construction Schedule: Comply with requirements specified in Section 01 32 16 "Construction Schedule."
- D. Accident Prevention Plan: Comply with requirements specified in Section 01 35 23 "Safety Requirements."
- E. Schedule of Values: Comply with requirements specified in Section 01 32 16 "Construction Schedule."
- F. Waste Recycling Plan: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

- G. Quality Control Plan: Comply with requirements specified in Section 01 40 00 "Quality Requirements."
- H. 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."
- I. Indoor Air Quality Management Plan: Comply with requirements specified in Section 01 57 19.11 "Indoor Air Quality Management."
- J. Leadership in Energy and Environmental Design (LEED™) Submittals: Comply with requirements specified in Section 01 81 13.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations," Section 01 81 13.16 "Sustainable Design Requirements - LEED for Commercial Interiors," Section 01 81 13.19 "Sustainable Design Requirements - LEED for Core and Shell Development," and Section 01 81 13.23 "Sustainable Design Requirements - LEED for Schools."
- K. Qualification Data: Prepare written information 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.
- L. 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.
- M. 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.
- N. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying manufacturer complies with Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Prepare written statements on manufacturer's letterhead certifying product complies with Contract Documents.
- P. Material Certificates: Prepare written statements on manufacturer's letterhead certifying material complies with Contract Documents.
- Q. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in Contract Documents.
- R. 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 agency, or on comprehensive tests performed by a qualified testing agency.
- S. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

- T. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in Contract Documents.
- U. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- V. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in Contract Documents.
- W. 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."
- X. 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.
- Y. 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.
- Z. 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.
- AA. Permit Compliance Products: Prepare required information for compliance with permit provisions. Products include written notification of project startup, suspension, and completion of work; photo documentation of site conditions; reports; and drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

3.2 CONTRACTING OFFICER'S ACTION

- A. General: Submittals will be disapproved without technical review if identification information is missing, not filled in, or if placed on 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 Contractor's approval.
 - 1. Any work done or orders for materials or services placed before approval shall be at 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. APPROVED: Acceptable with no corrections.
 - 2. APPROVED WITH NOTATIONS: Minor corrections or clarifications required. Comments are clear and no further review is required. 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. Contractor shall revise and resubmit with changes clearly identified.
- C. Informational Submittals: Contracting Officer will review each submittal and will either accept or reject it.
- D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

END OF SECTION 01 33 23

SECTION 01 35 13.22 – ARCHEOLOGICAL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section consists of Contractor responsibility for protecting archeological resources contained in soil deposits. Contractor is solely responsible for the scheduling, payment, and coordination of archeological monitoring and coordinating site visits with the Contracting Officer.
- B. All ground-disturbing activities at the project site requires archeological monitoring.**

1.2 DEFINITIONS

- A. Archeological Resources: Archeological resources are physical evidences of past human activity, including evidences of effects of that activity on the environment. Archeological resources represent both prehistoric and historic time periods, found above and below ground and under water.
- B. Archeologically Sensitive Areas: Areas having 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 state historic preservation officer and, if necessary, associated American Indian tribes.
- C. Non-sensitive Areas: Areas with little potential of containing significant (National Register eligible) archeological resources.
- D. Archeological Monitor: Representative of Government designated to oversee construction activities that could disturb archeological resources.
- E. Archeological Resources Protection Act (ARPA) of 1979 (Public Law (P.L.) 96-95; 93 United States Statutes at Large (Stat.) 712): defines archeological resources as any material remains of past human life or activities that are of archeological interest and at least 100 years old; Section 4 of the statute describes the requirements that must be met before Federal authorities can issue a permit to excavate or remove any archeological resource on Federal or Indian lands; the curatorial requirements of artifacts, and other materials excavated or removed.

1.3 SUBMITTALS

- A. Daily Work Schedule: Detail construction work in archeologically sensitive areas. Submit to Contracting Officer (CO) 30 days before start of ground disturbing site work.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 DAILY WORK SCHEDULE

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

PART 3 - EXECUTION

3.1 BARRICADES

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

3.2 ARCHEOLOGICAL INVESTIGATION BY NON-NPS PERSONNEL

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

3.3 OBSERVATION

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

3.4 DISCOVERY OF RESOURCES

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

3.5 WORK STOPPAGE

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

END OF SECTION 01 35 13.22

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. List and describe:
 - 1. Scaffolding, crane, and lifting equipment procedures will need to be developed for all portions of the exterior scope of work.
 - 2. A severe weather safety plan is required for addressing severe storms or flooring.
 - 3. Hazardous materials are present on site. Refer to the applicable reports in the appendices.
 - 4. Roof replacement and work will require fall hazard protection and access plan.

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.
 - 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 and 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.

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. 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.

- c. Upon contract award, Contractors should communicate with Contracting Officer regarding Contractor decisions and actions to protect the health and safety of workers for the duration of contract performance under which pandemic conditions exist.

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 National Fire Protection Association (NFPA) 241 (Standard for Safeguarding Construction, Alteration, and Demolition Operations).

3.4 CONFINED SPACES

- A. The basement crawlspace in the Maurice is considered to be a Confined Space. This is a space that is not designed for continuous worker occupancy, but it is large enough for workers to enter and perform certain jobs. The crawlspace work is part of this scope of work for this project. The environment includes a natural, free-flowing hot spring with a temperature of 130 – 140 degrees F. The space is hot and humid and has no natural lighting. Work within the crawlspace will include structural concrete repairs, replacement of vapor barrier, installation of new concrete foundation wall, ventilation, and installation of new drain. All work will comply with OSHA Quick Card Permit-Required Confined Spaces standards for working in Confined Spaces to address and enforce worker safety. www.osha.gov/confined-spaces

3.5 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.

3.6 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.

3.7 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.

3.8 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 **six** hard hats and other APP required equipment.

3.9 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. Protection, General
 8. Protection during application of chemicals
 9. Protection during use of heat-generating equipment
 10. Historic preservation treatment procedures

1.2 DEFINITIONS

- A. "Preservation" - To apply measures necessary to sustain existing form, integrity, and materials of historic property. Work may include preliminary measures to protect and stabilize the property.
- B. "Rehabilitation" - To make possible a compatible use for 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 form, features, and character of a property to its appearance at a particular period of time by means of removal of features from other periods in its history and 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 conditions and methods include:
 - 1. Replacement with Original or Historic Fabric: Includes fabric salvaged from other locations or projects having identical architectural qualities. Duplication of appearance using identical material possessing historical significance.
 - 2. Replacement with New Materials: Includes replacement with new material of like kind (custom fabricated or manufactured). Duplication of appearance using like material.
 - 3. Replacement with Substitute Materials: Includes replacement with a compatible substitute that is frequently contemporary and unlike the historic fabric. 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 Contracting Officer (CO) or designee.
- K. "Remove and Reinstall" - To detach items from existing construction, repair and prepare for reuse, and reinstall where indicated.
- L. "Existing to Remain" or "Retain" - Existing items of construction not to be removed and 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).
 - 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. Alternative Methods and Materials: If alternative methods and materials to those indicated are proposed for any phase of work, provide a written description including evidence of successful use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this Project.
- C. Photographs and Videotape: In accordance with Section 01 32 33 "Photographic 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.

1.4 QUALITY ASSURANCE

- A. Historic Preservation Treatment Specialist Qualifications: Experienced firm with required certifications and training able to demonstrate through past performance they are qualified to perform this work.

1.5 STORAGE AND PROTECTION OF HISTORIC MATERIALS

- A. Removed and Salvaged Historic Materials:
 - 1. Clean salvaged historic items.
 - 2. 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 within the Park.
 - 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.
- 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.

1.6 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.
- B. National Park Service, tenants, and visitors will occupy portions of buildings and site immediately adjacent to historic treatment area. Conduct historic treatment so National Park Service and visitor service operations will not be disrupted. Provide 72 hours' notice to Contracting Officer of activities that will affect National Park Service operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 HISTORIC PRESERVATION TREATMENT PLAN

- A. Prepare written plan for preservation work covering preservation components of project. Plan shall verify construction strategy and intent is compatible with Department of the Interior's (DOI) standards for Treatment of Historic Properties, guidelines for Treatment of Cultural Landscapes, and National Park Service management policies for cultural resources. Plan shall satisfy both project scope and resource protection requirements. Plan shall include:
 - 1. Organized list of preservation components of project, systems, and tasks
 - 2. Staging and sequence of work
 - 3. Disassembly and reassembly techniques and steps
 - 4. Equipment and tools required
 - 5. Supplies and materials with manufacturer or supplier identified including specific clean up/storage procedure including frequency and documentation of such.
 - 6. Skilled trades and crafts required
 - 7. Anticipated testing and analysis of fabric
 - 8. Additional investigations for extents or magnitude of treatments needed
 - 9. Protective measures
 - 10. Seasonal limitations on work
 - 11. Alternative means if primary treatment method is unfeasible
 - 12. Work conducted off-site (Approval from Contracting Officer required prior to taking resources off-site).

3.2 PROTECTION, GENERAL

- A. Comply with manufacturer's written instructions for precautions and effects of products and procedures on adjacent building materials, components, and vegetation.
- B. Ensure 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.

- 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.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm or damage resulting from applications of chemical cleaners and paint removers.

- B. Comply with requirements in 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.

3.4 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 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.
- B. Where sprinkler protection exists and is functional, maintain without interruption while operations are performed. If operations are performed near automatic sprinkler heads, shield individual heads temporarily with guards.

3.5 HISTORIC PRESERVATION TREATMENT PROCEDURES

- A. 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 repair work during construction with periodic construction photos and daily inspection reporting. Photo documentation is specified in Section 013233 "Photographic Documentation."
- B. Prohibit smoking by personnel performing work on or near historic structures.
- C. 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.

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

END OF SECTION 01 35 91

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. 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.
 - 2. Contractor is responsible for all testing costs, coordination, and corrective action for all work performed as part of this project.
- 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.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at a testing facility to verify performance characteristics.
 - 2. Integrated Exterior Mockups: Mockups of exterior envelope erected separately from building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 - 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

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

4. Contractor's job supervisory staff may be used to assist Quality Control Supervisor supplemented, as necessary, by additional certified testing technicians.
- 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.
- 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: 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.
- K. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable evaluation of quality of Work. Provide room mockups of following rooms:
1. **Roycroft Den: Wood Paneling and Millwork Refinishing.**
 2. **Roycroft Den: Wood Paneling and Millwork Replacement Components to Match Historic.**
 3. **Terrazzo Flooring: Provide new patches to match existing two colors of terrazzo flooring and related accessories to adjacent areas in the historic flooring.**
 4. **Lobby: Wood Paneling Refinishing.**
 5. **Lobby: Ceiling Decorative Paint Stabilization and Treatment.**

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. 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.
- C. Re-testing/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction of replaced work that failed to comply with Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with NPS and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Contracting Officer and Contractor promptly of irregularities or deficiencies observed in 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.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide:
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.
- F. 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

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.

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
FAA	Federal Aviation Administration www.faa.gov
FCC	Federal Communications Commission www.fcc.gov
FDA	Food and Drug Administration www.fda.gov
GSA	General Services Administration www.gsa.gov
HUD	Department of Housing and Urban Development www.hud.gov

LBL	Lawrence Berkeley National Laboratory www.lbl.gov
NCHRP	National Cooperative Highway Research Program (See TRB (Transportation Resource Board))
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
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/
DSCC	Defense Supply Center Columbus (See FS (Federal Specification))
FED-STD	Federal Standard (See FS (Federal Specification))

FS	<p>Federal Specification Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/ Available from General Services Administration www.gsa.gov</p> <p>Available from National Institute of Building Sciences www.nibs.org</p>
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	<p>Military Specification and Standards Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/</p>
UFAS	<p>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)</p>

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*
 - **ASHRAE 62.2**, *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*
 - **ASHRAE/IESNA 90.1**, *Energy Standard for Buildings, Except Low-Rise Residential Buildings*
 - **ASHRAE 90.2**, *Energy Efficient Design of Low-Rise Residential Buildings*
- C. American Association of State Highway and Transportation Officials (AASHTO):
- M288 Geotextile Specification for Highway Applications
 - **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
- C1601 Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces
- 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
- C67 Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
- C739 Standard Specification for Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation
- C936 Standard Specification for Interlocking Concrete Paver Units
- 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
- 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
- E1827 Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
- 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
- E477 Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers
- E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
- 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
- E948 Standard Test Method for Electrical Performance of Photovoltaic Cells Using Reference Cells Under Simulated Sunlight
- 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. Center for Resource Solutions

- Green-e program

F. 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**

G. Federal Trade Commission:

- **Guide for the Use of Environmental Marketing Claims**

H. Forest Stewardship Council:

- **Chain-Of-Custody**
- **Forest Management**

I. Green Building Initiative (GBI):

- **Green Globes - US**

J. Green Seal:

- **GC-03 Anti-Corrosive Paints**
 - **GC-12 Occupancy Sensors**
 - **GC-13 Split-Ductless Air-Source Heat Pumps**
 - **GS-05 Compact Fluorescent Lamps**
 - **GS-11 Paints**
 - **GS-13 Windows**
 - **GS-14 Window Films**
 - **GS-31 Electric Chillers**
 - **GS-32 Photovoltaic Modules**
 - **GS-36 Commercial Adhesives**
 - **GS-37 Industrial & Institutional Cleaners**
- K. International Iron and Steel Institute:
- **CO2 Breakthrough Program**
- L. 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**
- M. National Association of Home Builders:
- **Advanced Framing Techniques: Optimum Value Engineering**
- N. National Institute of Building Sciences:
- **MOIST program for transfer of heat and moisture**
 - **Whole Building Design Guide**
- O. National Institute of Standards and Technology:
- **BEES (Building for Environmental and Economic Sustainability) Lifecycle Decision Support Tool**
- P. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
- **IAQ Guidelines for Occupied Buildings Under Construction**
- Q. Southcoast Air Quality Management District:
- **1168 Adhesive And Sealant Applications**
- R. US Composting Council:
- Seal of Testing Assurance Program
- S. US Department of Agriculture:
- **Biobased Products – Definitions and Descriptions**
- T. US Green Building Council:
- **LEED™ 2009 Green Building Rating System**

- **LEED™ v4 (version 4) Green Building Rating System**

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.

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 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 without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations without any additional permit costs.
- C. Electric Power Service: Electric power from existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations without any additional permit costs.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with 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.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Temporary materials may be new or used, but must be adequate in capacity for required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.
- B. Pavement: Comply with Division 32 Section "Concrete Paving."
- C. Chain-Link Fencing: Minimum 2 inch (50 millimeters), 0.148 inch (3.76 millimeters) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 millimeter) high with galvanized steel pipe posts; minimum 2-3/8 inch (60 millimeters) OD (outside diameter) line posts and 2-7/8 inch (73 millimeters) OD corner and pull posts, with 1-5/8 inch (42 millimeters) OD top rails.
- D. 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 galvanized steel bases for supporting posts.
- E. Safety Barrier Fence: Orange plastic fence, minimum height, 4 feet.
- F. Barrier Tape: Yellow tape Imprinted with "CAUTION: CONSTRUCTION AREA."
- G. Wood Enclosure Fence: Plywood, 6 feet (1.8 millimeters) high, framed with four 2 by 4 inch (50 by 100 millimeters) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 millimeters) apart.
- H. Lumber and Plywood: Comply with requirements in Division 06 Section Rough Carpentry or Miscellaneous Rough Carpentry."
- I. 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.
- J. 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.
- K. 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.
- L. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 millimeters).

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
 - 1. Park may provide field office in either Maurice or Libbey Bathhouse for the use of the General Contractor and Contracting Officers Field Office.
- B. 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.
- C. Toilets: Sufficiently lighted and ventilated toilet facilities in weatherproof, sight proof, handicap accessible, sturdy enclosures with privacy locks.
 - 1. Provide separate toilet facilities for men and women.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. 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.
- C. Direct Digital Control (DDC) 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. 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.
- D. Contracting Officers Field Office
 - 1. Outlets: Minimum of two, quad outlets with surge protection.
 - 2. Refrigerator: Under counter, 3.2-cubic-foot volume with 0.8-cubic-foot freezer with dedicated power receptacle.
 - 3. Fire Extinguisher: UL listed and FM (Fire Pump Motors) approved, minimum rating of 2-A:10-B:C, dry chemical.
 - 4. First-Aid Kit: General office/light industrial kit which includes antiseptic wipes, bandages, disposable gloves, tape, instant cold pack, dressing pads, eye pads, scissors, and Tylenol tablets.
 - 5. 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.
6. Manufactured computer work station, capable of containing CPU (central processing unit), monitor, keyboard, printer; work station chair.
 7. Additional tables necessary for FAX machine and copier.
 8. Two 5-gallon trash cans and one 30-gallon trash can with lid.
 9. Ceiling mounted general lighting fixtures.

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 available from water source on site. Install piping and connections as required.
- 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 and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
1. Use of permanent heating and cooling system will not be allowed without written authorization from Contracting Officer. When the permanent heating and cooling system is approved for use as temporary heating and cooling, pay costs until final acceptance. Permanent heating and cooling 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 handling equipment is used for temporary heating and cooling. 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 and cooling 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: Use of existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to NPS.
1. When temporary connections are removed, restore existing utility services to original condition.
- I. 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 **underground**, unless otherwise indicated.
- J. 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.
- K. Telephone Service: No telephone service is available on site for Contractor's use. Make arrangements with Telephone Company and pay costs.
1. Contractor to provide cell phones for Project Manager and Superintendent with coverage at the National Park site.

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. Contracting Officers Field Office:
1. Provide Heat, lights, power, air conditioning, temporary water pressure and sewage holding tanks.
 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. Maintain and service water and sewer holding tanks as required.
- C. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
- D. Temporary Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 2. Prepare subgrade and install subbase and base for temporary paved areas according to Division 31 Section "Earth Moving."
 3. Recondition base after temporary use, including removing contaminated material, regrading, proof-rolling, compacting, and testing.
 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Asphalt Paving."
- E. Traffic Controls: Erect and maintain barricades, lights, danger signals, and warning signs in accordance with Manual on Uniform Traffic Control Devices (MUTCD), Part IV, latest edition.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
 3. Illuminate barricades and obstructions at night; keep safety lights burning from sunset to sunrise.
 4. Adequately barricade and post open cuts in or adjacent to thoroughfares.
 5. Protect pedestrian traffic by guardrails or fences.
 6. When pedestrian traffic is detoured onto a roadway, provide temporary walkways with protection as required at ends and overhead. For walkways, use lumber running parallel to direction of traffic movement and provide ramps at changes of elevation.
 7. Cover pipes, hoses, and power lines crossing sidewalks and walkways with troughs using beveled edge boards.
 8. Install Barrier Tape where directed by Contracting Officer. Keep a minimum of two rolls on site.

- F. Parking: Provide parking areas for construction personnel off site. Free parking is available in the City garage and on some nearby streets. No parking will be available at the project site.
- G. 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.
- H. Project Identification and Temporary Signs: Provide Project identification and other signs. 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.
- I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of agency(ies) with jurisdiction.
- J. 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.
- K. Existing Elevator Use: Existing elevators will NOT be permitted to be used by the Contractor for any reason.
 - 1. Provide signage that elevator is NOT to be used by any contractors for conducting work.
- L. Existing Stair Usage: Use of existing stairs will be permitted, as long as stairs and adjacent historic materials are protected, cleaned and maintained in a condition acceptable to Contracting Officer. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.
- M. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

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 required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 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.
- 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 IV, 2003 edition and agency(ies) with jurisdiction 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 Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas and finished areas of the building from dust and construction traffic.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
 - 2. Construct dustproof partitions with 2 layers of 3-mil (0.07-millimeters) polyethylene sheet on each side. Cover floor with 2 layers of 3-mil (0.07-millimeters) polyethylene sheet, extending sheets 18-inches (460 millimeters) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
 - 3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - 4. Protect air-handling equipment.
 - 5. Weather strip openings.
 - 6. Provide walk-off mats at each entrance through temporary partition.
- K. 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 welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of NPS. Check with Park; many require "burn permits" for welding.
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/existing buildings. 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.

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. Materials and facilities that constitute temporary facilities are property of Contractor. NPS reserves right to take possession of Project identification signs.
 2. At Substantial Completion, clean and renovate permanent facilities used during construction period.

END OF SECTION 01 50 00

SECTION 01 57 19.11 – INDOOR AIR QUALITY MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

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

1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- B. Adequate ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.
- C. Hazardous Materials: Any material 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 Work unless otherwise approved by Contracting Officer.
 - 2. Provide adequate ventilation during and after installation of interior wet products and interior final finishes.
 - 3. Provide filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 during construction and a MERV as described in the construction documents during NPS occupancy. Coordinate with work of Division 23 (15), Heating Ventilating and Air Conditioning (HVAC).

- G. Scheduling: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.
- H. Flush-Out: After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 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 weekly, and 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. Basement: Monitor basement and crawlspace humidity and dehumidify when relative humidity is greater than 70 percent for more than 2 weeks or at first sign of mold growth.
 - 5. Site drainage: Verify final grades of site work and landscaping drain surface water and ground water away from building.
 - 6. 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.
7. Plumbing: Verify satisfactory pressure test of pipes and drains is performed before closing in and insulating lines.
 8. HVAC: Inspect HVAC system as specified in Section on Commissioning. And, inspect HVAC to verify:
 - a. condensate pans are sloped and plumbed correctly;
 - b. access panels are installed to allow for inspection and cleaning of coils and ductwork downstream of coils;
 - c. ductwork and return plenums are air sealed;
 - d. duct insulation is installed and sealed; and
 - e. chilled water line and refrigerant line insulation are installed and sealed.]
- C. Schedule:
1. Schedule work such that absorptive materials, 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 as per one or more of the following; unless otherwise indicated, acceptable upper limits for concrete are < 4% top inch; < 85% headspace relative humidity (RH); <3 pounds per 1000 square feet per day:
 - a. ASTM D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
 - b. ASTM F1869 Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - c. ASTM F2170 Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.
 2. Wood: Moisture test as per ASTM D4444 - Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters; unless otherwise indicated acceptable upper limits for wood products are less than 20% at center of piece; less than 15% at surface.
- E. Testing for Moisture Penetration:
1. Skylights:—Test as per ASTM D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations; acceptable upper limits are no leakage for 15 minutes.

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 **deconstruction, renovation, construction** 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 MANAGEMENT

- A. Noise Control: Perform deconstruction, renovation, construction operations to minimize noise. Perform noise-producing work in less sensitive hours of the day or week as directed by the Contracting Officer (CO). Typical work hours are from 7:00 am to 5:00 pm. Notify Contracting Officer if work will occur outside of these times.
- B. Repetitive and/or intermittent, high-level noise: Permitted only during Daytime.
1. Do not exceed the following dB(A) limitations at 50 feet:

<u>Sound Level in dB(A)</u>	<u>Time Duration of Impact Noise</u>
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:				
	<u>EARTHMOVING</u>	<u>dB(A)</u>	<u>MATERIALS HANDLING</u>	<u>dB(A)</u>
	Front Loaders	75	Concrete Mixers	75
	Backhoes	75	Concrete Pumps	75
	Dozers	75	Cranes	75
	Tractors	75	Derricks Impact	75
	Scrapers	80	Pile Drivers	95
	Graders	75	Jack Hammers	75
	Trucks	75	Rock Drills	80
	Pavers, Stationary	80	Pneumatic Tools	80
	Pumps	75	Saws	75
	Generators	75	Vibrators	75
	Compressors	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 - UNDER-AN-ACRE 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/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. 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. National Park Service (NPS) Standards and Guidelines require water quality be protected to ensure compliance with Organic Act. Contractor shall prepare an Under-An-Acre Pollution Prevention Plan (UPPP) for each project resulting in less than 1 acre of soil disturbance or not otherwise subject to requirements of NPDES program. ([UPPP Guideline](#))
- C. The work of this section consists of implementing measures to prevent discharges of pollutants, including temporary storm water pollution during construction activities, in conformance with NPS guidance for UPPPs.
- D. Work of this section consists of implementing measures to Temporary Storm Water Pollution during construction activities, in conformance with NPS guidance for UPPPs.

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.

- F. UPPP: Developed and implemented pollution prevention plan (including stormwater management measures, if needed) to protect environment from pollutants on construction projects with less than one acre of disturbance in conformance with NPS guidelines.

1.3 SUBMITTALS

- A. After contract award and before pre-construction conference, prepare and submit:
 - 1. A UPPP in conformance with NPS guidelines and adherence to applicable construction storm water management practices.
- B. Inspection Schedule: Submit schedule for inspection and monitoring of pollution prevention measures.
- C. Inspection Schedule: Submit schedule for inspection and monitoring of storm water pollution prevention measures.
- D. 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. Orientation Meeting: Contractor shall be responsible for arranging and conducting Pollution Prevention meeting/briefing to inform parties scheduled to be on-site during project of measures to be implemented for proper pollution prevention and control (may be included as part of Pre-Construction Meeting).
 - 1. Installation of silt fences, storm drain protection, and other forms of pollution prevention controls shall not begin until after this meeting has occurred.
- D. Pollution Prevention Manager: Contractor shall designate Pollution Prevention Manager who will be responsible for implementation, inspection, maintenance, and amendments to approved plan.
 - 1. Pollution Prevention Manager shall be familiar with UPPP procedures and Best Management Practices (BMPs) and shall ensure emergency procedures and plan are updated as needed and available for inspection.
 - 2. When changes in approved plan are required, Pollution Prevention Manager shall prepare and certify an amendment and submit to Contracting Officer for review and concurrence.

- E. 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 UNDER-AN-ACRE POLLUTION PREVENTION PLAN

2.2 TEMPORARY STORM WATER POLLUTION PREVENTION PLAN

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

PART 3 - EXECUTION

3.1 ENVIRONMENTAL PROTECTION

- A. Protection of Natural Resources: Comply with applicable regulations and these specifications. Preserve natural resources within project boundaries and outside limits of work 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 work activities.
3. Equipment shall not be allowed to operate outside limits of work 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 UNDER-AN_ACRE 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. Furnish, install, maintain, and operate necessary control measures and other equipment necessary to prevent erosion as described in approved UPPP.
- L. 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 or 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. Comparable Product: 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 & Plastic Doors
 - h. Windows
 - i. Skylights
 - j. Gypsum Board
 - k. Tile
 - l. Acoustical Ceilings
 - m. Resilient Flooring
 - n. Wall Coverings
 - o. Paints & Coatings
 - p. Toilet Compartments
 - q. Elevators
 - r. Plumbing fixtures and equipment.
 - s. HVAC equipment
 - t. Lighting equipment
 3. Material Safety Data Sheets (MSDS): For each product required by OSHA to have a MSDS, submit an MSDS. MSDS shall be prepared no earlier than June 1998. 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.
 - 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.
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. Wood Flooring
 - f. Furnishings & Accessories

1.4 QUALITY ASSURANCE

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that 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 15 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.

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 a product and manufacturer, provide one of the products listed that complies with requirements or approved equal.
 4. Manufacturers: Where Specifications include manufacturers name, provide a product by the manufacturer listed that complies with requirements or approved equal.
 5. Available Products: Where Specifications include list of names of both products and manufacturer, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
 6. Available Manufacturers: Where Specifications include list a manufacturer, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
 7. Product Options: Where Specifications indicate sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide specified product, system, or approved equal.
 8. Basis-of-Design Product: Where Specifications name product and include a manufacturer, provide specified product or a comparable product by one of the other

- named manufacturer, or approved equal. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics based on the product named.
9. 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.
 10. 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 COMPARABLE PRODUCTS

- A. Conditions: Contracting Officer will consider Contractor's request for comparable product 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)						
Parking Stops (Plastic/Rubber)						
Patio Blocks/Rubber						
Patio Blocks/Plastic						
Playground Surfaces						
Concrete with fly ash						
Concrete with slag cement						
Concrete with low cement content						
Plastic lumber						
Building Insulation						
Rock Wool						
Fiber glass						
Cellulose						
Perlite Comp Board						
Plastic Rigid Foam						
Glass Fiber Reinforced Foam						
Phenolic Rigid Foam						
Ceramic tile						
Resilient flooring						
Floor Tiles/Rubber						
Floor Tiles/Plastic						
Running Tracks						
Carpet (PET)						
Paint						

Reprocessed Latex Paint White & Light Colors						
Reprocessed Latex Dark Colors						
Consolidated Latex Paint						
Toilet/Shower 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 buildings that do not contain Historic Fabric.

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. **Historic Materials: Do not cut and patch historic materials in any manner, without prior Contracting Officer approval, or as specifically noted within the drawings.**
- B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- C. 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.
- D. 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.

- E. 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.

- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to **[minimize] [prevent]** interruption to occupied 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. Concrete or Masonry: Cut using an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations 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 **land surveyor** 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 **two** copies signed by **land surveyor**.
- D. Quantity Surveys: Submit two copies showing quantities of work performed and actual construction completed in place.

1.3 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: Professional **land surveyor** 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 Entergy Arkansas, Inc., Dustin Morris, PE, (800) 368-3479 to coordinate Electrical service requirements.
 - a. Construction Contractor Responsibilities: Contractor is responsible for Extending new electrical service to the building.
 2. Water Service Contact: Contact City of Hot Springs Water Department, Shawn Newton, 501-321-6200 to coordinate Water service requirements.
 - a. Construction Contractor Responsibilities: Contractor is responsible for installation, testing, disinfection, etc. for the water service infrastructure as noted on the plans.
 3. Wastewater Service Contact: Contact City of Hot Springs Wastewater Department, Shawn Davis, 501-623-6981 to coordinate Wastewater service requirements.
 - a. Construction Contractor Responsibilities: Contractor is responsible for installation, testing, etc. for the wastewater service infrastructure as noted on the plans.
 4. Telephone Service Contact: Contact AT&T, Derek Wright, 501-321-3224 to coordinate Telephone service requirements.

- a. Construction Contractor Responsibilities: Contractor is responsible for work pertaining to any installations, upgrades, etc. pertaining to telecommunications.

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 **land surveyor** 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. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with NPS requirements for type and size of benchmark.
 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.6 INSTALLATION

- A. General: Locate 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 RELATED SECTIONS

- A. Refer to the Appendices for hazardous materials test reports, including lead, asbestos, and other metals.
- B. Hazardous Materials Handling and Abatement Specifications in Division 2 and Appendices.

1.3 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.

1.4 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] [75] <Insert number> 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)
 5. Asphaltic concrete (can be ground and used for fill on site)
 6. Cardboard, paper, packaging, newsprint
 7. Metals (from banding, stud trim, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze)
 8. Gypsum drywall - unpainted
 9. Non-hazardous paint and paint cans
 10. Beverage containers: Aluminum, glass, and plastic containers
 11. Insulation
 12. Ceiling grid and tiles
 13. Ductwork
 14. Wiring
 15. Other mixed construction and demolition waste as appropriate.
- C. If 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.
- E. Salvage/Recycle Requirements: Government goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:
- F. Salvage/Recycle Requirements: Government goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible. Government has established minimum goals for the following materials:
 - 1. Concrete, metals, equipment, plumbing fixtures, lighting, conduit, wiring, piping, and similar materials.

1.5 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 [3] copies 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 [three] copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. 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.

1.6 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, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
1. Salvaged Materials for Reuse: For materials 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 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 Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. 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 1-1/2 inch.
- B. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - 1. Pulverize concrete to maximum 1-1/2 inch.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. 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.
- F. 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.
- G. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- H. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- I. Lighting Fixtures: Separate lamps by type and protect from breakage.

- J. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
- K. Conduit: Reduce conduit to straight lengths and store by type and size.
- L. 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 Sections 220500, 230500, 260500, and 015719.11 Indoor Air Quality (IAQ) Management.

- b. Product Data for filtration media: As specified in Section 015719.11 Indoor Air Quality (IAQ) Management.
 - c. Moisture Control inspections and reports: As specified in Section 015719.11 Indoor Air Quality (IAQ) Management.
 - d. Material Safety Data Sheet (MSDS) Data: As specified in Section 015719.11 Indoor Air Quality (IAQ) Management and Section 016700 Product Requirements.
 - e. Affirmative Procurement Reporting Form: As specified in Section 016700 Product Requirements.
 - f. Environmental Product Data: As specified in Section 016700 Product Requirements.
 - g. Life-Cycle Assessment (LCA) Data: As specified in Section 016700 Product Requirements.
 - h. Chain-of-Custody Data: As specified in Section 016700 Product Requirements.
 - i. Final Summary of Solid Waste Disposal and Diversion: As specified in Section 017419 Construction Waste Management and Disposal.
 - j. Commissioning Report: As specified in 019114 Total Building 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. Approved pre-functional checklists and functional performance testing reports from commissioning documentation.
 - a. Equipment start-up requires coordination with commissioning process. Refer to Sections 230500, 260500, and 019114 Total Building Commissioning. Equipment shall not be "temporarily" started for commissioning.
 - 8. Test and balance report.
 - 9. Terminate and remove temporary facilities, mockups, construction tools, and similar elements from Project site, complete final cleaning requirements, including touchup painting.
 - 10. Touch up and repair and restore marred exposed finishes to eliminate visual defects.
 - 11. Instruct NPS personnel in operation, adjustment, and maintenance of products, equipment, and systems.

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 Sections 019114, 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 warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2 by 11 inch (215 by 280 millimeters) paper.
 - 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. Pest Control: Engage experienced, licensed exterminator to make a final inspection and rid project of rodents, insects, and other pests. Provide Government with report.
- C. 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**
- 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** 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 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.

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. 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.

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:

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.
- 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 **two** copies 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.

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 **seven** 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.

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. 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).
 5. 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.
 6. 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.
 7. 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 elevators and 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 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.

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. Building Envelope (walls, roof, windows, infiltration, etc.)

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

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 used to comply with Owner's Project Requirements and 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 Owner's Project Requirements. 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. Owner's Project Requirements: Document originated by Designer that details functional requirements of project and expectations of use and operation, including project goals,

measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. Document is updated, with input from Contracting Officer (CO) as required as project is finished.

- L. 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.
- M. Seasonal Performance Tests: Functional Performance Tests deferred until system(s) will experience seasonal conditions closer to their design conditions.
- N. 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), Building Commissioning Association (BCA), and National Environmental Balancing Bureau (NEBB))
 - b. Acted as principal Commissioning Authority where total building commissioning approach (including building envelope) 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 biweekly 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. Owner's project requirements.
- G. Functional performance test forms: Submit minimum 30 calendar days prior to testing
- H. 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.
- I. 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.
- J. 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 in other specification sections.
 - 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 specification Sections.
 1. Commissioning Scoping Meeting
 2. Finalize Owner's Project Requirements
 3. Commissioning Plan
 4. Prepare pre-functional checklists.
 5. Prepare functional performance worksheets.
 6. Perform Start-Up/Pre-Functional Checks in accordance with manufacturer's recommendations and pre-functional checklists.
 7. Functional Performance Testing in accordance with functional performance worksheets
 8. Deficiency Report and Resolution Record
 9. Operation and Maintenance Documentation
 10. Operations and Maintenance Training
 11. 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 Owner's Project Requirements.
 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 performance of building envelope. Document testing and conformance to Contract Documents.
 7. Verify completeness of operations and maintenance materials.
 8. 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)
Ventilation	Existing Exhaust Fan and Controls		

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Contracting Officer.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Contracting Officer that may be uncovered during demolition remain the property of Contracting Officer.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Contracting Officer.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site .
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.5 SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Contracting Officer's building manager's and other tenants' on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Contracting Officer's continuing occupancy of portions of existing building and of Contracting Officer's partial occupancy of completed Work.
- C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 FIELD CONDITIONS

- A. Contracting Officer will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Contracting Officer's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Contracting Officer as far as practical.
- C. Notify Contracting Officer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is included in the Contract Documents. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
- E. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Contracting Officer. Contracting Officer does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
 - 1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

3.3 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.

- C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 024296 "Historic Removal and Dismantling."
- D. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Contracting Officer.
 - 4. Transport items to Contracting Officer's storage area designated by Contracting Officer .
 - 5. Protect items from damage during transport and storage.
- E. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - 3. Protect items from damage during transport and storage.
 - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

- F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Contracting Officer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- B. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Contracting Officer's property, remove demolished materials from Project site and legally dispose of them.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.7 CLEANING

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

END OF SECTION 024119

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SECTION 02 83 33 - LEAD PAINT REMOVAL AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

In the event the Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Contractor. All costs incurred due to such action are also the responsibility of the Contractor.

A. Section Includes:

1. Removing, mitigating, clean-up and disposal of lead paint on painted surfaces and lead painted components in or on locations as indicated in the table below. Please note, all paints must be treated as containing lead.
2. See below for additional details:

BUCKSTAFF BATH HOUSE ROOF

Sample No.	Paint Color	Paint Substrate	Material Location	Analytical Result (% wt)
B-L-1	White	Wood and metal	Windows and doors	0.43
B-L-2	White	Concrete	Roof parapet	0.13
B-L-3	Silver	Metal	Vents and sky lights	10
B-L-4	Grey	Metal	Ladders	0.91
B-L-5	Black	Metal	Drainpipes	5.6

FORDYCE BATH HOUSE

Sample No.	Paint Color	Paint Substrate	Material Location	Analytical Result (% wt)
F-L-1	Beige	Wood	Window frames	0.017
F-L-2	Brown	Wood wall panel	Exterior of elevator equipment room	0.0061
F-L-3	Teal	Metal	Roof vents	0.021
F-L-4	Grey	Metal	Sky light	0.21

1.2 RELATED REQUIREMENTS

- A. Section 02 82 12, ASBESTOS ABATEMENT.

1.3 DEFINITIONS

- A. Action Level: Employee exposure, without regard to use of respirator, to lead airborne concentration of 30 micrograms per cubic meter (0.03 parts per million) of air averaged over 8-hour period. As used in this section, "30 micrograms per cubic meter of air (0.03 parts per million)" refers to action level.
- B. Area Monitoring: Sampling of lead concentrations within lead control area and inside physical boundaries which are representative of airborne lead concentrations which may reach breathing zone of personnel potentially exposed to lead.
- C. Breathing Zone: Area within hemisphere, forward of shoulders, with 150 mm to 225 mm (6 to 9 inches) radius and center at nose or mouth of employee.
- D. Certified Industrial Hygienist (CIH): As used in this section, refers to an Industrial Hygienist employed by Contractor. The Government reserves the right to employ and utilize their own CIH, and/or industrial hygienist.
- E. Change Rooms and Shower Facilities: Rooms within designated physical boundary around lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross- contamination.
- F. Competent Person: Person capable of identifying lead hazards in work area and authorized by contractor to take corrective action. Or Owner's Representative?
- G. Decontamination Room: Room for removal of contaminated personal protective equipment (PPE).
- H. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead averaged over 8-hour workday to which an employee is exposed.
- I. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. HEPA filter means 99.97 percent efficient against 0.3 micron (0.012 mil) size particles.
- J. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.
- K. Lead Control Area: Enclosed area or structure with full containment to prevent spreading lead dust, paint chips, and debris from lead paint removal operations. Lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.
- L. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter (0.05 parts per million) of air as 8-hour time weighted average as determined by 29 CFR Part 1910.1025. When employee is exposed for more than 8 hours per work day, determine PEL by following formula. $PEL \text{ micrograms/cubic meter (parts per million) of air} = 400/\text{No. of hrs. worked per day}$.
- M. Personnel Monitoring: Sampling of lead concentrations within employee breathing zone to determine 8-hour time weighted average concentration according to 29 CFR Part 1910.1025. Take samples representative of employee's work tasks.
- N. Physical Boundary: Area physically roped or partitioned off around enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean same as "outside lead control area."

1.4 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. American National Standards Institute (ANSI):
 - 1. Z9.2-12 - Fundamentals Governing the Design & Operation of Local Exhaust Ventilation Systems.
- C. Code of Federal Regulations (CFR):
 - 1. 29 CFR Part 1910 - Occupational Safety and Health Standards.
 - 2. 29 CFR Part 1926 - Safety and Health Regulations for Construction.

3. 40 CFR Part 260 - Hazardous Waste Management System: General.
 4. 40 CFR Part 261 - Identification and Listing of Hazardous Waste.
 5. 40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste.
 6. 40 CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste.
 7. 40 CFR Part 264 - Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities.
 8. 40 CFR Part 265 - Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.
 9. 40 CFR Part 268 - Land Disposal Restrictions.
 10. 49 CFR Part 172 - Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements, and Security Plans.
 11. 49 CFR Part 178 - Specifications for Packagings.
- D. Underwriters Laboratories (UL):
1. 586-09 - High-Efficiency, Particulate, Air Filter Units.

1.5 PRE-REMOVAL MEETINGS

- A. Conduct pre-removal meeting at project site, at the discretion of the Government, before beginning Work of this section.
1. Required Participants:
 - a. Contracting Officer.
 - b. Contractor.
 - c. Contractor's CIH and/or Industrial Hygienist.
 - d. Government's CIH and/or Industrial Hygienist
 - e. Other installers responsible for finishing resulting surfaces.
 2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
 - a. Respiratory protection program.
 - b. Hazard communication program.
 - c. Hazardous waste management plan.
 - d. Safety and health regulation compliance.
 - e. Employee training.
 - f. Removal schedule.
 - g. Removal sequence.
 - h. Preparatory work.
 - i. Protection before, during, and after removal.
 - j. Removal.
 - k. Inspecting and testing.
 - l. Other items affecting successful completion.
 3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 SUBMITTALS

- A. Submittal Procedures: SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Description of each product.
 - a. Paint removal products.
 - b. Vacuum filters.
 - c. Respirators.
 2. Safety data sheet for each paint removal product.

3. Installation instructions.
 - a. Paint removal products.
- C. Test Reports: Submit testing laboratory reports.
 1. Submit air monitoring results within three working days, signed by testing laboratory employee performing air monitoring, employee analyzing sample, and Contractor's CIH.
- D. Certificates: Certify completed training.
 1. Submit certificate for each employee signed and dated by Contractor's CIH and employee stating employee was trained.
- E. Qualifications: Substantiate qualifications comply with specifications.
 1. Paint removal contractor.
 2. Testing laboratory.
 - a. Name, address, and telephone number.
 - b. Current evidence of participation in NIOSH PAT Program.
 - c. Copy of current AIHA accreditation certificate.
 3. Contractor's CIH and industrial hygienist.
 - a. Name, address, and telephone number.
 - b. Resume showing previous experience.
 - c. Copy of current ABIH CIH certification.
 4. Paint disposal facility.
 - a. Name, address, and telephone number.
 - b. Current license or authorization to receive and dispose lead contaminated waste.
- F. Record Documents:
 1. Completed and signed hazardous waste manifest from waste transporter.
 2. Paint disposal facility receipts and disposition reports.
 3. Certification of medical examinations.
 4. Employee training certification.

1.7 QUALITY ASSURANCE

- A. Safety and Health Regulation Compliance:
 1. Comply with laws, ordinances, rules, and regulations of federal, state, and local authorities having jurisdiction regarding removing, handling, storing, transporting, and disposing lead waste materials.
 - a. Comply with applicable requirements of 29 CFR Part 1910.1025.
 - b. Notify Contracting Officer's Representative and request resolution of conflicts between regulations and specified requirements before starting work.
 2. Comply with all federal, state, local laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing lead-contaminated materials:
- B. Contractor: Experienced contractor, accredited by EPA, registered or licensed by applicable state agency regulating lead paint removal.
- C. Testing Laboratory: State certified independent testing laboratory experienced in airborne lead monitoring, testing, and reporting.
 1. Successful participant in the American Industrial Hygiene Association, Laboratory Accreditation Program for analysis of airborne lead concentrations.
- D. Contractor's CIH: Certified as CIH by American Board of Industrial Hygiene (ABIH) in comprehensive practice and responsible for:
 1. Certify Training.
 2. Review and approve lead paint removal plan for conformance to applicable referenced standards.
 3. Inspect lead paint removal work for conformance with approved plan.
 4. Direct monitoring or direction of IH technician.

5. Ensure work is performed according to specifications.
 6. Ensure personnel and environment hazardous exposures are adequately controlled.
- E. Paint Disposal Facility: State certified disposal facility qualified to receive and dispose of lead paint or lead painted components.
- F. Lead Paint Removal Plan:
1. Submit detailed, site-specific plan describing lead paint removal procedures.
 2. Include sketch showing location, size, and details of lead control areas, decontamination rooms, change rooms, shower facilities, and mechanical ventilation system.
 3. Include eating, drinking, and restroom procedures, interface of trades, work sequencing, collected wastewater and paint debris disposal plan, air sampling plan, respirators, protective equipment, and detailed description of containment methods ensuring airborne lead concentrations do not exceed action level outside lead control area.
 - a. Eating, drinking, and smoking are not acceptable within lead control area.
 4. Include air sampling, training and strategy, sampling methodology, frequency, duration, and qualifications of air monitoring personnel.
- G. Respiratory Protection Program: Establish and implement program required by 29 CFR Part 1910.134, 29 CFR Part 1910.1025, and 29 CFR Part 1926.62.
1. Provide each employee negative pressure or other appropriate respirator.
 - a. Test fit each employee's respirator at initial fitting and maximum 6-month intervals, as required by 29 CFR Part 1926.62.
- H. Hazard Communication Program: Establish and implement program required by 29 CFR Part 1910.1200.
- I. Hazardous Waste Management Plan: Establish and implement plan according to applicable requirements of Federal, State, and local hazardous waste regulations including the following:
1. Identification of hazardous wastes associated with work.
 2. Estimated quantities of generated and disposed waste.
 3. Names and qualifications of each contractor transporting, storing, treating, and disposing wastes. Include facility location and 24-hour point of contact. Provide two (2) copies of any and all applicable EPA, state, and local hazardous waste permit applications, permits, and EPA Identification numbers.
 4. Names and qualifications (experience and training) of personnel working on-site with hazardous wastes.
 5. List of required waste handling equipment including cleaning, volume reduction, and transport equipment.
 6. Spill prevention, containment, and cleanup contingency implementation measures.
 7. Work plan and schedule for waste containment, removal, and disposal with daily waste cleaned up and containerization.
 8. Hazardous waste disposal cost.

1.8 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PAINT REMOVAL PRODUCTS

- A. Chemical Stripper: Biodegradable, non-toxic, capable of removing existing paint layers in one application, and acceptable to Contractor's CIH and Government.

2.2 ACCESSORIES

- A. Containers: Air and water-tight, suitable to receive and retain any lead containing or contaminated materials until disposal at an approved site and labeled in accordance with OSHA Regulation 29 §1926.62, 29 CFR §1910.145, and/or 49 CFR §172, 173, 178 and 179.
- B. Waste Collection Drums: 49 CFR Part 178; Type 1A2, steel, removable head, 200 L (55 gal.) capacity, capable of containing waste without loss.
- C. Vacuum Cleaner: HEPA-filtered.
- D. Scrapers:
 - 1. Metal type for use on metal, concrete, and masonry surfaces.
 - 2. Plastic type for use on wood, plaster, gypsum board, and other surfaces.
- E. Rinse Water: Potable.
- F. Cleaning Cloths: Cotton.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Before exposure to lead-contaminated dust, provide workers with comprehensive medical examination required by 29 CFR Part 1926.62 (I) (1) (i) and (ii).
 - 1. Exemption: Examination is not required when employee medical records show last examination required by 29 CFR Part 1926.62(I) was completed within previous 12 months.
- B. Maintain complete and accurate employee medical records according to 29 CFR Part 1910.20.
- C. Train each employee performing paint removal, disposal, and air sampling operations according to 29 CFR Part 1926.62.
 - 1. Certify training is completed before employee is permitted to work on project and enter lead control area.

3.2 PREPARATION

- A. Protect existing work indicated to remain.
 - 1. Perform paint removal work without damaging and contaminating adjacent work.
 - 2. Restore affected components to original condition.
- B. Notify Contracting Officer, 20 calendar days before starting paint removal work.
- C. Lead Control Area Requirements:
 - 1. Establish lead control area by completely enclosing lead paint removal work area with approved containment methods.
 - 2. Contain removal operations using negative pressure full containment system with minimum one change room and HEPA filtered exhaust.
- D. Boundary Requirements: Provide physical boundaries around lead control area by roping off area and providing curtains, portable partitions or other enclosures to ensure that airborne lead concentrations do not meet or exceed action level outside of lead control area.
- E. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems supplying exhausting, and passing through lead control areas. Seal HVAC inlets and outlet within lead control area with 6-mil plastic sheet and tape. Tape seal seams in HVAC components passing through lead control area.
- F. Change Room and Shower Facilities: Provide clean change rooms and shower facilities within physical boundary around lead control area according to 29 CFR Part 1926.62.
- G. Mechanical Ventilation System:
 - 1. Provide ventilation system to control personnel exposure to lead according to 29 CFR Part 1926.57.
 - 2. Design, construct, install, and maintain HEPA filtered fixed local exhaust ventilation system according to ANSI Z9.2 and approved by Contractor's CIH.

3. Exhaust ventilation air to exterior wherever possible.
 4. When exhaust ventilation air must be recirculated into work area, provide HEPA filter with reliable back-up filter and controls to monitor lead concentration in return air and to bypass recirculation system automatically when system fails.
- H. Personnel Protection: Provide and use required protective clothing and equipment within lead control area.
- I. Warning Signs: Provide warning signs complying with 29 CFR Part 1926.62 at lead control area approaches. Locate signs so personnel read signs and take necessary precautions before entering lead control area.

3.3 WORK PROCEDURES

- A. Remove lead paint according to the Abatement/Removal submitted and final approved lead paint removal plan.
1. Perform work only in presence of Contractor's CIH or Industrial Hygienist (IH) Technician under direction of Contractor's CIH ensuring continuous inspection of work in progress and direction of air monitoring activities.
 2. Handle, store, transport, and dispose lead or lead contaminated waste according to 40 CFR Part 260, 40 CFR Part 261, 40 CFR Part 262, 40 CFR Part 263, 40 CFR Part 264, and 40 CFR Part 265. Comply with land disposal restriction notification requirements as required by 40 CFR Part 268.
- B. Use procedures, equipment and personal protection equipment required to limit occupational and environmental lead exposure when lead paint is removed according to 29 CFR Part 1926.62.
- C. Dispose removed paint and waste according to Environmental Protection Agency (EPA), federal, state, and local requirements.
- D. Personnel Exiting Procedures:
1. When personnel exit lead control area, comply with the following procedures:
 - a. Vacuum exposed clothing surfaces.
 - b. Remove protective clothing and equipment in decontamination room. Place clothing in approved impermeable disposal bag.
 - c. Shower.
 - d. Dress in clean clothes before leaving lead control area.
- E. Monitoring - General:
1. Monitor airborne lead concentrations according to 29 CFR Part 1910.1025 by testing laboratory as directed by Contractor's CIH.
 2. Take personal air monitoring samples on employees anticipated to have greatest exposure risk as determined by Contractor's CIH. Additionally, take air monitoring samples on minimum 25 percent of work crew or minimum of two (2) employees, whichever is greater, during each work shift.
 3. Submit results of air monitoring samples, signed by Contractor's CIH, within 48-hours after taking air samples. Notify Contracting Officer immediately of lead exposure at or exceeding action level outside of lead control area.
- F. Monitoring During Paint Removal:
1. Perform personal and area monitoring during entire paint removal operation.
 2. Conduct area monitoring at physical boundary daily for each work shift to ensure unprotected personnel are not exposed above action level anytime.
 3. For outdoor operations, take at least one (1) sample on each shift leeward of lead control area. When adjacent areas are contaminated, clean area of contamination and have Contractor's CIH visually inspect and certify lead contamination is cleaned.
 4. Stop work when outside boundary lead levels meet or exceed action level. Notify Contracting Officer, immediately.

5. Correct conditions causing increased lead concentration as directed by Contractor's CIH.
6. Review sampling data collected during work stoppage to determine if conditions require additional work method modifications as determined by Contractor's CIH.
7. Resume paint removal when approved by Contractor's CIH.

3.4 LEAD PAINT REMOVAL

- A. Remove paint when necessary to perform renovations. Minimize damage to substrate.
- B. Comply with paint removal processes described lead paint removal plan.
- C. Lead paint Removal: Select processes for each application to minimize work area lead contamination and waste.

3.5 SUBSTRATE SURFACE PREPARATION

- A. Protect substrates from deterioration and contamination until refinished.
 1. Protect metal substrates from flash rusting.
- B. Prepare and paint substrates according to other specifications.

3.6 FIELD QUALITY CONTROL

- A. Perform sampling and testing for:
 1. Air monitoring.
 2. Airborne lead paint.

3.7 CLEANING AND DISPOSAL

- A. Cleaning:
 1. Maintain lead control area surfaces free of accumulating paint chips and dust. Confine dust, debris, and waste to work area.
 2. HEPA vacuum and wet wipe clean the work area daily, at end of each shift, and when paint removal operation is complete. No visible accumulations of paint and dust shall remain.
- B. Contractor's CIH Certification: Certify in writing that inside and outside lead control area air monitoring samples are less than action level, employee respiratory protection was adequate, the work was performed according to 29 CFR Part 1926.62, and no visible accumulations of lead paint, dust, or used materials/supplies/PPE remain on worksite.
- C. Do not remove lead control area or roped-off boundary and warning signs before Contracting Officer receipt of Contractor's CIH's certification, or at Governments discretion – The Government reserves the right to have his/her own CIH or industrial hygiene technician conduct a visual inspection for paint chips, dust, debris and any confirmatory testing deemed necessary by the CIH/IH technician prior to release of the Contractor.
 1. Reclean areas showing dust or residual paint chips or any used materials/supplies/PPE.
- D. Testing: Contractor's CIH shall test all paint waste and any used abrasive, used materials/PPE according to 40 CFR Part 261 for hazardous waste (TCLP).
- E. Waste Collection:
 1. Collect lead-contaminated materials including waste, scrap, debris, bags, containers, equipment, and clothing, which may produce airborne lead contamination.
 2. Place lead contaminated materials in waste disposal drums. Label each drum identifying waste type according to 49 CFR Part 172 and date waste materials were first put into drum. Obtain and complete the Uniform Hazardous Waste Manifest forms. Comply with land disposal restriction notification requirements required by 40 CFR Part 268:
 3. Coordinate temporary storage location on project site with Contracting Officer.
- F. Waste Disposal:

1. Do not store hazardous waste drums in temporary storage location longer than 90 calendar days from drum label date.
2. Remove, transport, and deliver drums to lead paint disposal facility.
 - a. Obtain signed receipt including date, time, quantity, and description of materials received according to 40 CFR Part 262.
 - b. Obtain final report of materials disposition after disposal completion.
 - c. Return all copies to Government within 35 calendar days of leaving the site.

SEE THE APPENDICES FOR LEAD DRAWING

END OF SECTION 02 83 33

SECTION 03 01 30 - MAINTENANCE OF CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions apply to the work of this Section.

1.2 SUMMARY

- A. Section includes, but is not limited to the following as shown on the drawings and as specified herein:
 1. Removal of deteriorated concrete as described on Drawings and specified herein.
 2. Preparing the surface for repair, including cleaning of concrete and reinforcement, and applying anti-corrosion agent to the reinforcement.
 3. Supplying materials and the mixing and placing of concrete patching material as shown and described on the Drawings and as specified herein, including finishing and curing.
 4. Crack Repair
 5. Providing temporary support of existing construction and protection of adjacent areas, as required.
 6. The quality control testing of all materials.
 7. All other work and materials as may be reasonably inferred and needed to make the work of this section complete.
 8. Preparing concrete repair mockups, as required.

1.3 RELATED REQUIREMENTS

- A. Division 01 Section "General Requirements"
- B. Division 03 Section "Cast-in-Place Concrete"

1.4 REFERENCES

- A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, as referenced by the Building Code, except where more stringent requirements are shown or specified by the Contract Documents:
 1. ACI 201.1R "Guide for Conducting a Visual Inspection of Concrete in Service"
 2. ACI 224.1R "Causes, Evaluation and Repair of Cracks in Concrete Structures"
 3. ACI 301 "Specifications for Structural Concrete"
 4. ACI 304R "Guide for Measuring, Mixing, Transporting and Placing Concrete"
 5. ACI 308.1 "Standard Specification for Curing Concrete"
 6. ACI 315 "Details and Detailing of Concrete Reinforcement"
 7. ACI 318 "Building Code Requirements for Structural Concrete and Commentary"
 8. ACI 347 "Guide for Evaluation of Concrete Structures Before Rehabilitation"
 9. ACI 364.1R "Guide for Evaluation of Concrete Structures before Rehabilitation"
 10. ACI 503R "Use of Epoxy Compounds with Concrete"
 11. ACI 562 "Code Requirements for Evaluation, Repair and Rehabilitation of Concrete Buildings and Commentary"
 12. ACI SP-66 "ACI Detailing Manual"
 13. ICRI 210.3 "Guide for Using In-Situ Tensile Pull-Off Tests to Evaluate Bond of Concrete Surface Materials"

14. ICRI 310.1R "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion"
15. Concrete Reinforcing Steel Institute, (CRSI) "Manual of Standard Practice"
16. ASTM Standards as applicable and as noted in this specification.

1.5 SUBMITTALS

A. Action Submittals

1. Product Data: Provide manufacturer's data sheets and installation procedures for concrete patching materials, anti-corrosion agent and epoxy adhesive.
2. Shop Drawings: Rebar and anchors.
3. Drawings or photographs indicating location, size, estimated quantity and proposed patching material for each repair location.
4. Shoring: As project conditions require, calculations and shop drawings that are signed, sealed and dated by a Professional Contracting officer licensed in the Project's jurisdiction for the temporary shoring design.

B. Informational Submittals

1. Certificates and information required by this specification
2. Laboratory test reports
3. Materials certificates
4. Qualification data as specified herein

1.6 QUALITY ASSURANCE

- A. Qualifications: Contractor shall be qualified in the field of concrete repair with a successful track record of five years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative. Provide a list of similar jobs identifying when, where and for whom the work was done, and which have proven successful in all respects for a period at least three years. Submit a certified statement attesting that the experience and qualifications of the workers comply with the specifications.
- B. Contractor shall pay for the services of the manufacturer's representative to be present at start of concrete repair work to ensure proper application. If the continuity of the craftsmen cannot be maintained throughout the project, the Contractor shall pay the manufacturer for additional visits to train new craftsmen.
- C. All sampling and testing shall be the Contractor's responsibility and shall be performed by an approved independent agency, and by the Contracting officer, with commercial testing laboratory facilities, except as otherwise specified.
- D. Field-Constructed Mock-Ups: Prior to the start of construction, prepare samples of work and obtain Contracting officer's written acceptance of the samples before proceeding with work. Retain during construction as a standard for judging all completed work.
 1. Preparation: Provide a minimum of one (1) area demonstrating surface preparation at loose concrete. Mock-up to show method for removing and roughening concrete, surface cleaning, edge preparation and cleaning/priming of reinforcing bars.
 2. Repair Patch: Provide a minimum of one (1) completed patch demonstrating the materials and methods for be used for concrete patching and finishing. The craftsmen performing future patching work shall be the same craftsmen that perform the mock-up. The demonstration shall include surface cleaning, surface patching, curing, surface finish/texturing and appearance.

- a. For any concrete repairs, confirm the selection of course and fine aggregates to add to the mix by materials analysis, mockup, and evaluation prior to the placement of the repair material. These are subject to approval of the Contracting Officer.
 - b. Compressive Strength Testing: Take test samples from mock up and deliver to independent testing laboratory for testing, as specified herein, at 7 days and 28 days.
 - c. Bond Strength Testing: Test in-situ for tensile bond at 7 days as specified herein for Direct Tension Bond Test.
3. Crack Repair: Provide a minimum of one (1) completed crack repair demonstrating the materials and methods to be used.
 4. Each craftsman shall be approved to work on site based on the quality of their individual mock-ups. The Contractor shall keep approved craftsmen on the job. If the Contractor wants to bring new or additional craftsmen on to the project, they shall be approved by the quality of their individual mock ups related to the work they are intend to do.
 5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. The Contractor is responsible for equipment, materials, testing, labor and other items and services required to accomplish the work. Equipment and techniques proposed for use in the work shall not be used until they have been demonstrated and approved. Materials and equipment, which have not been approved for use in the work, shall not be stored or brought on to the site.
- F. Concrete and mortar proposed for use in the work shall have a 28-day compressive strength and air content matching the adjacent existing concrete. If existing documentation does not provide adequate information as to the compressive strength and air content of the existing concrete it shall be determined in accordance with ASTM C39 for compressive strength, and ASTM C457/ASTM C642 for air content. Take test specimens of existing concrete from a sound and intact representative portion of the structure, at locations indicated by the Structural Contracting officer. All sampling and testing shall be completed by the independent approved agency.

1.7 PRE-INSTALLATION CONFERENCE

- A. A pre-installation conference shall be held a minimum of two weeks prior to commencement of field operations and the submission of submittals for the work described herein to establish procedures, to maintain optimum working conditions, and to coordinate this work with related and adjacent work. Agenda for meeting shall include extent of removal and means and methods for the installation of patch repairs and crack fillers. Attendees shall include manufacturer's representative and Contracting officer.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of product.
- B. Comply with manufacturer's written instruction for handling and storage conditions; including moisture and temperature. Consult Material Safety Data Sheets for complete handling recommendations.

1.9 PROJECT CONDITIONS

- A. Protect persons from damage or injury which could result from the performance of the Work.

- B. Protect adjacent finish materials and building against spatter during patch material placement.
- C. Environmental Requirements: Do not apply concrete repairs unless the temperature is above 40°F and will remain so for at least 24 hours after completion of work. To control setting time use cold water when temperature is above 90 degrees Fahrenheit [32 degrees Celsius]. Stop repair work and protect in-place materials during periods of rain or other precipitation.
- D. Provide noise and vibration monitoring as directed by the Contracting officer.
- E. See Division 01 for additional site safety, construction and roadway operating requirements.

1.10 WARRANTY

- A. The Contractor shall guarantee the concrete repairs, against defects of materials and workmanship, for a period of five years, beginning with date of substantial completion.
- B. In addition to the Contractor's guarantee, there shall be a Manufacturer's Warranty that the concrete repairs will be sound and free from defects, including coverage against shrinkage of patching material, for a period of ten (10) years, beginning with date of substantial completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Concrete patching system materials for repair (Repair Mortar, Bonding Agent and Anti-Corrosion Agent) from a single manufacturer to ensure compatibility. Only use concrete patching systems recommended by the manufacturer for each applicable use.

2.2 MATERIALS

A. Materials, General

1. Source Limitations: Obtain each grade, type, and variety of product from a single source with resources to provide products with consistent quality in appearance and physical properties.
2. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

B. Concrete Patches: The physical properties and composition of the concrete patching materials shall match those of the existing concrete to be repaired.

1. Admixtures: Air entraining admixtures shall conform to ASTM C260, water-reducing or -retarding admixtures shall conform to ASTM C494, and pigments for integrally colored concrete shall conform to ASTM C979 and ASTM C1017. Admixtures shall not contain added chlorides. Concrete may also contain water reducers, high-range water reducers, or set retarders to provide special properties to the concrete. Use of admixtures shall be subject to approval.
2. Cementitious Material: Provide cementitious materials of one type and from one source. Cement composition shall match that of cement used in existing concrete to be repaired as determined by samples and testing and shall conform to the basic requirements of ASTM C150. Cement shall have non-shrink properties and shall conform to ASTM C1107, Class B or C, expansive cement type.
3. Sand: Clean, sharp sand free of loam, silt, soluble salts and organic matter. Aggregate shall conform to ASTM C33.

4. Proportions of Mixes: Provide trial batches that contain materials proposed to be used in the project. The concrete patching mixtures shall be designed using the lowest practical w/c ratio. The physical properties and composition of the concrete patching materials shall match those of the existing concrete to be repaired. Submit the results of trial mixture along with a statement giving the maximum nominal coarse aggregate size, aggregate gradation, and the proportions of all ingredients that will be used. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated.

C. Repair Mortar, Overhead and Vertical Applications

1. All repair mortars shall be fast setting, non-sag, fiber reinforced and polymer modified overhead repair mortar. The mortar shall contain a corrosion inhibitor, have an approved overhead lift height of at least two (2) inches [50 mm], and conforming to the following:
 - a. Compressive strength compatible with the existing concrete, as specified herein.
 - b. Bond strength of 2,000 psi [13.8 MPa] or more at 28 days when tested in accordance with ASTM C882.
 - c. Shrinkage shall be less than 0.05 percent when tested in accordance with ASTM C157.
 - d. Rapid Chloride Permeability in "Low Range" or better when tested with ASTM C1202.
2. Subject to compliance with manufacturer and code requirements, provide Sika Corporation "SikaQuick VOH" or equal approved by the Contracting officer of Record.

D. Anti-Corrosion Agent

1. Bonding agents are not permitted, only anti-corrosion agents are permitted as specified herein.
2. Shall be capable of protecting existing reinforcing steel against rust and corrosion and shall have the following properties:
 - a. Water Permeability of 7.32×10^{-15} feet/second [2.23 m/s] maximum at 145 psi [10 bar] of 8.92×10^{-15} feet/second [2.72 m/s].
 - b. Water vapor diffusion coefficient μ H₂O of 110
 - c. Carbon dioxide diffusion coefficient μ CO₂ of 14,000
 - d. Rapid chloride permeability of less than 150 coulombs at 28 days when tested in accordance with ASTM CR02 and AASHTO T-277.
3. Subject to compliance with manufacturer and code requirements, provide Sika Corporation "Sika Armatec 110 EpoCem" or equal approved by the Contracting officer of Record.

E. Crack Repair

1. A low viscosity epoxy injection resin system pumped under pressure into structural cracks shall conform to ASTM C881, Type I or IV. Epoxy-resin grout shall have the ability to structurally rebond cracks, delaminations, and hollow plane conditions in concrete; shall be insensitive to the presence of water; and shall have the capability to penetrate cracks down to 5 mils [0.127 mm] in width. Materials shall have been used in similar conditions for a period of at least five (5) years. Design injection ports for epoxy-resin grout for the intended use as detailed in this section, made according to the recommendation of the epoxy manufacturer. System shall meet the following criteria:
 - a. Tensile properties at 14 days of 3,000 psi [20.7 MPa] minimum when tested in accordance with ASTM D638.

- b. Total water absorption of 0.15 at 1 day when tested in accordance with ASTM D570.
 - c. Bond strength at 14 days of 3,000 psi [20.7 MPa] when tested in accordance with ASTM C882.
2. Subject to compliance with manufacturer and code requirements, provide Sika Corporation "Sikadur 35 Hi-Mod LV" with "Sikadur 33", or equal approved by the Contracting officer of Record, for sealing cracks prior to injection grouting.
- F. Reinforcing steel: Deformed bars conforming to ASTM A615, Grade 60, unless noted otherwise on the Drawings.
 - G. Anchors: Threaded stainless steel conforming to ASTM A276, Type [304 or 316], size as indicated.
 - H. Water: Potable water free from oils, acids, alkali, organic matter and other deleterious material to conform to ASTM C94 shall be used in cleaning concrete surfaces, producing concrete and mortars, and curing concrete. ASTM C94 for gray water use in the production of ready mixed concrete per approval by the Contracting officer of Record.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate installation of repairs with placement of reinforcing steel, where required.
- B. Work and schedule to be coordinated with Contracting officer.
- C. Concrete renovation shall be undertaken only after a complete evaluation and analysis of the areas to be repaired is completed, including sampling and testing of the existing concrete to determine its composition and qualities. A condition survey of the area to be repaired shall conform to ACI 201.1R and ACI 364.1R. Strength evaluation shall be in accordance with ACI 437R. Cracks shall be evaluated in accordance with ACI 224.1R. Examination and sampling procedures shall conform to ASTM C823.

3.2 SURFACE PREPARATION

- A. Establish Repair Boundaries
 - 1. All exposed concrete is to be examined, sounded and repaired by the Contractor using a lift, scaffolding, swing stage, or other approved access method, as required.
 - 2. The Contractor is advised that the Drawings and Specifications do not undertake to illustrate every location of work necessary to complete this project. The Drawings intend to convey approximate locations and quantities of work insofar as they have been determined by visual observation. The actual repair area may be less or more. For each type of repair specified as part of the Work the Contractor's bid shall indicate the assumed quantities in the base bid and provide unit costs for additions and deductions.
 - 3. The Contractor shall locate areas of unsound, weak, or damaged concrete by sounding with a hammer and marking boundaries of these conditions for repair. The sounding will produce a dull sound in areas of delaminated concrete and a sharp ringing sound will be heard when there is sound concrete. Methods for marking repair boundaries shall be approved by the Contracting officer.
- B. Sequence of Work and Shoring

1. Removal of large areas of concrete at one time has the potential to compromise the load-carrying capacity of the concrete structure. To ensure stability in the interim condition the Contractor shall retain a Professional Contracting officer licensed in the Project's jurisdiction to provide either of the documents listed below, signed and sealed:
 - a. Construction sequencing plan for repairs ensuring stability in the interim condition
 - b. Design of temporary shoring supports as required before beginning concrete removal.

C. Concrete Preparation

1. Remove unsound, weak or damaged concrete. Loose particles, spalling, cracked or debonded concrete shall be removed with hand tools unless otherwise noted. Perimeter of repair shall have a minimum of 0.5 inch [12.7 mm] in depth. Edges are to be cut perpendicular to underside surfaces; feathered edges are not permitted. Remove unsound concrete back to sound concrete substrate, by means of chipping or other approved methods. Surface grinders for use in preparing concrete and metal surfaces shall be small, hand-held equipment with a slow to moderate operating RPM, using stone grinding wheels. Saw cutting equipment shall use circular diamond blades. The back of the patch shall be approximately parallel with the exposed surface of the patch.
2. Equipment used to drill holes in concrete for patch anchors and other applications shall be standard handheld masonry drills, commonly used for drilling small holes in concrete and masonry, using rotary drilling mode only. Impact and rotary impact type drills are prohibited from use in patch anchor installations.
3. The Contractor shall take care to ensure that the existing steel is not damaged during cutting or chipping. Any damage shall be repaired at the Contractor's expense, to the satisfaction of the Contracting officer of Record.
4. Thoroughly clean removal areas of loose concrete, dust and debris. Provide fractured aggregate surface with a profile of at least 1/8 inch [3.18 mm] in accordance with ICRI CSP-5 minimum. Clean the surfaces by water blasting and manual scrubbing methods. The concrete surfaces shall be cleaned of dust, dirt, corrosion or other contamination.
5. The maximum depth of concrete removal shall be 4 inches [102 mm]. If the Contractor believes that additional depth is required, the Contracting officer of Record shall be notified. Deeper repairs are not to be performed unless approved by the Contracting officer of Record.

D. Steel Preparation

1. Exposed steel reinforcement shall be free of all rust, scale, oil, paint, grease, loose mill scale, and other foreign matter, which will prevent bonding with the repair concrete. Use abrasive grit blasting or power driven brushes to clean to a white metal finish corresponding to an SSPC Specification Number SP11.
2. Concrete behind bars shall be removed 1 inch minimum to allow for entire bar to be cleaned and coated, and allow for mechanical bond with patch material.
3. Notify Contracting officer of Record when the existing reinforcing steel has a section loss of 20% or greater. In these instances, supply and place additional reinforcing steel equal to at least 1.5 x the area lost. Provide reinforcement lap splices per the Drawings.

E. Formwork

1. Erect formwork as necessary to reconstruct concrete to match adjacent surfaces.

3.3 PATCHING REPAIR APPLICATION

A. General

1. Repair areas less than 3 inches [76.2 mm] deep, and all overhead repairs, shall be patches using an approved trowel-applied patching mortar. Repair areas greater than 3 inches [76.2 mm] deep shall be patched with concrete.

B. Patch Anchors

1. Surface areas to be patched, which do not have reinforcement or other metal embedment, shall be provided with patch anchors to ensure that the patch is tied to the existing concrete structure. Provide patch anchors within the excavation at a frequency of at least one patch anchor for every 6 linear inches [152 mm] in all directions with a minimum of two per patch. Set rods at 45 degrees to horizontal in opposing direction. Do not set anchors closer than 1 inch [25.4 mm] to any edge of the patch. The anchors shall be set back from the exterior face at least 1 inch [25.4 mm].

C. Anti-Corrosion Agent

1. Coat reinforcing bars with anti-corrosion agent, as soon as possible after the steel preparation, but preferably within 3 hours of cleaning.
2. Follow manufacturer's instructions and apply 2 coatings.

D. Repair Mortar

1. Prior to application dampen area to be repaired to achieve saturated surface dry (SSD) condition so that pores of concrete are filled with water.
2. Mix repair mortar in accordance with manufacturer's instructions. Follow time limits set by manufacturer to prevent hardening of material prior to placement. Do not mix more materials than can be used within recommended open time. Complete repair while bonding agent is still tacky.
3. Work a coat of the mixed material into the substrate with a stiff brush to ensure intimate contact and establish bond.
4. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
5. Apply in lifts not to exceed 1½ inches in thickness. Where multiple lifts are required, score top surface on each lift to produce a roughened substrate for the next lift. Allow preceding lift to harden before applying fresh material. Saturate surface of lift with clean water. See manufacturer's instructions for additional direction.
6. Dispose of waste material in accordance with project standards per Division 01.

E. Concrete Patching

1. Apply only to sound and clean, properly prepared surface.
2. Prior to application dampen area to be repaired to achieve saturated surface dry (SSD) condition so that pores of concrete are filled with water.
3. Place concrete to rebuild spalled or damaged areas to match the original surface profile.
4. Use vibrators to consolidate concrete as it is placed.
5. Where required place concrete by form method, designing forms to resist pumping pressure in addition to the weight of wet concrete.
6. Dispose of waste material in accordance with project standards per Division 01.

3.4 CRACK REPAIRS

A. Preparation

1. Remove old caulking or grout from previously repaired cracks where it is failing. Remove loose particles from cracks. Cracks shall be cleaned, pressure-washed to remove all loose debris, followed by blowing with filtered, dry, compressed air.
2. Isolated hairline cracks up to 1/16 inch [1.59 mm] shall be filled with low viscosity epoxy injection resin system.
3. Cracks larger than 1/16 inch [1.59 mm] shall be routed to a minimum width of 0.5 inches [12.7 mm] and a minimum depth of 0.75 inches [19.1 mm] being careful so as to not cut existing reinforcement.

B. Epoxy-Resin Grout

1. Mix epoxy-resin grout components in the proportions recommended by the manufacturer. The components shall be conditioned from 70 - 85 degrees Fahrenheit [21 – 29 degrees Celsius] for 48 hours prior to mixing. Mix the two epoxy components with a power-driven device. The polysulfide curing agent component shall be added gradually to the epoxy-resin component with constant stirring until a uniform mixture is obtained. The rate of stirring shall be such that the entrained air is at a minimum.

C. Pressure Injection of Cracks

1. Cracks shall be pressure-injected using a two component epoxy system. System shall be capable of injection pressures up to a maximum 150 psi [1.03 MPa] to ensure complete penetration of the crack.
2. Entry points shall be established along the crack. Drill 5/8 inch [15.8 mm] diameter holes along the crack. Space holes as directed by the manufacturer, typically as far apart as the concrete thickness, with a maximum spacing of one foot on center. Set injection ports into holes as directed by manufacturer, and wherever else required depending on crack size and other conditions.
3. Apply an adequate surface seal to the crack or joint to prevent the escape of epoxy. Fill the crack with a 100 percent solid epoxy adhesive.
4. Inject the adhesive into the crack at the first entry point with sufficient pressure to advance the epoxy to the next adjacent port. The original port shall be sealed and injection moved to the port at which the epoxy appears. When sealing vertical cracks, begin injecting at the bottom of the crack and work upwards. Continue the process until each joint and crack has been injected for its entire length. Epoxy shall be allowed to cure in accordance with manufacturer's instructions. Sealing materials shall then be removed and surface finished to match adjacent existing surface.
5. Care shall be taken to ensure that the crack is not widened during epoxy resin injection.

3.5 CURING

- A. Moist curing to commence immediately after finishing and continue for 48 hours. Use water based curing compound or fine mist of water.
- B. Maintain concrete and mortar to be moist-cured continuously wet for the entire curing period. If water or curing materials stain or discolor concrete and mortar surfaces which are to be permanently exposed, the concrete and mortar surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by covering with a 2 inch [50.8 mm] minimum thickness of continuously saturated sand, or by covering with waterproof paper, polyethylene sheet, polyethylene coated burlap, or saturated burlap.
- C. If a curing compound is used, Contractor to confirm with manufacturer that the selected product is compatible with patching mortar. Apply compound in a one-coat continuous operation by

mechanical spraying equipment, at a uniform coverage of 200 square-foot per gallon [4.91 square-meters per liter]. Keep surfaces coated with curing compound free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

- D. Protect and cure epoxy adhesives in accordance with the manufacturer's recommendations. The adjacent surfaces and ambient conditions shall be maintained within the manufacturer's recommendations.

3.6 FINISHING AND TEXTURING

- A. Provide hand tools used for finishing and texturing concrete and mortar. Equipment used for finishing and texturing concrete and mortar surfaces shall be a type commonly used in the concrete construction and repair industry for that application. Finish and texture subject to approval from Contracting Officer. At Contracting officer's direction finish with a broom for a slightly rough surface or a trowel for a smooth surface, to be determined based on mock-up.
- B. Concrete and mortar finishes and color shall match the finish and color of the existing adjacent concrete. Accomplish finishing at the time of concrete placement or immediately after formwork removal. The finishing and texturing shall be accomplished in such a way as to help conceal bond lines between the patch and adjacent surfaces. The texturing shall replicate all surface details, including tooling and machine marks.
- C. Provide a water-borne acrylic paint after concrete repairs are completed, as required to match existing.

3.7 PROTECTION AND CLEANING

- A. Protect surfaces of the structure, and surfaces adjacent to the repairs from damage which may result from the removal, cleaning and patching operations.
- B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.
- C. Protect patching repairs from freezing, rainfall and wind prior to final set. Given the site conditions and environmental requirements herein, the patches shall be largely protected from freezing and rain. In windy weather repair areas shall be covered with burlap for a minimum of 3 hours after patch placement.
- D. No sooner than 72 hours after completion of the curing period, exposed surfaces of concrete shall be washed down with water applied with a soft bristle brush, then rinsed with clean water. Discolorations which cannot be removed by these procedures, will be considered defective work. Perform cleaning work when temperature and humidity conditions are such that surfaces dry rapidly. Protect adjacent surfaces from damage during cleaning operations.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to sample materials and perform tests as follows:
 - 1. Compressive Strength – Concrete and mortar shall have a compressive strength at 28 days, which matches the present compressive strength of concrete in the structure. Provide a minimum of three samples from the mock-up, and three samples for each 500 square feet of subsequent repair area.
 - a. Repair Mortar – Mold test cubes of patching mortar in accordance with ASTM C109.

- b. Job-Mixed Concrete Patching Mortar – Strength test specimens for acceptance tests shall be molded and cured in accordance with ASTM C31. Cylinders shall be tested in accordance with ASTM C39.
 - c. Packaged, Cementitious Patching Mortar: Selected sets of samples for each type of mortar required shall be tested according to ASTM C 928.
 - d. Low Strength – When strength of patches is considered potentially deficient, obtain cores and test them in accordance with ASTM C42. All investigations, testing, load tests, and correction of deficiencies shall be performed, and approved by the Contracting officer, at their expense.
- 2. Air Content & Shrinkage – Tests for total air content shall be made on fresh samples of the concrete and mortar. Perform tests onsite, on samples taken at the location of placement. Determine air content in accordance with ASTM C231. Determine testing for shrinkage in accordance with ASTM C1107.
 - 3. Direct Tension Bond Test – Perform in-situ bond test in accordance with ASTM C1583, following recommendations in ICRI 210.3. One test will be performed at mock-up and two subsequent tests for each 2000 square feet [185 square meters] of repair work.
 - 4. Epoxy Crack Injection: Core-drilled samples to verify proper installation.
 - a. Testing Frequency: 1 sample for each 100 feet [30 .5 meters] of crack injected.
 - b. Where samples are taken, refill holes with epoxy mortar.
- B. Product will be considered defective if it does not meet specified tests and inspections criteria.
 - C. The qualified testing agency will prepare and distribute to the Contracting officer test and inspection reports of the tests and inspections it conducts.

3.9 FINAL INSPECTION

- A. The patched areas shall be sounded with a hammer 7 days after concrete placement to test for soundness, delamination and structural integrity. A hollow sound indicates areas likely have not properly bonded to substrate concrete. Defective areas noted by an approved inspection agency shall be repaired by removing and replacing the patch at Contractor's expense.
- B. Following completion of the work, an approved inspection agency shall inspect the structure for damage, staining, and other distresses. The patches shall be inspected for cracking, crazing, staining and other defects. Inspect the finish, texture, color and shade, and surface tolerances of the patches to verify that all requirements have been met. Repair all surfaces exhibiting defects, at Contractor's expense.

END OF SECTION 03 01 30

SECTION 040310 - HISTORIC MASONRY CLEANING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes historic treatment work consisting of cleaning historic clay brick, terra cotta and stone masonry surfaces.

1.2 DEFINITIONS

- A. Very Low-Pressure Spray: Less than 100 psi.
- B. Low-Pressure Spray:
 - 1. Pressure: 100 to 400 psi.
 - 2. Flow Rate: 4 to 6 gpm.
- C. Medium-Pressure Spray:
 - 1. Pressure: 400 to 800 psi.
 - 2. Flow Rate: 4 to 6 gpm.
- D. High-Pressure Spray:
 - 1. Pressure: 800 to 1200 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. Fire-protection plan.
 - e. Cleaning program.
 - f. Coordination with building occupants.

1.4 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: For each type of product.
 - 1. Include material descriptions and application instructions.
 - 2. Include test data substantiating that products comply with requirements.

- C. Qualification Data: For historic treatment specialists including field supervisors and workers paint-remover manufacturer and chemical-cleaner manufacturer.
- D. Preconstruction Test Reports: For cleaning materials and methods.
- E. Quality-control program.
- F. Cleaning program.

1.5 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: A qualified historic masonry cleaning specialist. Experience cleaning new masonry work is insufficient experience for historic treatment work.
- B. Paint-Remover Manufacturer Qualifications: A firm regularly engaged in producing masonry paint removers that have been used for similar applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.
- C. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.
- D. 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.
- E. 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.
- F. 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 Architect specifically approves such deviations in writing.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified historic treatment specialist or one or more chemical-cleaner and paint-remover manufacturers 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.

1.7 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 PAINT REMOVERS

- A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste or gel formulation for removing paint from masonry; containing no methylene chloride.
 - 1. Manufacturer:
 - a. PROSOCO, Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- B. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming, alkaline paste or gel formulation for removing paint from masonry; containing no methylene chloride.
 - 1. Manufacturer:
 - a. PROSOCO, Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- C. Solvent-Type Paste Paint Remover: Manufacturer's standard water-rinsable, solvent-type paste or gel formulation for removing paint from masonry.
 - 1. Manufacturer:
 - a. PROSOCO, Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- D. Low-Odor, Solvent-Type Paste Paint Remover: Manufacturer's standard low-odor, water-rinsable, solvent-type paste, gel, or foamed emulsion formulation for removing paint from masonry; containing no methanol or methylene chloride.
 - 1. Manufacturer:

- a. PROSOCO, Inc.
- b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
- c. Substitutions: See Section 016000 – Product Requirements.

2.2 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 (TSP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.
- D. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.
- E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
 - 1. Manufacturer:
 - a. PROSOCO, Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
 - 1. Manufacturer:
 - a. PROSOCO, Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- G. Mild-Acid Cleaner: Manufacturer's standard mild-acid cleaner based on phosphoric, oxalic, or citric acid; but not containing muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.
 - 1. Manufacturer:
 - a. PROSOCO, Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- H. Acidic Cleaner: Manufacturer's standard acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors.
 - 1. Manufacturer:
 - a. PROSOCO, Inc.

- b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- I. Two-Part Chemical Cleaner: Manufacturer's standard system consisting of potassium- or sodium-hydroxide-based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.
 - 1. Manufacturer:
 - a. PROSOCO, Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.

2.3 ACCESSORY MATERIALS

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
 - 1. Manufacturer:
 - a. PROSOCO, Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- B. 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.

2.4 CHEMICAL-CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.
- B. Acidic Cleaner Solution for Brick and Unpolished Stone : Dilute acidic cleaner with water to produce acid content of 3 percent or less, but not greater than that recommended in writing by chemical-cleaner manufacturer. Hydrofluoric acid is not permitted.
- C. Acidic Cleaner Solution for Glazed Terra Cotta: Dilute acidic cleaner with water to concentration demonstrated by testing that does not etch or otherwise damage terra cotta surface, but not greater than that recommended in writing by chemical-cleaner manufacturer.

PART 3 EXECUTION

3.1 HISTORIC TREATMENT SPECIALIST

- A. Historic Treatment Specialist Firms: Subject to compliance with requirements,
 - 1. Refer to Part 1 Article 1.5 in these specifications for Quality Assurance requirements.

3.2 PROTECTION

- A. Remove gutters and downspouts and associated hardware adjacent to immediate work area and store during masonry cleaning. Reinstall when masonry cleaning is complete.
 - 1. Provide temporary rain drainage during work to direct water away from building.

3.3 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 50 feet away by Architect.
- C. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold 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. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
 - 2. 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 chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
 - c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
 - d. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
 - e. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
 - f. For steam application, use steam generator capable of delivering live steam at nozzle.
- 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. Steam Cleaning: Apply steam to masonry surfaces at very low pressures indicated for each type of masonry. Hold nozzle at least 6 inches from masonry surface, and apply steam in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- I. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi . Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- J. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
- K. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.4 PRELIMINARY CLEANING

- A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. 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 include paint, caulking, asphalt, and tar.
1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
 2. Remove paint and caulking with alkaline paint remover .
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Repeat application up to two times if needed.
 3. Remove asphalt and tar with solvent-type paste paint remover .
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Apply paint remover only to asphalt and tar by brush without prewetting.
 - c. Allow paint remover to remain on surface for 10 to 30 minutes.
 - d. Repeat application if needed.

3.5 PAINT REMOVAL

- A. Paint-Remover Application, General: 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.

- B. Paint Removal with Alkaline Paste Paint Remover:
1. Remove loose and peeling paint using 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/hot water applied by low -pressure spray to remove chemicals and paint residue.
 5. Repeat process if necessary to remove all paint.
 6. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended in writing by chemical-cleaner or afterwash manufacturer.
 7. Rinse with cold water applied by low -pressure spray to remove chemicals and soil.
- C. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:
1. Remove loose and peeling paint using scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 2. Apply paint remover to dry, painted surface with trowel, spatula, 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. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended in writing by chemical-cleaner or afterwash manufacturer.
 8. Rinse with cold water applied by low -pressure spray to remove chemicals and soil.
 9. For spots of remaining paint, apply alkaline paste paint remover according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph.
- D. Paint Removal with Solvent-Type Paste Paint Remover:
1. Remove loose and peeling paint using scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 2. Apply thick coating of paint remover to painted surface with natural-fiber cleaning brush, deep-nap roller, or large paint brush. 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/hot water applied by low -pressure spray to remove chemicals and paint residue.

3.6 CLEANING BRICKWORK

- A. Cold-Water Soak:
1. Apply cold water by intermittent spraying to keep surface moist.
 2. Use perforated hoses or other means that apply a fine water mist to entire surface being cleaned.
 3. Apply water in cycles with at least 30 mins between cycles .
 4. Continue spraying for 72 hours .
 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 low -pressure spray.
- C. Hot-Water Wash: Use hot water applied by low -pressure spray.
- D. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi . Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.
- E. 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.
- F. Mold, Mildew, and Algae Removal:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 - 3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
 - 4. Rinse with cold or hot water applied by low -pressure spray to remove mold, mildew, and algae remover and soil.
 - 5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.
- G. Nonacidic Gel Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer established by mockup .
 - 4. Remove bulk of gel cleaner.
 - 5. Rinse with cold water applied by low -pressure spray to remove chemicals and soil.
 - 6. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- H. Nonacidic Liquid Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply cleaner to surface in two applications by brush or low-pressure spray.
 - 3. Let cleaner remain on surface for period indicated below: recommended in writing by chemical-cleaner manufacturer
 - a. As recommended in writing by chemical-cleaner manufacturer.
 - b. As established by mockup.
 - c. Two to three minutes.
 - 4. Rinse with cold water applied by low -pressure spray to remove chemicals and soil.
 - 5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

- I. Mild-Acid Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply cleaner to surface in two applications by brush or low pressure spray.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 - 4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
 - 5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

- J. Acidic Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply cleaner to surface in two applications by brush or low-pressure spray.
 - 3. Let cleaner remain on surface for period indicated below:
 - a. As recommended in writing by chemical-cleaner manufacturer.
 - b. As established by mockup.
 - c. Two to three minutes.
 - 4. Rinse with cold water applied by low -pressure spray to remove chemicals and soil. Rinse until all foaming, if any, stops and suds disappear.
 - 5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

3.7 CLEANING GLAZED TERRA COTTA

- A. Hot-Water Wash: Use hot water applied by low-pressure spray.

- B. Steam Cleaning: Apply steam at very low pressures not exceeding **30 psi (207 kPa)**. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.

- C. 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.

- D. Nonacidic Gel Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 - 4. Remove bulk of gel cleaner.
 - 5. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
 - 6. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

- E. Nonacidic Liquid Chemical Cleaning:
 1. Wet surface with hot water applied by low-pressure spray.
 2. Apply cleaner to terra cotta.
 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
 5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

- F. Mild-Acid Chemical Cleaning:
 1. Wet surface with cold water applied by low-pressure spray.
 2. Apply cleaner to terra cotta.
 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
 5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

- G. Two-Part Chemical Cleaning:
 1. Wet surface with hot water applied by low-pressure spray.
 2. Apply alkaline prewash cleaner to surface by brush or roller.
 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer unless otherwise indicated.
 4. Rinse with hot water applied by medium-pressure spray to remove chemicals and soil.
 5. Apply acidic afterwash cleaner to terra cotta, while surface is still wet, using low-pressure spray equipment, deep-nap roller or soft-fiber brush.
 6. Let neutralizer remain on surface for period recommended in writing by manufacturer unless otherwise indicated.
 7. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
 8. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

3.8 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 with at least 30 mins in between cycles .
 4. Continue spraying until surface encrustation has softened enough to permit its removal by water wash, as indicated by cleaning tests for 72 hours .
 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 low -pressure spray.

- C. Hot-Water Wash: Use hot water applied by low -pressure spray.

- D. Steam Cleaning: Apply steam at very low pressures not exceeding 30 psi . Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.

- E. For General Cleaning, use Prosoco Enviro Klean 2010 All Surface Cleaner.
- F. Detergent Cleaning:
 - 1. Wet surface with cold or hot 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 or hot 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.
- G. Mold, Mildew, and Algae Removal:
 - 1. Wet surface with cold or hot water applied by low-pressure spray.
 - 2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 - 3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
 - 4. Rinse with cold or hot water applied by low -pressure spray to remove mold, mildew, and algae remover and soil.
 - 5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup.
- H. Nonacidic Gel Chemical Cleaning:
 - 1. Wet surface with cold or hot water applied by low-pressure spray.
 - 2. Apply gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
 - 3. Let cleaner remain on surface for period indicated below:
 - a. As recommended in writing by chemical-cleaner manufacturer.
 - b. As established by mockup .
 - 4. Remove bulk of gel cleaner.
 - 5. Rinse with cold or hot water applied by low -pressure spray to remove chemicals and soil.
 - 6. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- I. Nonacidic Liquid Chemical Cleaning:
 - 1. Wet surface with cold or hot water applied by low-pressure spray.
 - 2. Apply cleaner to surface in two applications by brush or low-pressure spray.
 - 3. Let cleaner remain on surface for period indicated below:
 - a. As recommended in writing by chemical-cleaner manufacturer.
 - b. As established by mockup.
 - c. Two to three minutes.
 - 4. Rinse with cold or hot water applied by low -pressure spray to remove chemicals and soil.
 - 5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- J. Mild-Acid Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply cleaner to surface by brush.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.

4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

K. Acidic Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period indicated below:
 - a. As recommended in writing by chemical-cleaner manufacturer.
 - b. As established by mockup.
 - c. Two to three minutes.
4. Rinse with cold water applied by low -pressure spray to remove chemicals and soil. Rinse until all foaming, if any, stops and suds disappear.
5. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

L. One-Part Limestone Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer established by mockup .
4. Immediately repeat application of one-part limestone cleaner as indicated above over the same area.
5. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.

M. Two-Part Chemical Cleaning:

1. Wet surface with cold hot water applied by low-pressure spray.
2. Apply alkaline prewash cleaner to surface by brush or roller.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer unless otherwise indicated.
4. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
5. Apply acidic afterwash cleaner to terra cotta in two applications, while surface is still wet, using low-pressure spray equipment, deep-nap roller or soft-fiber brush.
6. Let neutralizer remain on surface for period recommended in writing by manufacturer unless otherwise indicated.
7. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
8. Repeat cleaning procedure, where needed to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

3.9 FINAL CLEANING

- A. Clean adjacent nonmasonry surfaces of spillage and debris. Use detergent and soft brushes or cloths.
- B. Remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- C. Remove masking materials, leaving no residues that could trap dirt.

END OF SECTION 040310

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SECTION 040323 - HISTORIC BRICK UNIT MASONRY REPOINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes historic treatment work consisting of repointing brick masonry as follows:
 - 1. Repointing joints with mortar.

1.2 DEFINITIONS

- A. Low-Pressure Spray:
 - 1. Pressure: 100 to 400 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 repointing.
 - 2. Review methods and procedures related to repointing historic brick 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, sequencing, tolerances, and required clearances.
 - c. Quality-control program.
 - d. Fire-protection plan.
 - e. Unit masonry historic treatment program.
 - f. Coordination with building occupants.

1.4 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include recommendations for product application and use.
 - 3. Include test data substantiating that products comply with requirements.
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, and locations of repointing work on the structure.
 - 2. Show provisions for expansion joints or other sealant joints.
 - 3. Show locations of scaffolding and points of scaffolding in contact with masonry. Include details of contact or anchorage.
- D. Samples for Initial Selection: For the following:
 - 1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches long by 1/2 inch wide, set in aluminum or plastic channels.

- a. Have each set contain a close color range of at least three Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.
 - 2. Sand Type Used for Pointing Mortar: Minimum 8 oz. of each in plastic screw-top jars.
 - a. For blended sands, provide Samples of each component and blend. Identify blend ratio.
 - b. Identify sources, both supplier and quarry, of each type of sand.
 - 3. Sealant materials.
 - 4. Include similar Samples of accessories involving color selection.
- E. Qualification Data: For historic treatment specialist including field supervisors and workers and testing service.
- F. Quality-control program.
- G. Unit masonry historic treatment program.

1.5 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: A qualified historic masonry repointing specialist. Experience in pointing or repointing only new or nonhistoric masonry is insufficient experience for masonry 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 worker performance and preventing damage.
- C. Unit Masonry Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of historic treatment work, including protection of surrounding materials and Project site.
 - 1. Include methods for keeping pointing 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.
- D. Mockups: Prepare mockups of historic treatment on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Repointing: Rake out joints in two separate areas, each approximately 36 inches high by 48 inches wide for each type of repointing required, and repoint one of the areas.
 - 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.

1.6 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.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit repointing work to be performed according to product manufacturers' written instructions and specified requirements.
- B. Temperature Limits: Repoint mortar joints 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 mortar-joint pointing unless otherwise indicated:
 - 1. When air temperature is below 40 deg F, heat mortar ingredients and existing masonry walls 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 pointing.
- D. Hot-Weather Requirements: Protect mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar 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.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Source Limitations: Obtain each type of material for repointing historic masonry (cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II; white or gray or both where required for color matching of mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.

- C. Factory-Prepared Lime Putty: ASTM C 1489.
- D. Quicklime: ASTM C 5, pulverized lime.
- E. Mortar Sand: ASTM C 144 unless otherwise indicated.
 - 1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
 - 2. Color: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
 - 3. Provide sand with rounded edges.
- F. Mortar Pigments: ASTM C 979/C 979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.
 - 1. Manufacturer:
 - a. Solomon Colors Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- G. Water: ASTM C 270, potable.
- H. Masonry Cement (pre-mixed, bagged mortar): Shall NOT be used.

2.3 ACCESSORY MATERIALS

- A. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- B. 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.

2.4 MORTAR MIXES

- A. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and 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.
 - 1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until

mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

- C. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Contracting Officer's approval.
 - 1. Mortar 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. Setting Mortar by Type: ASTM C 270, Proportion Specification, Type N unless otherwise indicated.
 - 2. Pointing Mortar by Type: ASTM C 270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime. Add mortar pigments to produce mortar colors required.

PART 3 EXECUTION

3.1 HISTORIC TREATMENT SPECIALIST

- A. Historic Treatment Specialist Firms: Subject to compliance with requirements,
 - 1. Refer to Part 1 Article 1.5 in these specifications for Quality Assurance requirements..

3.2 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry 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 pointing work to discourage mortar from adhering.
 - 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.
- B. Remove gutters and downspouts and associated hardware adjacent to immediate work area and store during masonry repointing work. Reinstall when repointing is complete.
 - 1. Provide temporary rain drainage during work to direct water away from building.

3.3 MASONRY REPOINTING, GENERAL

- A. Have repointing work performed only by qualified historic treatment specialist.
- B. Appearance Standard: Repointed surfaces are to have a uniform appearance as viewed from 20 feet away by Contracting Officer.

3.4 REPOINTING

- A. Rake out and repoint joints to the following extent:
 - 1. All joints in areas indicated.
 - 2. Joints at locations of the following defects:

- a. Holes and missing mortar.
 - b. Cracks that can be penetrated 1/4 inch or more by a knife blade 0.027 inch thick.
 - c. Cracks 1/16 inch(es) or more in width and of any depth.
 - d. Hollow-sounding joints when tapped by metal object.
 - e. Eroded surfaces 1/4 inch or more deep.
 - f. Deterioration to point that mortar can be easily removed by hand, without tools.
 - g. Joints filled with substances other than mortar.
- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows, according to procedures demonstrated in approved mockup:
- 1. Remove mortar from joints to depth of and not less than that required to expose sound, unweathered mortar. Do not remove unsound mortar more than 2 inches deep; consult Contracting Officer for direction.
 - 2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 - 3. Do not spall edges of bricks or widen joints. Replace or patch damaged bricks as directed by Contracting Officer.
 - a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without Contracting Officer's written approval based on approved quality-control program.
 - b. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar in bed joints and mortar in head joints by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.
- D. Notify Contracting Officer of unforeseen detrimental conditions, including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
- E. Pointing with Mortar:
- 1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 - 2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch(es) until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
 - 3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch(es). Fully compact each layer and allow it to become thumbprint hard before applying next layer. Where existing brick have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
 - 4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 - 5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
 - a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
 - b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
 - 6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Remove mortar and repoint.

3.5 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low-pressure spray.
 - 1. Do not use metal scrapers or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent nonmasonry 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.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage qualified testing agencies to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

END OF SECTION 040323

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SECTION 040326 - HISTORIC TERRA COTTA UNIT MASONRY REPAIR

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes historic treatment work consisting of repairing historic terra cotta masonry as follows:
 - 1. Repairing unit masonry.
 - 2. Removing abandoned anchors.
 - 3. Painting steel uncovered during the work.

1.2 DEFINITIONS

- A. Low-Pressure Spray:
 - 1. Pressure: 100 to 400(690 to 2750) psi (kPa).
 - 2. Flow Rate: 4 to 6(0.25 to 0.4) gpm (L/s).
- B. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.
- C. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of terra cotta units to freezing and thawing.

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 repair.
 - 2. Review methods and procedures related to repairing historic terra cotta 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, sequencing, tolerances, and required clearances.
 - c. Quality-control program.
 - d. Fire-protection plan.
 - e. Terra cotta historic treatment program.
 - f. Coordination with building occupants.

1.4 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include recommendations for product application and use.
 - 3. Include test data substantiating that products comply with requirements.

- C. Shop Drawings:
 1. Include plans, elevations, sections, and locations of masonry repair work on the structure.
 2. Show full-size patterns with complete dimensions for new terra cotta units and their jointing, showing relationship of existing units to new units.
 3. Indicate setting number of each new terra cotta unit and its location on the structure in annotated plans and elevations.
 4. Show provisions for expansion joints or other sealant joints.
 5. Show provisions for flashing, conduits, and weep holes as required.
 6. Show replacement and repair anchors. Include details of anchors within individual terra cotta units, with locations of anchors and dimensions of holes and recesses in units required for anchors.

- D. Samples for Initial Selection: For the following:
 1. Colored Mortar: Submit sets of mortar that will be left exposed in the form of sample mortar strips, 6 inches (150 mm) long by 1/4 inch (6 mm) wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least three Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.
 2. Sand Types Used for Mortar: Minimum 8 oz. (240 mL) of each in plastic screw-top jars.
 - a. For blended sands, provide Samples of each component and blend. Identify blend ratio.
 - b. Identify sources, both supplier and quarry, of each type of sand.
 3. Patching Compound: Submit sets of patching compound Samples in the form of plugs (patches in drilled holes) in sample units of masonry representative of the range of masonry colors on the building.
 - a. Have each set contain a close color range of at least three Samples of different mixes of patching compound that match the variations in existing masonry when cured and dry.
 4. Terra Cotta Glaze Replacement: Submit sets of terra cotta glaze replacement Samples applied to terra cotta shingle, with glaze colors representative of the range of glaze colors on the building.
 - a. Have each set contain a close color range of at least three Samples of different formulas that match the variations in existing terra cotta glazes.
 5. Include similar Samples of accessories involving color selection.

- E. Preconstruction Test Reports: For existing terra cotta units and replacement terra cotta units.

- F. Quality-control program.

- G. Terra cotta historic treatment program.

1.5 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: A qualified historic terra cotta repair specialist. Experience installing standard unit masonry is insufficient experience for masonry historic treatment work.
 1. Historic Treatment Worker Qualifications: When terra cotta units are being patched, assign at least one worker per crew who is trained and certified by manufacturer of patching compound to apply its products .

- B. Terra Cotta Manufacturer Qualifications: A firm regularly engaged in manufacturing custom architectural terra cotta units for building restoration purposes, of same type and of similar size, complexity, and tolerances as those required for the Work.
- C. 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.
- D. Terra Cotta Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of 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.
- E. 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. Terra Cotta Repair: Prepare sample areas for each type of terra cotta material and assembly indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches (1200 mm) 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. Replacement: Four terra cotta units replaced.
 - b. Reanchoring Veneers: Install three masonry repair anchors in mockup wall assembly of each anchor type required.
 - c. Patching: Three small holes as directed for each type of terra cotta indicated to be patched, so as to leave no evidence of repair.
 - 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.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on terra cotta masonry as follows:
 - 1. Provide test specimens as indicated and representative of proposed materials and existing construction.
 - 2. Replacement Terra Cotta: Test each proposed type of replacement masonry unit, according to sampling and testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).
 - 3. Existing Terra Cotta: Test each type of existing masonry unit indicated for replacement, according to testing methods in ASTM C 67 for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove five existing units for testing from locations designated by Contracting Officer. Take testing samples from these units.
 - 4. Temporary Patch: As directed by Contracting Officer, provide temporary materials followed by permanent repairs at locations from which existing samples were taken.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver terra cotta units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons and protected against impact and chipping.
- B. Deliver each piece of terra cotta with code mark or setting number on unexposed face, corresponding to Shop Drawings, using nonstaining paint.
- C. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. 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.
- F. Store lime putty covered with water in sealed containers.
- G. Store sand where grading and other required characteristics can be maintained and contamination avoided.
- H. Handle terra cotta units to prevent overstressing, chipping, defacement, and other damage.

1.8 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 terra cotta masonry only when air temperature is between 40 and 90 deg F (4 and 32 deg C) 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 masonry repair unless otherwise indicated:
 - 1. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
 - 2. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for seven days after repair.
- D. Hot-Weather Requirements: Protect masonry repairs when temperature and humidity conditions produce excessive evaporation of water from mortar and repair 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 (32 deg C) 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 (terra cotta, cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MASONRY MATERIALS

- A. Glazed Terra Cotta: New terra cotta units that match existing terra cotta units in physical properties, color, gloss, surface texture, thickness, profile, dimensions, and composition of surface glaze.
 - 1. Tolerances as Fabricated: According to tolerance requirements in ASTM C212, Type FTX.
 - 2. Date Identification: Emboss in the clay body on a concealed, interior surface of each unit in easily read 1/2-inch- (13-mm-) high characters, "MADE 2023." Manufacturer's name may also be embossed.

2.3 MORTAR MATERIALS

- A. See Specification Section 040327 - Historic Terra Cotta Unit Masonry Repointing.

2.4 MANUFACTURED REPAIR MATERIALS

- A. Terra Cotta Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching terra cotta masonry.
 - 1. Manufacturer:
 - a. Cathedral Stone Products, Inc.
 - 1) Jahn M100 Terra Cotta and Brick Repair Mortar.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics), included herein.
 - c. Substitutions: See Section 016000 – Product Requirements.
 - 2. Use formulation that is vapor and water permeable (equal to or more than the terra cotta unit), exhibits low shrinkage, has lower modulus of elasticity than the terra cotta units being repaired, and develops high bond strength to all types of masonry.
 - 3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 - 4. Formulate patching compound used for patching terra cotta in colors and textures to match each unit being patched. Provide no fewer than three colors to enable matching the color, texture, and variation of each unit.
- B. Terra Cotta Glaze Replacement: High-solids, nonyellowing, fade-resistant, waterborne acrylic latex, polyurethane, or epoxy coating intended for exterior use as terra cotta glaze replacement. Product shall be custom mixed by manufacturer to match color and gloss of existing terra cotta glaze.

2.5 ACCESSORY MATERIALS

- A. Terra Cotta Anchors: Type and size indicated or, if not indicated, to match existing, formed metal anchors in size and type. Fabricate anchors from Type 304 stainless steel.

- B. Masonry Repair Anchors, Expansion Type: Mechanical fasteners designed for masonry veneer stabilization consisting of 1/4-inch (6-mm) diameter, Type 304 stainless-steel rod with brass expanding shells at each end and water-shedding washer in the middle. Expanding shells shall be designed to provide positive mechanical anchorage to veneer on one end and backup masonry on the other.
- C. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of terra cotta units, less the required depth of pointing materials unless removed before pointing.
- D. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- E. 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. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of terra cotta units, less the required depth of pointing materials unless removed before pointing.
 - 3. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
 - 4. Minimal possibility of damaging exposed surfaces.
 - 5. Consistency of each application.
 - 6. Uniformity of the resulting overall appearance.
 - 7. 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.

2.6 MORTAR MIXES

- A. See Specification Section 040327 - Historic Terra Cotta Unit Masonry Repointing.

PART 3 EXECUTION

3.1 HISTORIC TREATMENT SPECIALIST

- A. Historic Treatment Specialist Firms: Subject to compliance with requirements, :
 - 1. Refer to Part 1 Article 1.10 in these specifications for Quality Assurance requirements.

3.2 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry 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.
- B. Remove gutters and downspouts and associated hardware adjacent to immediate work area, and store during masonry repair work. Reinstall when repairs are complete.
 - 1. Provide temporary rain drainage during work to direct water away from building.

3.3 MASONRY 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(6) feet (m) away by Contracting Officer.

3.4 ABANDONED ANCHOR REMOVAL

- A. Remove abandoned anchors, brackets, wood nailers, and other extraneous items no longer in use unless indicated to remain .
 - 1. Remove items carefully to avoid spalling or cracking masonry.
 - 2. Notify Contracting Officer before proceeding if an item cannot be removed without damaging surrounding masonry. Do the following where directed:
 - a. Cut or grind off item approximately 3/4(20) inch(es) (mm) beneath surface, and core drill a recess of same depth in surrounding masonry as close around item as practicable.
 - b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
 - 3. Patch the hole where each item was removed unless directed to remove and replace the terra cotta unit.

3.5 TERRA COTTA REMOVAL AND REPLACEMENT (04.06)

- A. At locations indicated, remove terra cotta units that are damaged, spalled, or deteriorated. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
- B. Support and protect remaining masonry that was supported by removed units.
- C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition. See Specification Section 076200 - Sheet Metal Flashing and Trim.
- D. Notify Contracting Officer of unforeseen detrimental conditions, including voids, cracks, bulges, loose masonry units in existing backup, rotted wood, rusted metal, and other deteriorated items.
- E. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for terra cotta replacement.
- F. Install replacement units into bonding and coursing pattern of existing units.
 - 1. Do not cut or grind glazed terra cotta.
 - 2. Maintain joint width for replacement units to match existing joints.
 - 3. Use setting buttons or shims to set units accurately spaced with uniform joints.
- G. Set replacement units in a full bed of rebuilding (setting) mortar. Replace existing, formed metal anchors with new terra cotta anchors matching existing configuration.
 - 1. Embed anchors in mortar, and fill voids behind units with mortar.
 - 2. Tool exposed mortar joints in repaired areas to match joints of surrounding existing terra cotta.
 - 3. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.

- H. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
 - 1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.6 PAINTING STEEL UNCOVERED DURING THE WORK

- A. Notify Contracting Officer if steel is exposed during masonry removal. Where Contracting Officer determines that steel is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
 - 1. Surface Preparation: Remove paint, rust, and other contaminants according to SSPC-SP 2, "Hand Tool Cleaning," as applicable to comply with paint manufacturer's recommended preparation.
 - 2. Antirust Coating: Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).
- B. If on inspection and rust removal, the thickness of a steel member is found to be reduced from rust by more than 10 percent, notify Contracting Officer before proceeding.

3.7 TERRA COTTA PATCHING (TC-1)

- A. Patch the following terra cotta units unless another type of repair or replacement is indicated:
 - 1. Units indicated to be patched.
 - 2. Units with holes.
 - 3. Units with chipped edges or corners. Patch chipped edges or corners measuring more than 3/4 inch(19 mm) in least dimension.
 - 4. Units with small areas of deep deterioration. Patch deep deteriorations measuring more than 3/4 inch(19 mm) in least dimension and more than 1/4 inch(6 mm) deep.
- B. Patching Terra Cotta:
 - 1. Remove deteriorated material as determined by sounding gently with a small hammer. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 (6) inch(es) (mm) thick, but not less than recommended in writing by patching compound manufacturer.
 - 2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of unit.
 - 3. Rinse surface to be patched and leave damp, but without standing water.
 - 4. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
 - 5. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
 - 6. Do not apply patching compound over mortar joints. If patching compound bridges mortar joints, cut out joints after patching compound hardens.
 - 7. Trowel, scrape, or carve surface of patch to match texture, details, and surrounding surface plane or contour of the unit. Shape and finish surface before or after curing, as determined by testing, to best match existing terra cotta.
 - 8. Keep each layer damp for 72 hours or until patching compound has set.
 - 9. After final layer of patching compound has cured, apply terra cotta glaze replacement according to manufacturer's written instructions. Apply two or more coats, as needed, to match glaze of adjacent terra cotta units.

- C. Repair the glaze on the terra cotta units indicated.
 - 1. Units indicated to have glaze repaired.
 - 2. Units with abraded or chipped glaze.
 - 3. Units with spots or areas of shallow deterioration greater than glaze thickness and less up to 1/16 (1.5) inch(es) (mm) deep.
- D. Remove and replace discolored or mismatched glaze repairs unless otherwise indicated or approved by Contracting Officer.
- E. Application: After other repairs have cured, apply terra cotta glaze replacement according to manufacturer's written instructions. Apply two or more coats, as needed, to match glaze of adjacent terra cotta units. Do not apply glaze to joint surfaces between units or within joints that will be mortared or sealed.

3.8 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low-pressure spray.
 - 1. Do not use metal scrapers or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent nonmasonry 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.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage qualified independent testing agencies to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

3.10 MASONRY-WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property.
- B. Masonry Waste: Remove masonry waste and legally dispose of off Contracting Officer's property.

END OF SECTION 040326

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SECTION 040327 - HISTORIC TERRA COTTA UNIT MASONRY REPOINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes historic treatment work consisting of repointing terra cotta masonry as follows:
 1. Repointing joints with mortar.
 2. Repointing joints with sealant.

1.2 DEFINITIONS

- A. Low-Pressure Spray:
 1. Pressure: 100 to 400 (690 to 2750) psi (kPa).
 2. Flow Rate: 4 to 6 (0.25 to 0.4) gpm (L/s).

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 repointing.
 2. Review methods and procedures related to repointing historic terra cotta 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, sequencing, tolerances, and required clearances.
 - c. Quality-control program.
 - d. Fire-protection plan.
 - e. Terra cotta historic treatment program.
 - f. Coordination with building occupants.

1.4 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include recommendations for product application and use.
 3. Include test data substantiating that products comply with requirements.
- C. Shop Drawings:
 1. Include plans, elevations, sections, and locations of repointing work on the structure.
 2. Show provisions for expansion joints or other sealant joints.
 3. Show locations of scaffolding and points of scaffolding in contact with masonry. Include details of contact or anchorage.
- D. Samples for Initial Selection: For the following:

1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches (150 mm) long by 1/2 inch (13 mm) wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least three samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.
 2. Sand Type Used for Pointing Mortar: Minimum 8 oz. (240 mL) of each in plastic screw-top jars.
 - a. For blended sands, provide Samples of each component and blend. Identify blend ratio.
 - b. Identify sources, both supplier and quarry, of each type of sand.
 3. Sealant materials.
 4. Include similar Samples of accessories involving color selection.
- E. Qualification Data: For historic treatment specialist including field supervisors and workers and testing service.
- F. Quality-control program.
- G. Terra cotta historic treatment program.

1.5 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: A qualified historic masonry repointing specialist. Experience in pointing or repointing only new or nonhistoric masonry is insufficient experience for masonry 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 worker performance and preventing damage.
- C. Terra Cotta Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of historic treatment work, including protection of surrounding materials and Project site.
 1. Include methods for keeping pointing 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.
- D. Mockups: Prepare mockups of historic treatment on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.
 1. Repointing: Rake out joints in two separate areas, each approximately 36 inches (900 mm) high by 48 inches (1200 mm) wide for each type of repointing required, and repoint one of the areas.
 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.

1.6 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.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit repointing work to be performed according to product manufacturers' written instructions and specified requirements.
- B. Temperature Limits: Repoint mortar joints only when air temperature is between 40 and 90 deg F (4 and 32 deg C) 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 mortar-joint pointing unless otherwise indicated:
 - 1. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients and existing masonry walls to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
 - 2. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for seven days after pointing.
- D. Hot-Weather Requirements: Protect mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar 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 (32 deg C) and above unless otherwise indicated.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Source Limitations: Obtain each type of material for repointing historic masonry (cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II; white or gray or both where required for color matching of mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Factory-Prepared Lime Putty: ASTM C 1489.
- D. Quicklime: ASTM C 5, pulverized lime.
- E. Mortar Sand: ASTM C 144 unless otherwise indicated.
 - 1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
 - 2. Color: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
 - 3. Provide sand with rounded edges.
- F. Mortar Pigments: ASTM C 979/C 979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.
 - 1. Manufacturer:
 - a. Solomon Colors Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- G. Water: ASTM C 270, potable.
- H. Masonry Cement (pre-mixed, bagged mortar): Shall NOT be used.

2.3 ACCESSORY MATERIALS

- A. Sealant Materials:
 - 1. Sealant manufacturer's standard elastomeric sealant(s) of base polymer and characteristics indicated below and according to applicable requirements in Section 079200 "Joint Sealants."
 - 2. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the 100 sieve.
- B. Joint-Sealant Backing:
 - 1. See Specification Section 079200 - Joint Sealants.
- C. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- D. Tee Caps: Lead stone flashing strips; weather-cap incorporated.
- E. 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.

2.4 MORTAR MIXES

- A. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix to ASTM C 5 and 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.
 1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
- C. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Contracting Officer's approval.
 1. Mortar 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. Mix mortar materials in the following proportions:
- F. Setting Mortar by Type: ASTM C 270, Proportion Specification, Type N unless otherwise indicated.
- G. Pointing Setting Mortar by Type: ASTM C 270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime. Add mortar pigments to produce mortar colors required.

PART 3 EXECUTION

3.1 HISTORIC TREATMENT SPECIALIST

- A. Historic Treatment Specialist Firms: Subject to compliance with requirements,
 1. Refer to Part 1 Article 1.5 in these specifications for Quality Assurance requirements..

3.2 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry 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 pointing work to discourage mortar from adhering.
 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.
- B. Remove gutters and downspouts and associated hardware adjacent to immediate work area and store during masonry repointing work. Reinstall when repointing is complete.
1. Provide temporary rain drainage during work to direct water away from building.

3.3 MASONRY REPOINTING, GENERAL

- A. Have repointing work performed only by qualified historic treatment specialist.
- B. Appearance Standard: Repointed surfaces are to have a uniform appearance as viewed from 20 (6) feet (m) away by Contracting Officer.

3.4 REPOINTING

- A. Rake out and repoint joints to the following extent:
1. All joints in areas indicated.
 2. Joints indicated as sealant-filled joints.
 3. Joints at locations of the following defects:
 - a. Holes and missing mortar.
 - b. Cracks that can be penetrated 1/4 inch (6 mm) or more by a knife blade 0.027 inch (0.7 mm) thick.
 - c. Cracks 1/16 (1.6) inch(es) (mm) or more in width and of any depth.
 - d. Hollow-sounding joints when tapped by metal object.
 - e. Eroded surfaces 1/4 inch (6 mm) or more deep.
 - f. Deterioration to point that mortar can be easily removed by hand, without tools.
 - g. Joints filled with substances other than mortar.
- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows, according to procedures demonstrated in approved mockup:
1. Remove mortar from joints to depth of 2-1/2 times joint width. Do not remove unsound mortar more than 2 (50) inches (mm) deep; consult Contracting Officer for direction.
 2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 3. Do not spall edges of terra cotta units or widen joints. Replace or patch damaged units as directed by Contracting Officer.
 - a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without Contracting Officer's written approval based on approved quality-control program.
- D. Notify Contracting Officer of unforeseen detrimental conditions, including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
- E. Pointing with Mortar:
1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.

2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than [3/8 (9)] inch(es) (mm) until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
 3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than [3/8 (9)] inch(es) (mm). Fully compact each layer and allow it to become thumbprint hard before applying next layer. Where existing terra cotta units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
 4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
 - a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
 - b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
 6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Remove mortar and repoint.
- F. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.5 PREPARATION FOR TEE CAP AT SKY-FACING JOINTS:

- A. Mark off width of selected tee cap on the stone surface and apply 1" masking tape lateral to marks.
- B. Pre-fit or shape and cut tee cap strips to closely conform to the profile of the stone substrate as required before setting.
- C. Select width to overlap joint edges not less than 1/8".
- D. Cut strips to lay in a single full length of each joint wherever possible with an end turn-down over front and back faces of ledges and copings a minimum of 1" or to drop edge.
- E. Make all joints in tee cap neatly mitered, coped, or butted to produce close fitting, weather resisting joint protection; notch strips as recommended by manufacturer.

3.6 POINTING WITH TEE CAP AT SKY-FACING JOINTS:

- A. Install backer rod to a depth of 1/4" below tip of anchor shaft when tee cap is set in place.
- B. Prime stone.
- C. Fill joint with sealant to a height of approximately 1/8" above the adjacent masonry surface per manufacturer's instructions

- D. Set preformed tee cap strip into the sealant bed, press down firmly to the stone surface to ensure bonding grooves are solidly filled and no voids exist between tee cap and masonry.
- E. Clean off excess sealant compound using a putty knife and leave adjacent masonry clean.
- F. Carefully remove masking tape from adjacent surfaces.

3.7 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low-pressure spray.
 - 1. Do not use metal scrapers or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent nonmasonry 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.

END OF SECTION 040327

SECTION 040342 - HISTORIC STONE MASONRY REPAIR

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes historic treatment work consisting of repairing historic stone assemblies as follows:
 - 1. Repairing stone masonry.
 - 2. Removing abandoned anchors.

1.2 DEFINITIONS

- A. Low-Pressure Spray:
 - 1. Pressure: 100 to 400 psi.
 - 2. Flow Rate: 4 to 6 gpm.
- B. Face Bedding: Setting of stone with the rift or natural bedding planes (strata) vertical and parallel to the wall plane rather than horizontal or "naturally bedded," which holds bedding planes together by gravity.
- C. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.
- D. Rift: The most pronounced direction of splitting or cleavage of a stone.
- E. Stone Terminology: ASTM C 119.

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.
 - f. Coordination with building occupants.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include recommendations for product application and use.
 3. Include test data substantiating that products comply with requirements.
- C. Shop Drawings:
1. Include plans, elevations, sections, and locations of stone repair work on the structure.
 2. Indicate complete dimensions for new stone units and their jointing, showing relation of existing to new units.
 3. Show partial replacement stone units (dutchmen).
 4. Indicate setting number of each new stone unit and its location on the structure in annotated plans and elevations.
 5. Show provisions for expansion joints or other sealant joints.
 6. Show provisions for flashing, lighting fixtures, conduits, and weep holes as required.
 7. Show replacement and repair anchors, including drilled-in pins. Include details of anchors within individual stone units, with locations of anchors and dimensions of holes and recesses in stone required for anchors, including direction and angle of holes for pins.
 8. Show locations of scaffolding and points of scaffolding in contact with masonry. Include details of each point of contact or anchorage.
- D. Samples for Initial Selection: For the following:
1. Colored Mortar: Submit sets of mortar that will be left exposed in the form of sample mortar strips, 6 inches long by 1/4 inch wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least six Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.
 2. Each type of sand used for mortar; minimum 8 oz. of each in plastic screw-top jars.
 - a. For blended sands, provide Samples of each component and blend. Identify blend ratio.
 - b. Identify sources, both supplier and quarry, of each type of sand.
 3. Patching Compound: Submit sets of patching compound Samples in the form of plugs (patches in drilled holes) in sample units of stone representative of the range of stone colors on the building.
 - a. Have each set contain a close color range of at least six Samples of different mixes of patching compound that matches the variations in existing stone when cured and dry.
 4. Include similar Samples of accessories involving color selection.
 5. Each type of replacement stone. Include sets of Samples to show full range of color, texture, grain, veining, and finish to be expected. Provide sets of at least three 12-by-12-inch Samples for each type, but no fewer than necessary to indicate full range and the proportion of variations within range.
 6. Each type of patching compound in form of briquettes, at least 3 inches long by 1-1/2 inches wide. Document each Sample with manufacturer and stock number or other information necessary to order additional material.
 7. Each type of adhesive.
- E. Samples for Verification: For the following:
1. Accessories: Each type of anchor, accessory, and miscellaneous support.
- F. Qualification Data: For historic treatment specialist including field supervisors and workers and testing service.
- G. Preconstruction Test Reports: For existing stone types and replacement stone.
- H. Quality-control program.

- I. Stone historic treatment program.

1.5 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: A qualified historic stone repair specialist. Experience installing standard unit masonry or new stone masonry is insufficient experience for stone historic treatment work.
 - 1. Historic Treatment Worker Qualifications: When stone units are being patched, assign at least one worker per crew who is trained and certified by manufacturer of patching compound to apply its products.
- 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.
- 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. Replacement: Four stone units replaced.
 - b. Partial Stone Replacement: Two partial stone replacements (dutchman repairs).
 - c. Stone Plug Repair: Two stone plug repairs for each type of stone indicated to be plugged.
 - d. Crack Injection: Apply crack injection in two separate areas as directed .
 - e. Patching: Three small holes as directed for each type of stone indicated to be patched, so as to leave no evidence of repair.
 - 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.

1.6 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. Replacement Stone: Test each proposed type of replacement stone, according to ASTM C 170/C 170M for compressive strength, wet and dry, perpendicular and parallel to rift; ASTM C 99/C 99M for modulus of rupture, wet and dry, perpendicular and parallel to rift; and ASTM C 97/C 97M for absorption and bulk specific gravity.
3. Existing Stone: Test each type of existing stone indicated for replacement, according to ASTM C 170/C 170M for compressive strength, wet and dry, perpendicular and parallel to rift; ASTM C 99/C 99M for modulus of rupture, wet and dry, perpendicular and parallel to rift; and ASTM C 97/C 97M for absorption and bulk specific gravity. Carefully remove five existing stones for testing from locations designated by Contracting Officer. Take testing samples from these stones.
4. Temporary Patch: As directed by Contracting Officer, provide temporary materials followed by permanent repairs at locations from which existing samples were taken.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver stone to Project site strapped together in suitable packs or pallets or in heavy-duty crates and protected against impact and chipping.
- B. Deliver each piece of stone with code mark or setting number on unexposed face, corresponding to Shop Drawings, using nonstaining paint.
- C. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. 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.
- F. Store sand where grading and other required characteristics can be maintained and contamination avoided.
- G. Handle stone to prevent overstressing, chipping, defacement, and other damage.

1.8 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 (stone, cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MASONRY MATERIALS

- A. Types of Existing Stone:
 - 1. Sandstone
 - 2. Limestone
- B. Stone Matching Existing: Natural building stone of variety, color, texture, grain, veining, finish, size, and shape that match existing stone and with physical properties within 10 percent of those determined from preconstruction testing of selected existing stone.
 - 1. For existing stone that exhibits a range of colors, textures, grains, veining, finishes, sizes, or shapes, provide stone that proportionally matches that range rather than stone that matches an individual color, texture, grain, veining, finish, size, or shape within that range.
- C. Quarrying New Stone: Have quarry clearly label the direction of rift or bedding planes when rough stone is quarried, to facilitate cutting stones so that natural bedding planes are as required in "Cutting New Stone" Paragraph.
- D. Cutting New Stone: Regardless of how existing stone was cut and set, cut each new stone so that, when it is set in final position, the rift or natural bedding planes match the rift orientation of existing stones.

2.3 MORTAR MATERIALS

- A. See Specification Section 040343 - Historic Stone Masonry Repointing for Mortar Materials.

2.4 MANUFACTURED REPAIR MATERIALS

- A. Stone-Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching stone.
 - 1. Manufacturer:
 - a. Cathedral Stone Products, Inc.

- b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
 - 2. Use formulation that is vapor and water permeable (equal to or more than the stone), exhibits low shrinkage, has lower modulus of elasticity than the stone units being repaired, and develops high bond strength to all stone types.
 - 3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 - 4. Formulate patching compound in colors, textures, and grain to match stone being patched. Provide sufficient number of colors to enable matching each piece of stone.
 - B. Cementitious Crack Filler: Ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all stone types.
 - 1. Manufacturer:
 - a. Cathedral Stone Products, Inc.
 - 1) Micro Injection Grout Product:
 - (a) Jahn M30 #32 Micro Injection Grout for Brick and Soft Stone.
 - 2) Crack Injection Grout Product:
 - (a) Jahn M40 Crack Injection Grout.
 - 3) Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - b. Substitutions: See Section 016000 – Product Requirements.
 - C. Stone-to-Stone Adhesive: Two-part polyester or epoxy-resin stone adhesive with a 15- to 45-minute cure at 70 deg F (21 deg C), recommended in writing by adhesive manufacturer for type of stone repair indicated, and matching stone color.

2.5 ACCESSORY MATERIALS

- A. Stone Anchors and Pins: Type and size indicated or, if not indicated, to match existing anchors in size and type. Fabricate from Type 304 stainless steel.
- B. 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.
- C. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- D. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer according to MPI #23 (surface-tolerant, anticorrosive metal primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating).
 - 1. Surface Preparation: Use coating no better than SSPC-SP 2, "Hand Tool Cleaning," SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," surface preparation according to manufacturer's literature or certified statement.
 - 2. VOC Limit: Use coating with a VOC content of 400 g/L or less.
- E. 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.

2.6 MORTAR MIXES

- A. See Specification Section 040343 - Historic Stone Masonry Repointing for Mortar Materials.

PART 3 EXECUTION

3.1 HISTORIC TREATMENT SPECIALIST

- A. Historic Treatment Specialist Firms: Subject to compliance with requirements,
 1. Refer to Part 1 Article 1.5 in these specifications for Quality Assurance requirements..

3.2 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.
- B. Remove gutters and downspouts and associated hardware adjacent to immediate work area and store during stone repair work. Reinstall when repairs are complete.
 1. Provide temporary rain drainage during work to direct water away from building.

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 ABANDONED ANCHOR REMOVAL

- A. Remove abandoned anchors, brackets, wood nailers, and other extraneous items no longer in use unless indicated to remain.
 1. Remove items carefully to avoid spalling or cracking stone.
 2. Notify Contracting Officer before proceeding if an item cannot be removed without damaging surrounding stone; do the following where directed:
 - a. Cut or grind off item approximately 3/4 inch beneath surface, and core drill a recess of same depth in surrounding stone as close around item as practical.
 - b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.

3. Patch the hole where each item was removed unless directed to remove and replace the stone unit.

3.5 PARTIAL STONE REPLACEMENT (04.07)

- A. Remove defective portion of existing stone unit (backing stone). Carefully remove defective portion of stone by making vertical and horizontal saw cuts at face of backing stone and removing defective material to depth required for fitting partial replacement (dutchman).
 1. Make edges of backing stone at cuts smooth and square to each other and to finished surface; essentially rectangular. Make back of removal area flat and parallel to stone face.
 2. Do not overcut at corners and intersections. Hand trim to produce clean sharp corners with no rounding and no damage to existing work to remain.
 3. If backing stone becomes further damaged, remove damaged area and enlarge partial replacement as required.
- B. Remove mortar from joints that abut area of stone removal to same depth as stone was removed. Remove loose mortar particles and other debris from surfaces to be bonded and surfaces of adjacent stone units that will receive mortar by cleaning with stiff-fiber brush.
- C. Cut and trim partial replacement to accurately fit area where material was removed from backing stone. Fabricate to size required to produce joints between partial replacement and backing stone of no more than 1/16 inch width, and to produce joints between partial replacement and other stones that match existing joints between stones. Cut partial replacement so that, when it is set in final position, natural bedding planes match the orientation of bedding planes of the backing stone unless otherwise indicated.
- D. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch-diameter, threaded stainless-steel pins set into 1/4-inch-diameter holes drilled at a 45-degree downward angle through face of partial replacement and into backing stone.
 1. Center and space pins between 3 and 5 inches apart and at least 2 inches from any edge. Insert pins at least 2 inches in backing stone and 2 inches in partial replacement, with end countersunk at least 3/4 inch from exposed face of partial replacement.
- E. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch-diameter, threaded stainless-steel pins set into 1/4-inch-diameter holes drilled into backing stone and into, but not through, the partial replacement.
 1. Center and space pins between 3 and 5 inches apart and at least 2 inches from any edge. Insert pins at least 2 inches in backing stone and 2 inches in partial replacement, but no closer than 3/4 inch from exposed face of partial replacement.
- F. Apply stone-to-stone adhesive according to adhesive manufacturer's written instructions. Coat bonding surfaces of backing stone and partial replacement, completely filling all crevices and voids.
- G. Apply partial replacement while adhesive is still tacky, and hold securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of partial replacement with face of backing stone.
- H. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes as specified in "Stone Patching" Article.

3.6 STONE PATCHING (04.02)

- A. Patch the following stone units unless another type of repair or replacement is indicated:
 - 1. Units indicated to be patched.
 - 2. Units with holes.
 - 3. Units with chipped edges or corners. Patch chipped edges or corners measuring more than 3/4 inch in least dimension.
 - 4. Units with small areas of deep deterioration. Patch deep deteriorations measuring more than 3/4 inch in least dimension and over 1/4 inch deep.
- B. Remove deteriorated material, and remove adjacent material that has begun to deteriorate. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch thick, but not less than as recommended in writing by patching compound manufacturer.
- C. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of stone unit.
- D. Brush-coat stone surfaces with slurry coat of patching compound according to manufacturer's written instructions.
- E. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
 - 1. Simple Details: Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the stone. Shape and finish surface before or after curing, as determined by testing, to best match existing stone.
 - 2. Carved Details: Build patch up 1/4 inch above surrounding stone, and carve surface to match adjoining stone after patching compound has hardened.
- F. Keep each layer damp for 72 hours or until patching compound has set.
- G. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.

3.7 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
 - 1. Do not use metal scrapers or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- 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.

3.8 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 Contracting Officer's property.

END OF SECTION 040342

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SECTION 040343 - HISTORIC STONE MASONRY REPOINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes historic treatment work consisting of repointing stone masonry joints with mortar .

1.2 DEFINITIONS

- A. Low-Pressure Spray:
 - 1. Pressure: 100 to 400 psi.
 - 2. Flow Rate: 4 to 6 gpm.
- B. Rift: The most pronounced direction of splitting or cleavage of a stone. Rift may be obscure in igneous rocks such as granite. Often it is obvious, as with bedding planes in many sedimentary stones.

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 masonry historic treatment and repointing.
 - 2. Review methods and procedures related to repointing 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.
 - f. Coordination with building occupants.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Field Survey – Scope Verification: Refer to requirement as specified in section 040342 Historic Stone Masonry Repair.
- C. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include recommendations for product application and use.
 - 3. Include test data substantiating that products comply with requirements.
- D. Shop Drawings:

1. Include plans, elevations, sections, and locations of repointing work on the structure.
 2. Show provisions for expansion joints or other sealant joints.
 3. Show locations of scaffolding and points of scaffolding in contact with masonry. Include details of each point of contact or anchorage.
- E. Samples for Initial Selection: For the following:
1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches long by 1/4 inch wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least six Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.
 2. Each type of sand used for pointing mortar; minimum 8 oz. of each in plastic screw-top jars.
 - a. For blended sands, provide Samples of each component and blend. Identify blend ratio.
 - b. Identify sources, both supplier and quarry, of each type of sand.
 3. Sealant materials.
 4. Include similar Samples of accessories involving color selection.
- F. Qualification Data: For historic treatment specialist including field supervisors and workers and testing service.
- G. Quality-control program.
- H. Stone historic treatment program.

1.5 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: Engage an experience masonry restoration firm, with a minimum of (7) years of documented experience in historic preservation projects. Work shall be done by skilled workmen, fully instructed as to the requirements Specified herein and adequately supervised during the work. Firm shall have completed work similar in material, design, and extent to that indicated for this Project. With a record of successful in-service performance in the past five (5) years. Experience installing standard unit masonry or new stone masonry is insufficient experience for stone historic treatment work.
1. Field Supervision: The Masonry Restoration Contractor shall maintain a steady crew consisting of qualified craftsmen and full time supervisor(s), on site daily, with a minimum of seven (7) years of successful experience. Supervisors shall not be changed during the Project except for causes beyond control of the Masonry Restoration firm. The Masonry Restoration Contractor shall confirm that all works under their direction fully understand the requirements of the job.
 2. Qualifications of Workers: The Masonry Restoration Contractor shall demonstrate that the masons performing the Work have competence in completing the historic restoration work specified in this section.
- B. Historic Treatment Specialist Qualifications: A qualified historic masonry repointing specialist. Experience in pointing or repointing only new or nonhistoric masonry is insufficient experience for masonry historic treatment work.
- C. 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.

- D. 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 pointing 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.
- E. Mockups: Prepare mockups of historic treatment on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Repointing: Rake out joints in two separate areas, each approximately 36 inches high by 48 inches wide for each type of repointing required, and repoint one of the areas.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect 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.

1.6 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.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit repointing work to be performed according to product manufacturers' written instructions and specified requirements.
- B. Temperature Limits: Repoint mortar joints 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 mortar-joint pointing unless otherwise indicated:
 - 1. When air temperature is below 40 deg F, heat mortar ingredients 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 pointing.
- D. Hot-Weather Requirements: Protect mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar 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.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Source Limitations: Obtain each type of material for repointing historic masonry (cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II; white or gray or both, where required for color matching of mortar.
1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Factory-Prepared Lime Putty: ASTM C 1489.
- D. Quicklime: ASTM C 5, pulverized lime.
- E. Mortar Sand: ASTM C 144 unless otherwise indicated.
1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
 2. Color: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
 3. Provide sand with rounded edges.
- F. Mortar Pigments: ASTM C 979/C 979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.
1. Manufacturer:
 - a. Solomon Colors Inc.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 – Product Requirements.
- G. Water: ASTM C 270, potable.

2.3 ACCESSORY MATERIALS

- A. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- B. Tee Caps: Lead stone flashing strips.
 - 1. Manufacturer:
 - a. Weathercap, Inc.
 - 1) Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - b. Substitutions: See Section 016000 – Product Requirements.
- C. Joint Sealant: See Section 079000 - Joint Sealants.
- D. Joint-Sealant Backing: See Section 079000 - Joint Sealants.
- E. 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.

2.4 MORTAR MIXES

- A. Preparing Lime Putty: Slake quicklime and prepare lime putty according to appendix in ASTM C 5 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.
 - 1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
- C. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
 - 1. Mortar 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. Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.
- D. Do not use admixtures in mortar unless otherwise indicated.
- E. Mixes: Mix mortar materials in the following proportions:
 - 1. Setting Mortar by Type: ASTM C 270, Proportion Specification, Type N unless otherwise indicated.

2. Pointing Mortar by Type: ASTM C 270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to portland cement and lime. Add mortar pigments to produce mortar colors required.

PART 3 EXECUTION

3.1 HISTORIC TREATMENT SPECIALIST

- A. Historic Treatment Specialist Firms: Subject to compliance with requirements,
 1. Refer to Part 1 Article 1.5 in these specifications for Quality Assurance requirements..

3.2 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 pointing work to discourage mortar from adhering.
 3. Immediately remove mortar splatters in contact with exposed stone and other surfaces.
- B. Remove gutters and downspouts and associated hardware adjacent to immediate work area and store during stone repointing work. Reinstall when repointing is complete.
 1. Provide temporary rain drainage during work to direct water away from building.

3.3 STONE REPOINTING, GENERAL

- A. Have repointing work performed only by qualified historic treatment specialist.
- B. Appearance Standard: Repointed surfaces are to have a uniform appearance as viewed from 20 feet away by Architect.

3.4 REPOINTING (04.03)

- A. Rake out and repoint joints to the following extent:
 1. All joints in areas indicated.
 2. Joints indicated as sealant-filled joints.
 3. Joints at locations of the following defects:
 - a. Holes and missing mortar.
 - b. Cracks that can be penetrated 1/4 inch or more by a knife blade 0.027 inch thick.
 - c. Cracks 1/16 inch or more in width and of any depth.
 - d. Hollow-sounding joints when tapped by metal object.
 - e. Eroded surfaces 1/4 inch or more deep.
 - f. Deterioration to point that mortar can be easily removed by hand, without tools.
 - g. Joints filled with substances other than mortar.
- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows, according to procedures demonstrated in approved mockup:
 1. Remove mortar from joints to depth of not less than that required to expose sound, unweathered mortar . Do not remove unsound mortar more than 3 inches deep; consult Architect for direction.

2. Remove mortar from stone surfaces within raked-out joints to provide reveals with square backs and to expose stone for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 3. Do not spall edges of stone units or widen joints. Replace or patch damaged stone units as directed by Architect.
 - a. Cut out mortar by hand with chisel and resilient mallet. Do not use power-operated grinders without Architect's written approval based on approved quality-control program.
 - b. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar in bed joints and mortar in head joints by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.
- D. Notify Architect of unforeseen detrimental conditions, including voids in mortar joints, cracks, loose stone, rotted wood, rusted metal, and other deteriorated items.
- E. Pointing with Mortar:
1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly, and allow it to become thumbprint hard before applying next layer.
 3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer, and allow it to become thumbprint hard before applying next layer. Where existing stone has worn or rounded edges, slightly recess finished mortar surface below face of stone to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed stone surfaces or to feather edge the mortar.
 4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
 - a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
 - b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
 6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Remove mortar and repaint.
- F. Where repointing work precedes cleaning of existing stone, allow mortar to harden at least 30 days before beginning cleaning work.
- G. Preparation for Tee Cap at Sky-facing Joints:
1. Mark off width of selected tee cap on the stone surface and apply 1" masking tape lateral to marks.
 2. Pre-fit or shape and cut tee cap strips to closely conform to the profile of the stone substrate as required before setting.
 3. Select width to overlap joint edges not less than 1/8".
 4. Cut strips to lay in a single full length of each joint wherever possible with an end turn-down over front and back faces of ledges and copings a minimum of 1" or to drop edge.
 5. Make all joints in tee cap neatly mitered, coped, or butted to produce close fitting, weather resisting joint protection; notch strips as recommended by manufacturer.

- H. Pointing with Tee Cap at Sky-facing Joints:
1. Install backer rod to a depth of 1/4" below tip of anchor shaft when tee cap is set in place.
 2. Prime stone.
 3. Fill joint with sealant to a height of approximately 1/8" above the adjacent masonry surface per manufacturer's instructions.
 4. Set preformed tee cap strip into the sealant bed, press down firmly to the stone surface to ensure bonding grooves are solidly filled and no voids exist between tee cap and masonry.
 5. Clean off excess sealant compound using a putty knife and leave adjacent masonry clean.
 6. Carefully remove masking tape from adjacent surfaces.

3.5 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
1. Do not use metal scrapers or brushes.
 2. Do not use acidic or alkaline cleaners.
- 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.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage qualified testing agencies to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

END OF SECTION 040343

SECTION 055133 - METAL LADDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Prefabricated ladders.

1.2 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- C. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008 (Reaffirmed 2018).
- D. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2019.
- E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2023).
- H. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata (2020).
- I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

1.3 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.4 QUALITY ASSURANCE

- A. Design ladder under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.1 PREFABRICATED LADDERS

- A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
 - 1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
 - 2. Materials: Aluminum; ASTM B211/B211M 6063 alloy, T52 temper.
 - 3. Finish: Powder coat; color to be selected by Contracting Officer from manufacturer's standard range.
 - 4. Manufacturer:
 - a. Precision Ladders; Fixed Aluminum Wall Ladder.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics).
 - c. Substitutions: See Section 016000 - Product Requirements.

2.2 FINISHES - ALUMINUM

- A. Exterior Aluminum Surfaces: High performance organic coating.
- B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
- C. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as indicated.

2.3 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- A. Supply setting templates to the appropriate entities for steel items required to be embedded in masonry.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on shop drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION 055133

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SECTION 061000 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concealed wood blocking, nailers, and supports.

1.2 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- B. AWWA U1 - Use Category System: User Specification for Treated Wood 2023.
- C. PS 20 - American Softwood Lumber Standard 2021.

1.3 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: Provide technical data on each process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Factory mark each piece of lumber with grade stamp of grading agency.

1. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: Kiln-dry or MC15.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 1. Lumber: S4S, No. 2 or Standard Grade.
 2. Boards: Standard or No. 3.

2.3 ACCESSORIES

- A. Fasteners and Anchors:
 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. NES NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.2 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.3 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

- B. Provide wood curb at each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

END OF SECTION 061000

SECTION 070150.19 - PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Replacement of existing roofing system in preparation for new roofing system in designated areas as indicated on drawings.
- B. Removal of existing flashing and counterflashings.
- C. Temporary roofing protection.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.
 - 1. Attendees:
 - a. Contracting Officer.
 - b. Contractor.
 - c. Installer.
 - d. Roofing system manufacturer's field representative.
 - e. Inspection and Testing Agency Representatives.
 - 2. Meeting Agenda: Provide agenda to participants prior to meeting in preparation for discussions on the following:
 - a. Removal and installation schedule.
 - b. Necessary preparatory work.
 - c. Protection before, during, and after roofing system installation.
 - d. Removal of existing roofing system.
 - e. Installation of new roofing system.
 - f. Temporary roofing and daily terminations.
 - g. Transitions and connection to and with other work.
 - h. Inspections and testing of installed systems.
- B. Schedule work to coincide with commencement of installation of new roofing system.

1.3 QUALITY ASSURANCE

- A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least three years of documented experience.
 - 1. Comply with EPA notification regulations prior to start of roofing removal work.
 - 2. Comply with removal and disposal regulations of local authorities having jurisdiction (AHJ).
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
 - 1. When same installer as new roofing system, comply with related requirements of section indicated for new roofing system.

1.4 FIELD CONDITIONS

- A. Existing Roofing System: single-ply membrane and clay tile roofing.
- B. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents or intended continued occupancy.
- C. Maintain continuous temporary protection prior to and during installation of new roofing system.
- D. Provide notice at least three days before starting activities that will affect normal building operations.
- E. Verify that occupants have been evacuated from building areas when work on structurally impaired roof decking is scheduled to begin.
- F. Contracting Officer will occupy building areas directly below re-roofing area.
 - 1. Provide Contracting Officer with at least 48 hours written notice of roofing activities that may affect their operations and to allow them to prepare for upcoming activities as necessary.
 - 2. Do not disrupt Contracting Officer's operations or activities.
 - 3. Maintain access of Contracting Officer's personnel to corridors, existing walkways, and adjacent buildings.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. See the following sections for additional information on components relating to this work:
 - 1. Replacement and removal of existing roofing system in preparation for new roofing system in designated areas as indicated on drawings, see Section 075400.
 - 2. Remove existing flashing and counterflashings in preparation for replacement of these materials as part of this work, see Section 076200 for material requirements.

2.2 MATERIALS

- A. Temporary Roofing Protection Materials:
 - 1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

2.3 ACCESSORIES

- A. Fasteners: Type and size as required and compatible with existing and new roofing system to resist local wind uplift.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.2 PREPARATION

- A. Sweep roof surface clean of loose matter.

3.3 MATERIAL REMOVAL

- A. Remove only existing roofing materials that can be replaced with new materials as the weather will permit.
- B. Remove metal counter flashings.
- C. Remove damaged insulation and fasteners, cant strips, and blocking.
- D. Remove vapor retarder, sheathing paper, and underlay.
- E. Repair existing concrete deck surface to provide smooth working surface for new roof system.

3.4 INSTALLATION

- A. Coordinate scope of this work with requirements for installation of new roofing system, see Section 075400 for additional requirements.

3.5 PROTECTION

- A. Provide protection of existing roofing system that is not having work performed on it.
- B. Provide temporary protective sheeting over uncovered deck surfaces.

END OF SECTION 070150.19

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SECTION 073213 - CLAY ROOF TILES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Clay roof tiles.
- B. Underlayment.
- C. Wood attachment components.
- D. Metal roof flashing and counterflashing.

1.2 REFERENCE STANDARDS

- A. ASTM C91/C91M - Standard Specification for Masonry Cement 2023.
- B. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
- C. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.
- D. ASTM C1167 - Standard Specification for Clay Roof Tiles 2022.
- E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- F. NRCA (RM) - The NRCA Roofing Manual 2023.

1.3 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on tile and underlayment, indicating material characteristics, installation instructions, and limitations and precautions.
- C. Verification Samples: Set of tiles representing actual product in color, finish, and style, including special shapes and fittings.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture of roofing systems similar to those required for this project, with not less than 5 years of documented experience.

1.5 MOCK-UPS

- A. Provide a mock-up for evaluation of clay roof tile installation workmanship, including typical ridge detail.

1. Mock-up Size: 4 feet by 1 foot (1220 mm by 305 mm), minimum.
- B. Locate where directed.
- C. Mock-up may remain as part of work.

1.6 FIELD CONDITIONS

- A. Do not install roof tiles, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F (7 degrees C).
- B. Protect surrounding areas and adjacent surfaces during execution of this work.

1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.1 ROOF TILES

- A. Existing Clay Roof Tiles: Salvage and reuse intact and serviceable existing clay tiles wherever possible.
- B. Clay Roof Tiles:
 1. Match existing tile as closely as possible.
 2. Comply with requirements of ASTM C1167, Grade 2 tile; with nail holes made before firing.
 3. Profile: As indicated.
 4. Tile Size: Matching existing.
 5. Vertical Exposure: As indicated on drawings.
 6. Finish: Match existing.
 7. Color: To match existing.
- C. Special Shapes and Fittings: Supply special shapes and fittings of same material and finish as adjacent tile, factory-formed before firing, as indicated on drawings or as required for specific project conditions, including but not limited to hip caps.

2.2 SHEET MATERIALS

- A. Underlayment: Self-adhering butyl-rubber sheet complying with ASTM D1970/D1970M; strippable release film.
 1. Reinforcement Layer: Non-woven polyester top surface.
 2. Sheet Thickness: 40 mil, 0.040 inch (1 mm), minimum.
 3. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 4. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.

2.3 METAL FLASHING

- A. Provide metal roof flashing; see Section 076200.

2.4 ACCESSORIES

- A. Attachment Components:
 - 1. Material: Wood, pressure preservative treated; see Section 061000.
 - 2. Battens: 2 inch by 4 inch (50 mm by 100 mm), nominal, spaced as required for tile size.
 - 3. Nailers: Nominal 2-inch (50 mm) thick members, height as required for specific conditions.
- B. Fasteners:
 - 1. Underlayment Fasteners: Hot-dip galvanized steel roofing nails, 11-gauge, 0.12-inch (3.05 mm) diameter, sharp pointed with barbed shanks, minimum 3/8-inch (9.5 mm) diameter head, and of length sufficient to penetrate 3/4 inch (19 mm) into solid substrate or completely through sheathing.
 - 2. Tile Fasteners: Stainless steel ring shank nails, 10-gauge, 0.134-inch (3.40 mm) diameter, with minimum 3/8-inch (9.5 mm) diameter head, of sufficient length to penetrate 3/4 inch (19 mm) into solid substrate or completely through sheathing.
- C. Mortar:
 - 1. Cement: ASTM C91/C91M, Type M.
 - 2. Sand: ASTM C144, uniformly graded and free from organic materials.
 - 3. Mix: Premixed or site mixed, ASTM C270, Type M mortar.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine structural roof deck for compliance with specified requirements, and verify that roof penetrations and roof openings are correctly installed in proper locations.
- B. Do not begin installation of tile roofing until substrates have been properly prepared, and if substrate preparation is responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Prepare roof deck surfaces using methods recommended by tile manufacturer for achieving best results under project conditions.
- B. Seal roof deck joints wider than 1/16 inch (1.5 mm) with deck tape.

3.3 INSTALLATION

- A. Install clay tile roofing system in accordance with manufacturers recommendations and NRCA (RM) applicable requirements.
- B. Underlayment:

1. Roof Slopes Less than 4:12: Install one layer of elastomeric membrane underlayment over entire roof area, perpendicular to roof slope, with ends and edges weather lapped a minimum of 4 inches (100 mm), and staggering end laps of each layer.
- C. Sheet Metal Flashing: Install flashing at other locations as indicated and as required by project conditions.
 1. Install flashing at each location where clay roof tiles intersect other roofs, walls, parapets, chimneys, ventilators, and similar projections.
- D. Attachment Components:
 1. Nailers: Install nailers at ridge and hips, directly over underlayment; protect with additional layer of underlayment before installing ridge and hip tiles and accessories.
- E. Clay Tile:
 1. Install first row of tile at eaves with minimum projection of 1 inch (25 mm).
 2. Lay tile square with building lines and parallel with roof slope, and install filler, closure, and mitered pieces as required.
 3. Unless otherwise indicated or recommended by tile manufacturer, install tile with minimum of 3-inch (75 mm) headlaps.
 4. Nail tiles by driving nails to point where nail heads just clear surface of tile, so tiles hang on nails; do not overdrive nails by putting pressure on underlying tile, and do not underdrive nails and put strain on overlying tile.
 5. Cut and fit tiles neatly around vents, pipes, and other projections.
 6. Set top of hip tile in full bed of mortar, and strike flush with face of tile.
 7. Install accessories in accordance with manufacturer's details and recommendations.

3.4 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Clean exposed work upon completion of installation; remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to finish.

3.5 PROTECTION

- A. Minimize traffic over finished roof surface; where walking on roof is absolutely necessary, wear soft-soled shoes and walk on abutting tiles to avoid breakage.
- B. Remove and replace damaged or broken tile before Date of Substantial Completion.

END OF SECTION 073213

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Adhered system with thermoplastic polyolefin (TPO) roofing membrane.
- B. Insulation, flat and tapered.
- C. Deck sheathing and coverboard.
- D. Roofing cant strips and walkway pads.

1.2 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2022.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2023.
- D. ASTM D638 - Standard Test Method for Tensile Properties of Plastics 2022.
- E. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method 1983 (Reapproved 2018).
- F. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing 2021.
- G. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces 2011 (Reapproved 2019).
- H. NRCA (RM) - The NRCA Roofing Manual 2023.
- I. NRCA (WM) - The NRCA Waterproofing Manual 2021.
- J. UL (DIR) - Online Certifications Directory Current Edition.
- K. UL (FRD) - Fire Resistance Directory Current Edition.
- L. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.4 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: Provide manufacturer's written information listed below.
 1. Product data indicating membrane materials, flashing materials, insulation, surfacing, and fasteners.
 2. Preparation instructions and recommendations.
 3. Storage and handling requirements.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and paver layout.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
- F. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- G. Warranty:
 1. Submit manufacturer warranty and ensure that forms have been completed in Contracting Officer's name and registered with manufacturer.
 2. Submit installer's certification that installation complies with all warranty conditions for the waterproof membrane.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum twenty (20) years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section:
 1. With minimum five (5) years documented experience.
 2. Approved by membrane manufacturer.
 3. Extend manufacturer's labor and materials guarantee.
 4. Extend manufacturer's No Dollar Limit guarantee.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

- C. Protect products in weather protected environment, clear of ground and moisture.
- D. Protect foam insulation from direct exposure to sunlight.
- E. Provide Safety Data Sheets (SDS) at the project site at all times during transportation, storage, and installation of materials.
- F. Comply with requirements from Contracting Officer to prevent overloading or disturbance of the structure when loading materials onto the roof.

1.7 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather. Refer to manufacturer's written instructions.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C) or above 90 degrees F (32 degrees C).
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Proceed with work so new roofing materials are not subject to construction traffic as work progresses.
- F. Do not allow grease, oil, fats, or other contaminants to come into direct contact with membrane.

1.8 WARRANTY

- A. See Section 017700 - Closeout Procedures for additional warranty requirements.
- B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within 10 years after installation.
- C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
 - 1. Warranty Term: 30 years.
 - 2. For repair and replacement include costs of both material and labor in warranty.
 - 3. Include accidental punctures according to the manufacturer's standard warranty terms.
 - 4. Include hail damage according to the manufacturer's standard warranty terms.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Roofing Membrane System:
 - 1. Elevate; Ultraply Platinum Roofing

2. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics), included herein.

B. Substitutions: See Section 016000 - Product Requirements.

2.2 ROOFING APPLICATIONS

A. TPO Membrane Roofing: One ply membrane, fully adhered, over insulation.

B. Roofing Assembly Performance Requirements and Design Criteria:

1. Solar Reflectance Index (SRI): 78, minimum, calculated in accordance with ASTM E1980.
 - a. Field applied coating may not be used to achieve specified SRI.
2. Roof Covering External Fire Resistance Classification: Class A when tested per UL 790.
3. Wind Uplift:
 - a. Designed to withstand wind uplift forces calculated with ASCE 7.
4. Drainage: No standing water within 48 hours after precipitation.

2.3 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Single Source Responsibility: Provide and install products from single source.

B. Membrane:

1. Material: Thermoplastic Polyolefin (TPO) complying with ASTM D6878/D6878M.
2. Reinforcing: Internal fabric.
3. Thickness: 80 mil (0.080 inch) (2 mm), minimum.
4. Sheet Width: Factory fabricated into largest sheets possible.
5. Color: White.
6. Product:
 - a. Elevate; Ultraply TPO Platinum.

C. Seaming Materials: As recommended by membrane manufacturer.

D. Flexible Flashing Material: Same material as membrane.

E. Base Flashing: Provide waterproof, fully adhered base flashing system at all penetrations, plane transitions, and terminations.

2.4 DECK SHEATHING AND COVER BOARDS

A. Cover Board: Polyisocyanurate (ISO) thermal board, complying with ASTM C1289; Type II - Faced with coated-glass facer on both major surfaces of core foam, Class 4 with thickness of 1/2 inch (12.7 mm), and Grade 1 with 109 psi (751 kPa), maximum, compressive strength.

1. Product:
 - a. Elevate; Isogard HD Coverboard

2.5 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Complies with ASTM C1289, Type II, Class 2 - Faced with dark coated-glass facer on one side and dark coated-glass facer on other surface of core foam.

1. Tapered Board: Slope as indicated; minimum thickness 1/4 inch (6.35 mm); fabricate of fewest layers possible.
2. Grade and Compressive Strength: Grade 2, 20 psi (Grade 2, 138 kPa), minimum.
3. Board Thickness: 1 1/2 inches (38 mm).
4. Product:
 - a. Elevate; Isogard CG

2.6 ACCESSORIES

- A. Prefabricated Flashing Accessories:
 1. Corners and Seams: Same material as membrane, in manufacturer's standard thicknesses.
 2. Penetrations: Same material as membrane, with manufacturer's standard cut-outs, rigid inserts, clamping rings, and flanges.
 3. Sealant Pockets: Same material as membrane, with manufacturer's standard accessories, in manufacturer's standard configuration.
 4. Pressure Sensitive Cover Strips: 6 inches (152 mm) wide, 45 mil, 0.045 inch (1.1 mm) thick, non-reinforced TPO membrane laminated to 35 mil, 0.035 inch (0.9 mm) thick cured synthetic rubber with pressure sensitive adhesive.
 5. Pressure Sensitive Cover Strips: 6 inches (152 mm) wide, 45 mil, 0.045 inch (1.1 mm) thick, non-reinforced TPO membrane laminated to 35 mil, 0.035 inch (0.9 mm) thick cured synthetic rubber with pressure sensitive adhesive.
 6. Walkway Rolls:
 - a. Width: 30 inches, nominal.
 - b. Length: 50 feet, nominal.
 - c. Color: White.
 - d. Product:
 - 1) Elevate; Ultraply TPO Walkway Pad
 7. Miscellaneous Flashing: Non-reinforced TPO membrane; 80 mil, 0.080 inch (2.0 mm) thick, in manufacturer's standard lengths and widths.
- B. Insulation Adhesive: Two-component polyurethane, expanding foam.
 1. Product:
 - a. Elevate; ISO Stick Insulation Adhesive.
- C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches (150 mm) wide; self adhering.
- D. Membrane Adhesive: As recommended by membrane manufacturer.
 1. Product:
 - a. Elevate; Single Ply LVOC Bonding Adhesive.
- E. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- F. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.
- G. Sealants: Refer to Specification Section 079200 - Joint Sealant for sealant information.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.2 PREPARATION, GENERAL

- A. Clean substrate thoroughly prior to roof application.
- B. Do not begin work until other work that requires foot or equipment traffic on roof is complete.
- C. Apply manufacturer's recommended vapor retarder or temporary roof before roof installation.

3.3 CONCRETE DECK PREPARATION

- A. Verify adjacent precast concrete roof members do not vary more than 1/4 inch (6 mm) in height. Verify grout keys are filled flush.
- B. Fill surface honeycomb and variations with latex filler.
- C. Confirm dry deck by moisture meter with 12 percent moisture maximum when tested per ASTM D4263.

3.4 INSTALLATION - GENERAL

- A. Perform work in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Coordinate the work with installation of associated counterflashings installed by other sections as the work of this section proceeds.
- G. When substrate preparation is responsibility of another installer, notify Contracting Officer of unsatisfactory conditions before proceeding.

3.5 INSULATION APPLICATION

- A. Attachment of Insulation: Embed insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.
- B. Do not install wet, damaged, or warped insulation boards.
- C. Lay subsequent layers of insulation with joints staggered minimum 6 inch (152 mm) from joints of preceding layer.
- D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- E. Lay boards with edges in moderate contact without forcing, and gap between boards no greater than 1/4 inch (6.3 mm). Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- F. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.
- G. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches (450 mm).
- H. Do not apply more insulation than can be completely waterproofed in the same day.

3.6 MEMBRANE APPLICATION

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive at manufacturer's recommended rate. Fully embed membrane in adhesive except in areas directly over or within 3 inches (75 mm) of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Seam Welding:
 - 1. Seam Welding: Overlap edges and ends and seal seams by heat welding, minimum 3 inches (76.2 mm).
 - 2. Cover seams with manufacturer's recommended joint covers.
 - 3. Probe seams once welds have thoroughly cooled, in approximately 30 minutes.
 - 4. Repair deficient seams within the same day.
 - 5. Seal cut edges of reinforced membrane after seam probe is complete.
- E. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 8 inches (203.2 mm) onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
 - 3. Insert flashing into reglets and secure.
- F. Coordinate installation of roof drains and related flashings. Locate all field splices away from low areas and roof drains. Lap upslope sheet over downslope sheet.
- G. Install walkway pads as shown on Drawings. Space pad joints to permit drainage.

- H. Daily Seal: Install daily seal per manufacturers instructions at the end of each work day. Prevent infiltration of water at incomplete flashings, terminations, and at unfinished membrane edges.

3.7 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for general requirements for field quality control and inspection.
- B. Require site attendance of roofing and insulation material manufacturers at minimum two times during installation of this Work.

3.8 CLEANING

- A. See Section 017700 - Closeout Procedures for additional requirements.
- B. Remove wrappings, empty containers, paper, and other debris from the roof daily. Dispose of debris in compliance with local, State, and Federal regulations.
- C. Remove bituminous markings from finished surfaces.
- D. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
- E. Repair or replace defaced or damaged finishes caused by work of this section.

3.9 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and other items indicated in Schedule.
- B. Sheet metal splash pans.

1.2 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2020.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. ASTM B32 - Standard Specification for Solder Metal 2020.
- D. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction 2012 (Reapproved 2019).
- E. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017.
- F. CDA A4050 - Copper in Architecture - Handbook current edition.
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.4 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: For each type of product.
- C. Shop Drawings: For sheet metal flashing and trim: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Distinguish between shop- and field-assembled work.
 - 3. Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, expansion joints and expansion-joint covers, direction of expansion, connections to adjoining work and installation details.

- D. Sample warranty.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Maintain one copy of each document on site.
- C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.6 MOCK-UPS

- A. Build mockup of typical roof components:
 - 1. Eave, approximately four feet long.
 - 2. Gutter, approximately four feet long.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch (0.61 mm) thick base metal.
- B. Pre-Finished Aluminum: ASTM B209/B209M; 18 gauge, 0.040 inch (1.02 mm) thick; plain finish shop pre-coated with PVDF coating.
 - 1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; pretreated metal with two-coat system including primer and color coat with at least 70 percent PVDF coating.
 - 2. Color: As selected by Contracting Officer from manufacturer's full colors.
- C. Copper: ASTM B370, cold rolled 20 oz/sq ft, 22 gauge, 0.027 inch (0.69 mm) thick; natural finish.

2.2 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

- B. Fabricate cleats of same material as sheet, minimum 2 inches (50 mm) wide, interlocking with sheet.
- C. Form pieces in single length sheets.
- D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Tin edges of copper sheet to be soldered; solder shop formed metal joints, and after soldering, remove flux, wipe and wash solder joints clean; provide weathertight joints.
- G. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.
- H. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

2.3 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: 3-inch Rectangular profile.
- B. Downspouts: Rectangular profile.
- C. Gutters and Downspouts: Sizes indicated.
 - 1. Buckstaff
 - a. See Specification Section 077123 - Manufactured Gutters and Downspouts.
 - 2. Fordyce
 - a. Gutters: 3 inches wide by 2.25 inches deep.
 - b. Downspouts: 3 inch smooth rectangular.
- D. 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 (25 mm) deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- E. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Straps.
- F. Splash Pans: Same metal type as downspouts, formed to 24 by 8 inch (___ by ___ mm) size; rolled sides of 4 inch (___ mm) high for inverted pan placement.
- G. Downspout Boots: Cast iron.
- H. Downspout Extenders: Same material and finish as downspouts.
- I. Seal metal joints.
- J. Collector box: SMACNA Rectangular profile with overflow opening.

2.4 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal.
- B. Underlayment: ASTM D226/D226M, organic roofing felt, Type II, No. 30.
- C. High Temperature Underlayment: SBS modified bitumen roofing membrane complying with ASTM D1970; nominal total thickness of 40 mil, 0.040 inch (1.0 mm).
- D. Slip Sheet: Rosin sized building paper.
- E. Primer: Zinc chromate type.
- F. Concealed Sealants: Non-curing butyl sealant.
- G. Exposed Sealants: See Section 079200 Joint Sealants; color as selected by Contracting Officer.
- H. Reglets: Recessed type.
- I. Solder: ASTM B32; Sn50 (50/50) type.
- J. Gutter guards with screen: As recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.
- C. Obtain field measurements for accurate fit before shop fabrication.
- D. 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.
- E. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

- C. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

3.3 INSTALLATION

- A. Insert flashings into reglets to form tight fit; seal flashings into reglets with sealant.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. 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 stainless-steel 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.
- F. Exterior Flashing Receivers: Install in accordance with manufacturer's recommendations, and in proper relationship with adjacent construction, and as follows:
 - 1. Secure receiver at perimeter of wall opening with adhesives or fasteners.
 - 2. Place flashing into receiver channel.
 - 3. Secure flashing with receiver clip.
- G. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- H. 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.
- I. Solder metal joints for full metal surface contact, and after soldering wash metal clean with neutralizing solution and rinse with water.
 - 1. Clean surfaces to be soldered, removing oils and foreign matter.
 - 2. Pre-tin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 3. Do not use torches for soldering without written permission in advance for Design Team.
 - 4. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

- 5. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
- J. Secure gutters and downspouts in place with concealed fasteners.
 - 1. Install sheet metal downspout items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- K. Slope gutters 1/4 inch per 10 feet (2.1 mm per m), minimum.
- L. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches (600 mm) of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- M. Connect downspouts to downspout boots as indicated, and fully solder connection watertight.
- N. Set splash pans under downspouts, and set in place with manufacturer recommended adhesive .

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions.

3.5 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.6 SCHEDULE

- A. Through-Wall Flashing in Masonry:
 - 1. Buckstaff
 - a. Material: Pre-finished Aluminum.
 - 2. Fordyce
 - a. Material: Copper.
- B. Fascia and Cornices:
 - 1. Buckstaff
 - a. Material: Pre-finished Aluminum.
 - 2. Fordyce

- a. Material: Copper.
- C. Gutters and Downspouts:
 - 1. Buckstaff:
 - a. See Specification Section 077123 - Manufactured Downspouts and Gutters.
 - 2. Fordyce:
 - a. Material: Copper.
- D. Collector Boxes:
 - 1. Buckstaff
 - a. See Specification Section 077123 - Manufactured Downspouts and Gutters.
 - 2. Fordyce
 - a. Material: Copper
 - b. Size: 12" x 12" x 8".
- E. Sill Flashings:
 - 1. Buckstaff
 - a. Material: Pre-finished Aluminum
 - 2. Fordyce
 - a. Material: Copper; Galvanized at base of penthouse skylight only.
- F. Eave Flashings:
 - 1. Buckstaff
 - a. Material: Pre-finished Aluminum.
 - 2. Fordyce
 - a. Material: Copper.
- G. Flashings Associated with Clay Tiles, including Valley, Hip, Ridge, Eave, Gutter Edge, Gable Edge, Chimney:
 - 1. Fordyce
 - a. Material: Copper
- H. Counterflashings at Roofing Terminations (over roofing base flashings):
 - 1. Buckstaff
 - a. Material: Pre-finished Aluminum; Galvanized at Penthouse roof edge only.
 - 2. Fordyce
 - a. Material Copper.
- I. Counterflashings at Curb-Mounted Roof Items:
 - 1. Buckstaff
 - a. Material: Pre-finished Aluminum.
 - 2. Fordyce
 - a. Material: Copper.

END OF SECTION 076200

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SECTION 077123 - MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pre-finished aluminum gutters and downspouts.
- B. Precast concrete splash pads.
- C. Sheet metal splash pans.
- D. Pre-finished aluminum collector box.

1.2 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- C. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Comply with SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.
- B. Comply with applicable code for size and method of rain water discharge.
- C. Maintain one copy of each document on site.

1.4 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: Provide data on prefabricated components.
- C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- D. Samples: Submit two samples, 12 inch (____ mm) long illustrating component design, finish, color, and configuration.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.
- C. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Pre-Finished Aluminum Sheet: ASTM B209/B209M; .040 inch (1.02 mm) thick.
 - 1. Finish: Plain, shop pre-coated with polyvinylidene fluoride (PVDF) coating.
 - 2. Color: As selected from manufacturer's standard colors.

2.2 COMPONENTS

- A. Gutters: SMACNA rectangular style profile.
- B. Downspouts: SMACNA rectangular profile.
- C. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: In accordance with SMACNA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Straps.
- D. Fasteners: Same material and finish as gutters and downspouts, with soft neoprene washers.
- E. Collector box: SMACNA Rectangular profile with overflow opening.

2.3 FABRICATION

- A. Form gutters and downspouts of profiles and size indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

2.4 FINISHES

- A. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; pretreated metal with two-coat system including primer and color coat with at least 70 percent PVDF coating.

2.5 ACCESSORIES

- A. Splash Pans: Same metal type as downspouts, formed to 24 by 8 inches (610 by 203 mm) size; rolled sides 2 inch (51 mm) high for inverted pan placement.
- B. Splash Pads: Precast concrete type, profiles size(s) as indicated; minimum 3,000 psi (21 MPa) compressive strength at 28 days, with minimum 5 percent air entrainment.
- C. Gutter guards with screen: As recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.2 PREPARATION

- A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.381 mm).

3.3 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Slope gutters 1/4 inch per foot (6 mm/m) .
- C. Set splash pans under downspouts.

3.4 SCHEDULE

- A. Gutters
 - 1. Buckstaff
 - a. Type B
 - 1) Material: Pre-finished aluminum.
 - 2) Size: 5 inches wide by 3 inches deep.
 - b. Type C
 - 1) Material: Pre-finished aluminum.
 - 2) Size: 6 inches wide by 4.5 inches deep.
- B. Downspouts
 - 1. Buckstaff
 - a. Material: Pre-finished aluminum.
 - b. Size: 4 inch corrugated rectangular.
- C. Collector Box
 - 1. Buckstaff
 - a. Material: Pre-finished aluminum.

- b. Size: 12" x 12" x 8" rectangular with overflow opening.

END OF SECTION 077123

SECTION 077200 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roof curbs.
- B. Equipment rails.
- C. Roof penetrations mounting curbs.

1.2 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance requirements.

PART 2 PRODUCTS

2.1 ROOF CURBS

- A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
 - 1. Applications: Roof curbs used for roof penetrations/openings as indicated on drawings.
 - 2. Roof Curb Mounting Substrate: Curb substrate consists of concrete deck with insulation.
 - 3. Sheet Metal Material:
 - a. Aluminum: 0.080 inch (2.03 mm) minimum thickness, with 3003 alloy, and H14 temper.
 - 1) Finish: Powder coat.
 - 2) Color: As selected by Architect from manufacturer's standard line of colors.
 - 4. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing system at 1:1 slope; minimum cant height 4 inches (102 mm).
 - 5. Provide layouts and configurations indicated on drawings.
- B. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
 - 1. Height Above Finished Roof Surface: 8 inches (203 mm), minimum.
- C. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches (400 mm) square unless otherwise indicated.
 - 1. Height Above Finished Roof Surface: 8 inches (203 mm), minimum.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.4 CLEANING

- A. Clean installed work to like-new condition.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Joint backings and accessories.

1.2 REFERENCE STANDARDS

- A. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016 (Reapproved 2023).
- D. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2022.
- E. ASTM C1311 - Standard Specification for Solvent Release Sealants 2022.
- F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2023.
- G. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2022).

1.3 DEFINITIONS

- A. M Type Substrates: Cast-in-place concrete, concrete masonry units, clay brick, masonry mortar, natural stone.
- B. G Type Substrates: Glass and transparent plastic glazing sheets.
- C. A Type Substrates: Metals, porcelain, glazed tile, and smooth plastics.
- D. O Type Substrates: Wood, unglazed tile; substrates not included under other categories.
- E. Use T: Surfaces bearing pedestrian or vehicular traffic.
- F. Use NT: Non-traffic-bearing surfaces.

1.4 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 2. List of backing materials approved for use with the specific product.
 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 4. Substrates the product should not be used on.
 5. Substrates for which use of primer is required.
 6. Substrates for which laboratory adhesion and/or compatibility testing is required.
 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 8. Provide manufacturer's technical guide containing recommendations for primers for each exterior sealant/substrate combination.
 9. Sample product warranty.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Executed warranty.

1.5 MOCK-UP

- A. Before beginning installation, install sealers in joints in actual construction as directed by the Architect, to show color, materials, and installation.
- B. Locate where directed.
- C. Keep mock-ups intact as the standard for evaluating the completed joint sealer work.
- D. Mock-up may remain as part of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original containers or bundles with labels showing manufacturer, product name or designation, color, shelf life, and installation instructions.

1.7 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, damp or covered with snow, ice or frost.
 3. When joint substrates are dusty, oily, or otherwise contaminated.
 4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrate.

1.8 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Contracting Officer's name and register with manufacturer.
- C. Extended Correction Period: Correct defective work within 5- year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Nonsag Sealants:
 - 1. Sika Corporation: www.usa.sika.com.
 - 2. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics), included herein.
 - 3. Substitutions: See Section 016000 – Product Requirements.

2.2 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - 1) Exception: Such gaps and openings in gypsum board and plaster finished stud walls and suspended ceilings. See Section 092116 for additional information.
 - c. Other joints indicated below.
 - 3. Do not seal the following types of joints:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- B. Type 1 - Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.
- C. Type 2 - Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

- D. Type 3 - Concealed joints: Use noncuring butyl sealant, unless otherwise indicated.
- E. Type 4 - Exterior Expansion Joints between Tile: Non-sag non-traffic grade polyurethane sealant.

2.3 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.4 NONSAG JOINT SEALANTS

- A. Type 1 - Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
 - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 - 4. Color: To be selected by Contracting Officer from manufacturer's standard range.
 - 5. Cure Type: Single-component, neutral moisture curing.
 - 6. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
 - 7. Product:
 - a. Sika Corporation; Sikasil WS-290.
- B. Type 2 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Color: To be selected by Contracting Officer from manufacturer's standard range.
 - 3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
 - 4. Product:
 - a. Sika Corporation; Sikaflex-15 LM.
- C. Type 3 - Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
 - 1. Color: To be selected by Contracting Officer from manufacturer's standard range.
 - 2. Service Temperature Range: Minus 13 to 180 degrees F (Minus 25 to 82 degrees C).

2.5 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Flexible, nonabsorbent, compressible polyethylene foam: ASTM C1330; either open cell or nongassing closed sell, unless otherwise restricted by sealant manufacturer; preformed to appropriate size and shape.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

- D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

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. Masonry.
 - 3. 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.
- 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

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.

- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install acoustical sealant application work in accordance with ASTM C919.
- E. Install bond breaker backing tape behind sealants where sealant backer rod are not used between sealants and backs of joints.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Install sealant completely filling recesses in each joint configuration.
- H. Install sealant to produce uniform, cross-sectional shapes and depths relative to joint widths taht allow optimum sealant movement capability.
- I. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- J. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 - 4. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 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.

3.5 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.

3.6 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 5 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 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.
 - 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. 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.
 - 4. 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.
 - 5. 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.
- C. 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.

END OF SECTION 079200

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SECTION 092400 - CEMENT PLASTERING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cement plastering.

1.2 RELATED REQUIREMENTS

- A. Section 099113 - Exterior Painting.

1.3 REFERENCE STANDARDS

- A. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- B. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.
- C. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters 2015 (Reapproved 2020).
- D. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster 2023.

1.4 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: Provide data on plaster materials and trim accessories.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.6 MOCK-UPS

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Mock-Up Panel: Construct a 4 foot wide by 8 foot high (1200 mm wide by 2400 mm high) sample panel of plaster work at the jobsite demonstrating installation procedures, finish texture, and color. Show each phase of installation including framing and reinforcement.

1.7 FIELD CONDITIONS

- A. Exterior Plaster Work: Do not apply plaster when substrate or ambient air temperature is 40 degrees F (4 degrees C) or lower, or when temperature is expected to drop below 40 degrees F (4 degrees C) within 48 hours of application.

PART 2 PRODUCTS

2.1 CEMENT PLASTER APPLICATIONS

- A. Solid Plaster Base: Concrete masonry.
 - 1. Plaster Type: Factory prepared plaster mix.

2.2 FACTORY PREPARED CEMENT PLASTER

- A. Exterior Portland cement plaster system made of scratch and brown base coat and acrylic finish coat; install in accordance with ASTM C926.
- B. Premixed One-Coat Base: Mixture of Type II Portland cement complying with ASTM C150/C150M, hydrated lime complying with ASTM C207, fibers and other approved ingredients; install in accordance with ASTM C926.
- C. Painted Finish Coating: See Section 099113.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify masonry joints are flush and surfaces are ready to receive work of this section, and that there are no existing bituminous or water repellent coatings on masonry surfaces.

3.2 PREPARATION

- A. Dampen masonry surfaces to reduce excessive suction.

3.3 MIXING

- A. Mix only as much plaster as can be used prior to initial set.
- B. Mix materials dry, to uniform color and consistency, before adding water.
- C. Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.

3.4 APPLICATION

- A. Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.
- B. Base Coats:
 - 1. Follow guidelines in ASTM C926 and manufacturer's written installation instructions for moist curing base coats and application of subsequent coats.
- C. Finish Coats:
 - 1. Cement Plaster:
 - a. Apply with sufficient material and pressure to ensure complete coverage of base to specified thickness.
 - b. Apply desired surface texture while mix is still workable.

3.5 TOLERANCES

- A. Maximum Variation from True Flatness: 1/4 inch in 10 feet (6 mm in 3 m).

3.6 REPAIR

- A. Patching: Remove loose, damaged or defective plaster and replace with plaster of same composition; finish to match surrounding area.

END OF SECTION 092400

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SECTION 099113 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Paints and coatings on previously painted surfaces.
- D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- E. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Non-metallic roofing and flashing.
 - 6. Floors, unless specifically indicated.
 - 7. Ceramic and other types of tiles.
 - 8. Glass.
 - 9. Concealed pipes, ducts, and conduits.
- F. See Schedules at end of this Section

1.2 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- F. SCAQMD 1113 - Architectural Coatings 1977, with Amendment (2016).
- G. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1 2016.

H. SSPC-SP 3 - Power Tool Cleaning 2018.

1.3 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name.
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit two paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Allow 30 days for approval process, after receipt of complete samples by Contracting Officer.
- D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- E. Maintenance Materials: Furnish the following for Contracting Officer's use in maintenance of project.
 - 1. See Section 016700 - Product Requirements for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.4 MOCK-UPS

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Locate where directed by Contracting Officer.
- C. Mock-up may remain as part of the work.
- D. Final approval of color selections will be based on mockups.
 - 1. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Contracting Officer at no added cost to Owner.
- E. 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.6 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 2. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics), included herein.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 016000 - Product Requirements.

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 4. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.
 5. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 6. Supply each paint material in quantity required to complete entire project's work from a single production run.
 7. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Flammability: Comply with applicable code for surface burning characteristics.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Contracting Officer from the manufacturer's full line.
- D. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Contracting Officer after award of contract.
 2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Contracting Officer.

2.3 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete masonry units, brick, and stone and stucco.
1. Two top coats and one coat primer.
 2. Top Coat(s): Exterior Latex, High Performance Architectural; MPI #311 or 315.
 - a. Product:
 - 1) Sherwin Williams; SuperPaint Exterior Latex, Flat.

2.4 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali-Resistant Water-Based Primer; MPI #3.
 - a. Product:
 - 1) Sherwin-Williams; Loxon Concrete and Masonry Primer Sealer, LX02W50. (MPI #3)

2.5 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before proceeding.
- E. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Exterior Plaster and Stucco: 12 percent.
 - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
- G. 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 Manual" applicable to substrates and paint systems indicated.
- B. Clean surfaces thoroughly and correct defects prior to application.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- D. Remove or repair existing paints or finishes that exhibit surface defects.
- E. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing. 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.
- F. Seal surfaces that might cause bleed through or staining of topcoat.
- G. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- H. 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.
- I. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 2. Prepare surface as recommended by top coat manufacturer.
 3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi (4,140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
- J. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- K. Previously Painted Surfaces:
1. Thoroughly remove all grease, dirt, dust or other foreign matter.
 2. Remove coatings that are blistering, cracking, flaking, peeling, or otherwise deteriorating.
 3. Roughen slick surfaces.
 4. Repair damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls with suitable material to match adjacent undamaged areas.
 5. Feather edge edges of chipped paint, and sand smooth.
 6. Clean metal surfaces in accordance with SSPC requirements using solvent, mechanical, or chemical cleaning methods to provide surfaces suitable for painting. Preparation of ferrous surfaces if not specified shall as recommended by coating manufacturer, but in no case less than SSPC-SP 3.
 7. Chalk shall be removed so that when tested in accordance with ASTM D4214, the chalk resistance rating is no less than 8.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
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 entire exposed surface of window frames and sashes.
 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.
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Tint undercoats same color as topcoat, but tint each undercoat a progressively 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.
- F. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- G. 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.
- H. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- I. Apply each coat to uniform appearance.
- J. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for field inspection.
- B. Dry Film Thickness Testing: Contractor to engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from 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.

3.6 PROTECTION

- A. 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.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- C. Protect finishes until completion of project.
- D. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 099113

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SECTION 107500 - FLAGPOLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum Flagpoles.

1.2 REFERENCE STANDARDS

- A. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2022.
- B. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles 2007.

1.3 SUBMITTALS

- A. See Section 013323 - Submittal Procedures for submittal procedures.
- B. Product Data: Provide data on pole, accessories, and configurations.
- C. Shop Drawings: Indicate detailed dimensions, attachment details, anchor requirements, and imposed loads.
- D. Designer's Qualification Statement.
- E. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules and _____.

1.4 QUALITY ASSURANCE

- A. Designer Qualifications: Design flagpole supports under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed the State in which the Project is located.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer:
 - 1. Exterior Flagpole:
 - a. Concern American Flagpole; External - Continental.
 - b. Approved equal systems provided by other manufacturers are acceptable provided that they meet the design, performance, and warranty requirements (salient characteristics), included herein.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.2 FLAGPOLES

- A. Flagpoles:
 - 1. Material: Aluminum.
 - 2. Design: Cone tapered.
 - 3. Mounting: Vertical wall mounted type.
 - 4. Outside Butt Diameter: 4 inches (____ mm).
 - 5. Nominal Height: 20 ft (____ m); measured from center of wall mounting.
 - 6. Halyard: External type, cleat.
- B. Performance Requirements:
 - 1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 90 miles/hr (40 km/hr) wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.3 POLE MATERIALS

- A. Aluminum: ASTM B241/B241M, 6063 alloy, T6 temper.
 - 1. Finish: Black Anodized.

2.4 ACCESSORIES

- A. Finial Ball: Black painted aluminum, 6 inch (150 mm) diameter.
- B. Cleats: 6 inch (____ mm) size, aluminum with stainless steel fastenings, one per halyard.
- C. Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.
- D. Halyard: 5/16 inch (8 mm) diameter nylon, braided, white.

2.5 MOUNTING COMPONENTS

- A. Wall Support Assembly: Aluminum; round; two piece assembly, back-plate for through bolting, with stainless steel anchor bolts and cover.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that wall supports are ready to receive work and dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Install flagpole and fittings in accordance with manufacturer's instructions.
- B. Set brackets for wall set flagpoles anchored securely into parapet construction. Seal watertight.

3.3 TOLERANCES

- A. Maximum Variation From Plumb: 1 inch (25 mm).

3.4 ADJUSTING

- A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION 107500

SECTION 22 05 00 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work shall include, but is not necessarily limited to:
 - a. Furnish and install all items listed in the Plumbing Material List.
 - b. Furnish and install complete sanitary sewer and vent system.
 - c. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 22 05 50.
 - d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
 - e. Complete all applicable tests, certifications, forms, and matrices.
 - 2. Heating Work: Refer to Section 23 05 00 "Basic HVAC Requirements".
 - 3. Air Conditioning and Ventilating Work: Refer to Section 23 05 00 "Basic HVAC Requirements".
 - 4. Testing, Adjusting, and Balancing Work: Refer to Section 23 05 00 "Basic HVAC Requirements".

1.3 WORK SEQUENCE

- A. All work that will produce excessive noise or interference with normal building operations, as determined by the Contracting Officer, shall be scheduled with the Contracting Officer. It may be necessary to schedule such work during unoccupied hours. The Contracting Officer reserves the right to determine when restricted construction hours will be required.

1.4 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

- A. Definitions:
 - 1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.

- b. Heating Contractor.
 - c. Air Conditioning and Ventilating Contractor.
 - d. Temperature Control Contractor.
 - e. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
 3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
 4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
 5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
 6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
 7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.

4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including steam and condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Contractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Contracting Officer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. Temperature Control Contractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.
 - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.5 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Contracting Officer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Contracting Officer.
3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and Contractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Contracting Officer.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Contracting Officer's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Contracting Officer.
 - e. When additional access panels are required, they shall be provided without additional cost to the Contracting Officer.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or Contractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.6 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each Contractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Contracting Officer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and Contractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the State of Indiana Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards of National Parks.
3. Conform to all State Codes.
4. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.
5. If there is a discrepancy between the codes and regulations and these specifications, the Contracting Officer shall determine the method or equipment used.
6. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Contracting Officer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
7. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Contracting Officer.
8. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
9. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Contracting Officer or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.
2. Comply with all utility company requirements.
3. Make application for and pay for service connections, such as sewer and water and gas.
4. Make application for and pay for all meters and metering systems required by the utility company.

F. Examination of Drawings:

1. The drawings for the plumbing work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Contracting Officer.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Contractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.

3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.7 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

Referenced Specification Section	Submittal Item
22 05 29	Hangers and Supports
22 05 48	Vibration Isolation Equipment
22 05 50	Seismic Restraint Systems
22 05 53	Plumbing Identification
22 10 00	Plumbing Piping Systems and Valves
22 10 30	Plumbing Specialties

- B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Contracting Officer
 - d. Contractor and Contractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents

- i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
- a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Contracting Officer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all Contractors' submittals as described above.
 - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.

- c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 9. Reproduction of contract documents alone is not acceptable for submittals.
 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Contracting Officer.
 11. Submittals not required by the contract documents may be returned without review.
 12. The Contracting Officer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Contracting Officer to recheck and handle the additional shop drawing submittals.
 13. Submittals shall be reviewed and approved by the Contracting Officer **before** releasing any equipment for manufacture or shipment.
 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Contracting Officer's approval.
 15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Contracting Officer if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Contracting Officer or other contractors.
 - a. Allow at least two weeks for Contracting Officer's review and processing of each submittal.
 16. Contracting Officer reserves the right to withhold action on a submittal which, in the Contracting Officer's opinion, requires coordination with other submittals until related submittals are received. The Contracting Officer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Contracting Officer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 22 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 22 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.8 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:

1. Seismic Restraints and Equipment Bracing

- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Contracting Officer and include copies of Contracting Officer's Operation and Maintenance Manuals.

1.9 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Contracting Officer. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.10 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Contracting Officer.

1.11 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Contracting Officer for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Contracting Officer.
- C. Warranty requirements shall extend to correction, without cost to the Contracting Officer, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.12 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.13 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first manufacturer is the basis for job design and establishes the quality.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Contracting Officer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractor's part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Contracting Officer, nor the presence of the Contracting Officer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Contracting Officer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Contracting Officer and the Contracting Officer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 CONTRACTING OFFICER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Contracting Officer prior to:
 - 1. Placing fill over underground and underslab utilities.
 - 2. Covering exterior walls, interior partitions and chases.
 - 3. Installing hard or suspended ceilings and soffits.

- B. The Contracting Officer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 - 1. All work above the ceilings must be complete prior to the Contracting Officer's review. This includes, but is not limited to:
 - a. Pipe insulation is installed and fully sealed.
 - b. Pipe wall penetrations are sealed.
 - c. Pipe identification and valve tags are installed.
 - 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 - 3. It is understood that if the Contracting Officer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Contracting Officer may not recommend further payments to the contractor until such time as full access has been provided.

3.3 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
 - 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 - 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Contracting Officer so that the final observation can be scheduled.
 - 4. It is understood that if the Contracting Officer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Contracting Officer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 - 1. Operation and maintenance manuals with copies of approved shop drawings.
 - 2. Record documents including marked-up or reproducible drawings and specifications.
 - 3. A report documenting the instructions given to the Contracting Officer's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Contracting Officer's representatives.
 - 4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 - 5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Contracting Officer required prior to final payment approval.

3.4 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Contracting Officer's review and approval. The electronic copy shall be corrected as required to address the Contracting Officer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Contracting Officer.
2. Approved O&M manuals shall be completed and in the Contracting Officer's possession prior to Contracting Officer's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Contracting Officer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div22.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Contracting Officer with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Contracting Officer, Contractor, all Contractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Contracting Officer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.

9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.
16. Contracting Officer and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

3.5 INSTRUCTING THE CONTRACTING OFFICER

- A. Adequately instruct the Contracting Officer in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Contracting Officer by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Contractor shall make a DVD video recording of instructions to the Contracting Officer while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Contracting Officer.
- D. The Contracting Officer has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- E. The instructions shall include:
 1. Explanation of all system flow diagrams.
 2. Maintenance of equipment.
 3. Start-up procedures for all major equipment.
 4. Explanation of seasonal system changes.
 5. Explanation of Contracting Officer's Responsibilities to operate, maintain, and flush domestic water system (i.e., ASHRAE Standard 188).
- F. Notify the Contracting Officer of the time and place for the verbal instructions to be given to the Contracting Officer's representative so a representative can attend if desired.
- G. Minimum hours of instruction for each item shall be:
 1. Domestic Hot Water System - 2 hours
 2. All Domestic Water Systems operation, maintenance and flushing of all fixtures and dead legs - 4 hours
 3. Domestic Water Pressure Booster System - 2 hours.
 4. Water Softener, Filtration and/or Purification System - 2 hours
- H. The Contractor shall prepare a detailed, written training agenda and submit it to the Contracting Officer a minimum of four weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.

- I. Operating Instructions:
 1. Contractor is responsible for all instructions to the Contracting Officer for the mechanical and control systems.
 2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Contracting Officer for the Contracting Officer to perform these services.

3.6 SYSTEM STARTING AND ADJUSTING

- A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- E. The Contractor, Contractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Contracting Officer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Contracting Officer on a time and materials basis for services rendered at the Contracting Officer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Contracting Officer for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.7 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of plumbing drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- D. Before completion of the project, a set of reproducible plumbing drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.

- E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- F. Record changes daily and keep the marked drawings available for the Contracting Officer's examination at any normal work time.
- G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Contracting Officer.

3.8 PAINTING

- A. This Contractor shall paint the following items:
 - 1. All piping in mechanical room
 - 2. Piping exposed in kitchen
- B. Paint all equipment that is marred or damaged prior to the Contracting Officer's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Contracting Officer the color preference and furnish this color.
- F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- G. Paint all outdoor uninsulated steel piping the color selected by Contracting Officer or Contracting Officer.
- H. Paint all outdoor exposed natural gas piping the color selected by Contracting Officer.

3.9 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Contracting Officer's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.

- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Contracting Officer's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Contracting Officer's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

3.11 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
 - 1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
 - d. Protect stored on-site and installed absorptive materials from moisture damage.
 - 2. Request that the Contracting Officer designate an IAQ representative.
 - 3. Review and receive approval from the Contracting Officer's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
 - 4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
 - 5. Schedule activities that may cause IAQ conditions that are not acceptable to the Contracting Officer's IAQ representative during unoccupied periods.
 - 6. Request copies of and follow all of the Contracting Officer's IAQ and infection control policies.
 - 7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
 - 8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
 - 9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".

3.12 UTILITY REBATE

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All plumbing fixtures installed and caulked.
3. Pipe insulation complete, pipes labeled and valves tagged.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Contracting Officer so that the final observation can be scheduled.

It is understood that if the Contracting Officer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Contracting Officer for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 22 05 00

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SECTION 22 05 05 - PLUMBING DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Plumbing Demolition.
- B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. THE DRAWINGS ARE INTENDED TO INDICATE THE GENERAL SCOPE OF WORK AND DO NOT SHOW EVERY PIPE, DUCT, OR PIECE OF EQUIPMENT THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY CONDITIONS PRIOR TO SUBMITTING A BID.
- B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.
- C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.
- D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.
- E. Coordinate work with all other Contractors and the Contracting Officer. Schedule removal of equipment to avoid conflicts.
- F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.
- G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

- A. Disconnect plumbing systems in walls, floors, and ceilings scheduled for removal.
- B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.

- C. Existing Plumbing System: Maintain service to all plumbing fixtures until new piping is installed. Obtain permission from Contracting Officer at least 48 hours before shutting down system for any reason. Make changeover to new piping with minimum outage. Do not disconnect any roof drainage piping until new piping is in place and operational.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. Demolish and extend existing plumbing work under provisions of Division 2 and this Section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned piping to source of supply and/or main lines.
- D. Remove exposed abandoned pipes, including abandoned pipes above accessible ceilings. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.
- E. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.
- F. Repair adjacent construction and finishes damaged during demolition and extension work.
- G. Extend existing installations using materials and methods compatible with existing installations, or as specified.
- H. Remove unused sections of domestic water piping back to mains and cap. Capped pipe shall be less than 2 feet from main to prevent "dead legs".
- I. Temporarily cap all openings to the sanitary and vent system to prevent odor from entering the work area and building.

3.4 CUTTING AND PATCHING

- A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 22 05 29 for additional requirements.
- B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.
- C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.
- D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Contracting Officer prior to start of work.
- E. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.5 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.

- B. Clean all systems adjacent to project which are affected by the dust and debris caused by this construction.
- C. PLUMBING ITEMS REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE Contracting Officer. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE Contracting Officer IN A LOCATION COORDINATED WITH THE Contracting Officer. THE CONTRACTOR SHALL DISPOSE OF MATERIAL THE Contracting Officer DOES NOT WANT TO REUSE OR RETAIN FOR MAINTENANCE PURPOSES.

3.6 SPECIAL REQUIREMENTS

- A. Install temporary filter media over outside air intakes which are within 100 feet of the limits of construction. This Contractor shall complete any cleaning required for existing systems which are affected by construction dust and debris.
- B. Review locations of all new penetrations in existing floor slabs or walls. Determine construction type and review for possible interferences. Bring all concerns to the attention of the Contracting Officer before proceeding.

END OF SECTION 22 05 05

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SECTION 22 05 29 - PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Sleeves and Seals.
- D. Flashing and Sealing of Equipment and Pipe Stacks.
- E. Cutting of Openings.
- F. Escutcheon Plates and Trim.

1.2 REFERENCES

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices
- D. MSS SP-127 - Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application.

1.3 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 22 05 00. Include plastic pipe manufacturers' support spacing requirements.

1.4 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 SEISMIC RESTRAINTS

- A. Refer to Section 22 05 50 for additional requirements for seismic restraints.

2.2 HANGER RODS

A. Hanger rods for single rod hangers shall conform to the following:

Pipe Size	Hanger Rod Diameter	
	Column #1	Column #2
2-1/2" and smaller	3/8"	3/8"
3" through 3-5/8"	3/8"	3/8"
4" and 5"	1/2"	1/2"
6"	3/4"	5/8"
8" through 12"	7/8"	3/4"
14"	1"	7/8"
16" and 18"	1"	N/A
20" and 24"	1-1/4"	N/A

Column #1: Steel, cast iron, and glass pipe.

Column #2: Copper and plastic pipe.

- B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.
- C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
- D. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication. This applies to the following areas:

2.3 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.
3. Copper piping located in an exposed area, including indirect waste piping in kitchens and janitor's closets, shall use split ring standoff hangers for copper tubing. Galvanized iron support clamp shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, or equal. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.

a. Products:

- 1) Anvil Fig. CT138R, copper plated, malleable iron, split ring clamp meeting MSS SP-58 (Type 1)
- 2) Or equal.

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

- a. Products:
 - 1) Cooper/B-Line Fig B3373 Series, steel riser clamp, finish as required for piping supported.
 - 2) Or equal.
2. Cold Pipe: Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.
 - a. Products:
 - 1) Mason RBA, RCA or RDA, captive neoprene mounting.
 - 2) Mason BR, restrained bridge, captive neoprene mounting.
 - 3) Or equal.
 3. Cold Pipe Alternative: Insulated pipe riser clamp with no thermal bridging between clamp and pipe; water repellant calcium silicate insulation material adhered inside the clamp; ASTM A653 galvanized steel clamp.
 - a. Products:
 - 1) Pipeshields E1000
 - 2) Or equal.
 4. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Contracting Officer.
 5. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.
- C. Hangers and Clamps:
 1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
 2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, or equal, within their temperature limits of -65°F to +275°F.
 3. Vertical cold pipe drops and rough-ins to fixtures shall be supported by insulated pipe clamps to prevent thermal bridging and condensation.
 4. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
 5. Ferrous hot piping 4 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.
 - a. Products:
 - 1) Anvil Fig. 160, 161, 162, 163, 164, 165
 - 2) Or equal.
 6. Unless otherwise indicated, hangers shall be as follows:
 - a. Clevis Type:
 - 1) Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches & Smaller
 - 2) Products: Bare Steel Plastic or Insulated Pipe:
 - a) Anvil Fig. 260, zinc plated, meeting MSS SP-58 (Type 1)
 - b) Or equal.

- 3) Products: Bare Copper Pipe:
 - a) Cooper/B-Line Fig. B3100C, copper plated, meeting WW-H-171-E (Type 1)
 - b) Or equal.
- b. Continuous Channel with Clevis Type: Service: Plastic Tubing, Flexible Hose, Soft Copper Tubing:
 - 1) Products:
 - a) Cooper/B-Line Fig. B3106, V-bottom clevis hanger, with Fig. B3106V, galvanized iron channel.
 - b) Or equal.
7. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
 - a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
 - b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.
8. Unless otherwise indicated, pipe supports for use with struts shall be as follows:
 - a. Clamp Type:
 - 1) Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and smaller
 - 2) Galvanized iron clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, or equal.
 - 3) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.
 - 4) Bare Steel, Plastic or Insulated Pipe:
 - a) Unistrut Fig. P1100 or P2500
 - b) Or equal.
 - 5) Bare Copper Pipe:
 - a) Cooper/B-Line Fig. BVT
 - b) Or equal.
- D. Upper (Structural) Attachments:
 1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:
 - a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.):
 - 1) Products:
 - a) Anvil Fig. 92, ductile iron, hardened set screw and locknut.
 - b) Or equal
 - b. Steel Structure Clamps: Scissor Type Beam Clamps (for use with bar-joists and wide flange):
 - 1) Products:
 - a) Anvil Fig. 228, 292, forged steel.

- b) Or equal.
- c. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
- d. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.
- e. Steel Structure Welding:
 - 1) Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and protecting walls and ceilings from smoke damage.
- f. Wood Anchors: Tension wood rod hanger for suspending 3/8" threaded rod. Zinc plated carbon steel.
 - 1) Minimum allowable tension loads for Douglass Fir/Southern Pine:
 - a) 3/8" diameter rod; 2-1/2" shank: 600 lb/590 lb.
 - b) Load values are based on full shank penetration into wood member. Minimum edge distance 3/4". Minimum end distance 3-1/4".
 - 2) Limitations:
 - a) Truss: Do not hang from wood trusses without truss manufacturer or Structural Engineer's approval.
 - b) Sheetrock/Gypsum Ceiling: When drilling through non-wood materials (e.g., sheet rock, gypsum, etc.), increase shank length by depth of non-wood materials.
 - c) Plywood Flooring/Roofing: Do not hang from plywood floor or roofing.
 - d) Spacing: Refer to wood structure spacing of hangers.
 - 3) Products:
 - a) Simpson RWV
 - b) Or equal.

2.4 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
2. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Contracting Officer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

- C. Grout:
 - 1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco" or equal), unless otherwise indicated on the drawings or approved by the Contracting Officer.
 - 2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
 - 3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

2.5 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Contracting Officer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.
- E. Do not cut structural members without written approval of the Contracting Officer or Structural Contracting Officer.
- F. Exposed Housing Penetrations: Seal pipes with surface temperature below 150°F, penetrating housings with conical stepped, white silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite.

2.6 ROOF PENETRATIONS

- A. Roof Curb Enclosure: Provide weatherproof roof curb and enclosure for pipe penetrations. Refer to drawings for details.
- B. Conical Pipe Boot: Seal pipes with surface temperature below 150°F penetrating single-ply roofs with conical stepped, UV-resistant silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite. Color: shall match roofing membrane.
- C. Break insulation only at the clamp for pipes between 60°F and 150°F. Seal outdoor insulation edges watertight.

2.7 SLEEVES AND LINTELS

- A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Contracting Officer or Structural Contracting Officer.

- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas.
- E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Contracting Officer. Sleeves shall then comply with the Contracting Officer's design.
- F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
- G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.
- J. Wall Seals ("Link-Seals"):
 1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
 2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve. If piping carries only fluids below 120°F, sleeves may be thermoplastic with integral water seal and textured surface.
 3. Sleeves shall be at least 2 pipe sizes larger than the pipes.
 4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.
 5. Sealing element shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	High/Low Temperature (Steam)	Silicone	-67°F to 400°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant/Stainless	Nitrile	-40°F to 210°F

6. Manufacturers:
 - a. Thunderline Corporation "Link-Seals"
 - b. Or equal.

2.8 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.

- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.9 PIPE PENETRATIONS

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.10 PIPE ANCHORS

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.11 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 PLUMBING SUPPORTS AND ANCHORS

- A. General Installation Requirements:
 - 1. Install all items per manufacturer's instructions.
 - 2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
 - 3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - 4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with sheet metal contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.
- B. Supports Requirements:
 - 1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
 - 2. Set all concrete inserts in place before pouring concrete.
 - 3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
 - 4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
 - 5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.
- C. Pipe Requirements:
 - 1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.

2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
 3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
 4. Piping shall not introduce strains or distortion to connected equipment.
 5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
 6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
 7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
 8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.
- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
 2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
 - a. The hanger is attached within 6" from a web/chord joint.
 - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
 3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
 4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Contracting Officer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Steel/Concrete Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" & under: 7'-0"
 - 2) 1-1/2": 9'-0"
 - 3) 2": 10'-0"
 - 4) 2-1/2": 11'-0"
 - 5) 3": 12'-0"
 - 6) 4" & larger: 12'-0"

2. Steel (Std. Weight or Heavier - Vapor Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" and under: 9'-0"
 - 2) 1-1/2": 12'-0"
 - 3) 2" & larger: 12'-0"
3. Hard Drawn Copper & Brass (Liquid Service):
 - a. Maximum Spacing:
 - 1) 3/4" and under: 5'-0"
 - 2) 1": 6'-0"
 - 3) 1-1/4": 7'-0"
 - 4) 1-1/2": 8'-0"
 - 5) 2": 8'-0"
 - 6) 2-1/2": 9'-0"
 - 7) 3": 10'-0"
 - 8) 4": 12'-0"
 - 9) 6": 12'-0"
4. Hard Drawn Copper & Brass (Vapor Service):
 - a. Maximum Spacing:
 - 1) 3/4" & under: 7'-0"
 - 2) 1": 8'-0"
 - 3) 1-1/4": 9'-0"
 - 4) 1-1/2": 10'-0"
 - 5) 2": 11'-0"
 - 6) 2-1/2" & larger: 12'-0"
5. Plastic Pipe:
 - a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.
6. Ultra-Flexible Pipe, and Flexible Hose, and Soft Copper Tubing:
 - a. Continuous channel with hangers maximum 8'-0" OC.
- I. Wood Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
 1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" & under: 7'-0"
 - 2) 1-1/2": 9'-0"
 - 3) 2": 10'-0"
 - 4) 2-1/2": 11'-0"
 - 5) 3": 12'-0"
 - 6) 4" through 6": 12'-0"
 - 7) 8": 9'-0"
 - 8) 10": 6'-0"
 - 9) 12": 4'-0"
 2. Steel (Std. Weight or Heavier - Vapor Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" and under: 9'-0"

- 2) 1-1/2": 12'-0"
 - 3) 2" & larger: 12'-0"
 - 4) 2-1/2": 11'-0"
 - 5) 3": 12'-0"
 - 6) 4" through 8": 12'-0"
 - 7) 10": 9'-0"
 - 8) 12": 6'-0"
3. Hard Drawn Copper & Brass (Liquid Service):
- a. Maximum Spacing:
 - 1) 3/4" and under: 5'-0"
 - 2) 1": 6'-0"
 - 3) 1-1/4": 7'-0"
 - 4) 1-1/2" 8'-0"
 - 5) 2": 8'-0"
 - 6) 2-1/2": 9'-0"
 - 7) 3": 10'-0"
 - 8) 4": 12'-0"
 - 9) 6": 12'-0"
4. Hard Drawn Copper & Brass (Vapor Service):
- a. Maximum Spacing:
 - 1) 3/4" & under: 7'-0"
 - 2) 1": 8'-0"
 - 3) 1-1/4": 9'-0"
 - 4) 1-1/2": 10'-0"
 - 5) 2": 11'-0"
 - 6) 2-1/2" & larger: 12'-0"
5. Plastic Pipe:
- a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.
6. Ultra-Flexible Pipe, Flexible Hose, and Soft Copper Tubing:
- a. Continuous channel with hangers maximum 8'-0" OC.
- J. Wood Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
- 1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
 - a. Maximum Spacing:
 - 1) 1-1/4" & under: 7'-0"
 - 2) 1-1/2": 9'-0"
 - 3) 2": 10'-0"
 - 4) 2-1/2": 11'-0"
 - 5) 3": 12'-0"
 - 6) 4" through 6": 12'-0"
 - 7) 8": 9'-0"
 - 8) 10": 6'-0"
 - 9) 12": 4'-0"
 - 2. Steel (Std. Weight or Heavier - Vapor Service):
 - a. Maximum Spacing:

- 1) 1/2" and under: 6'-0"
 - 2) 3/4" to 1": 8'-0"
 - 3) 1-1/4" and under: 9'-0"
 - 4) 1-1/2": 10'-0"
 - 5) 2" & larger: 10'-0"
 - 6) 3": 12'-0"
 - 7) 4" through 8": 12'-0"
 - 8) 10": 9'-0"
 - 9) 12": 6'-0"
3. Hard Drawn Copper & Brass (Liquid Service):
- a. Maximum Spacing:
 - 1) 3/4" & under: 5'-0"
 - 2) 1": 6'-0"
 - 3) 1-1/4": 6'-0"
 - 4) 1-1/2": 6'-0"
 - 5) 2": 8'-0"
 - 6) 2-1/2": 9'-0"
 - 7) 3": 10'-0"
 - 8) 4": 10'-0"
 - 9) 6": 10'-0"
4. Hard Drawn Copper & Brass (Vapor Service):
- a. Maximum Spacing:
 - 1) 3/4" & under: 6'-0"
 - 2) 1": 6'-0"
 - 3) 1-1/4": 6'-0"
 - 4) 1-1/2": 6'-0"
 - 5) 2": 10'-0"
 - 6) 2-1/2" & larger: 10'-0"
5. Plastic Pipe:
- a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.
6. Ultra-Flexible Pipe, Flexible Hose, and Soft Copper Tubing:
- a. Continuous channel with hangers maximum 8'-0" OC.
- K. Installation of hangers shall conform to MSS SP-58, 69, 89 and the applicable Plumbing Code.

END OF SECTION 22 05 29

SECTION 22 05 53 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Identification of products installed under Division 22.

1.2 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
- B. ASTM B-1, B-3, and B-8 for copper conductors.
- C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 2kV Cables.
- D. CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders for Medical Use.
- E. NFPA-99 Health Care Facilities.
- F. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 05 00. Include list of items identified, wording, letter sizes, and color coding.
- B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 1. Seton
- 2. Or equal.

2.2 MATERIALS

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD of Pipe or Insulation	Marker Length	Size of Letters
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"
8" to 10"	24"	2-1/2"
Over 10"	32"	3-1/2"

Plastic tags may be used for outside diameters under 3/4"

- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.

- C. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
- D. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.
- E. Stencil Painted Pipe Markers: Use industrial enamel spray paint per ANSI Standard A13.1. Indicate fluid conveyed and flow direction.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Pipe Markers:
 1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3, or equal, on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8, or equal, on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
 2. Snap-on Markers: Use Seton "Setmark", or equal, on pipes up to 5-7/8" OD. Use Seton "Setmark", or equal, with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
 3. Stencil Painted Pipe Markers:
 - a. Remove rust, grease, dirt, and all foreign substances from the pipe surface.
 - b. Apply primer on non-insulated pipes before painting.
 - c. Use background and letter colors as scheduled later in this section.
 4. Apply markers and arrows in the following locations where clearly visible:
 - a. At each valve.
 - b. On both sides of walls that pipes penetrate.
 - c. At least every 20 feet along all pipes.
 - d. On each riser and each leg of each "T" joint.
 - e. At least once in every room and each story traversed.
 5. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.
- D. Equipment:
 1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
 2. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

3.2 SCHEDULE

- A. Pipes to be marked shall be labeled with text as follows, regardless of which method or material is used:
1. CONDENSATE DRAIN: White lettering; green background
 2. SANITARY SEWER: Black lettering; yellow background
 3. VENT: Black lettering; yellow background
 4. NATURAL GAS: Black lettering; yellow background

END OF SECTION 22 05 53

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SECTION 22 10 00 - PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe and Pipe Fittings.

1.2 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- D. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.3 REFERENCES

- A. ANSI/ASME A112.3.1 - Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above and Below Ground.
- B. ASME A112.6.9 - Siphonic Drain Test; The American Society of Mechanical Engineers.
- C. ANSI/ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- D. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- E. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- F. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- G. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- H. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- I. ANSI/ASME B31.3 - Chemical Plant and Petroleum Refinery Piping.
- J. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- K. ANSI/ASTM B32 - Solder Metal.
- L. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- M. ANSI/ASTM D2466 - PVC Plastic Pipe Fittings, Schedule 40.
- N. ANSI/AWS D1.1 - Structural Welding Code.

- O. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings 3" through 48", for Water and Other Liquids.
- P. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
- Q. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- R. ANSI/AWWA C153 - Compact Ductile Iron Fittings 3" through 48", for Water and Other Liquids.
- S. ASME - Boiler and Pressure Vessel Code.
- T. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.
- U. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- V. ASTM A74 - Hub and Spigot Cast Iron Soil Pipe and Fittings.
- W. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- X. ASTM A312 - Standard for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- Y. ASTM A554 - Standard for Welded Stainless Steel Mechanical Tubing.
- Z. ASTM A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
- AA. ASTM A888 - Hubless Cast Iron Soil Pipe and Fittings.
- BB. ASTM B88 - Seamless Copper Water Tube.
- CC. ASTM B306 - Copper Drainage Tube (DWV).
- DD. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- EE. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- FF. ASTM C1540 - Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
- GG. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- HH. ASTM D1785 - Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- II. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- JJ. ASTM D2661 - ABS DWV Pipe & Fittings.
- KK. ASTM D2665 - PVC DWV Pipe & Fittings.

- LL. ASTM D2846 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
 - MM. ASTM D3033 - Type PSP (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.
 - NN. ASTM D3034 - Type PSM (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.
 - OO. ASTM F402 - Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
 - PP. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
 - QQ. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
 - RR. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipes.
 - SS. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
 - TT. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
 - UU. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
 - VV. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.
 - WW. AWS A5.8 - Brazed Filler Metal.
 - XX. AWWA C651 - Disinfecting Water Mains.
 - YY. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
 - ZZ. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.
 - AAA. FM 1680 - Couplings Used in Hubless Cast Iron Systems.
 - BBB. NFPA 24 - Private Fire Service Mains and Their Appurtenances.
 - CCC. NFPA 54 - National Fuel Gas Code.
 - DDD. NFPA 58 - Storage and Handling of Liquefied Petroleum Gases.
 - EEE. NSF - National Sanitation Foundation
- 1.4 SUBMITTALS
- A. Submit shop drawings per Section 22 05 00.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver and store valves in shipping containers with labeling in place.

1.6 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 22 05 00 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

2.1 CAST IRON PIPE

- A. Cast Iron; Standard Weight; Hub and Spigot Joints:
 - 1. Pipe: Standard weight hub and spigot cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888CISPI 301 and CISPI Trademark.
 - 2. Design Pressure: Gravity Maximum Design Temperature: 180°F
 - 3. Joints: Compression gasket, ASTM C564.
 - 4. Adapters: Heavy duty no-hub transition for joining cast iron and PVC pipe. Adapters shall be tested and certified to ASTM C 1460 and be constructed with Type 304 stainless steel shield, thickness 0.015" shield, gasket material to meet ASTM C564, 1-1/2" to 4" will be 3" wide with four 304 stainless steel bands, and 6" to 10" will be 4" wide with six 304 stainless steel bands and 3/8" 305 stainless steel hex head screws torqued to 80 inch pounds.
- B. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets:
 - 1. Pipe: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888CISPI 301 and CISPI Trademark.
 - 2. Design Pressure: Gravity Maximum Design Temperature: 180°F
 - 3. Joints: Heavy duty, neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
 - 4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

2.2 COPPER PIPE

- A. Copper Pipe; Type L; Solder Joints:
 - 1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
 - 2. Design Pressure: 175 psi; Maximum Design Temperature: 200°F.
 - 3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
 - 4. Fittings: Wrought copper solder joint, ANSI B16.22.
- B. Copper Pipe; Type L; Mechanical Press Connection:
 - 1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
 - 2. Design Pressure: 175 psi; Maximum Design Temperature: 200°F.
 - 3. Joints: Mechanical press connection.
 - 4. Fittings: Copper, ANSI B-16.22, with embedded EPDM O-ring, NSF-61.
 - 5. Manufacturers:
 - a. Viega ProPress
 - b. Or equal
- C. Copper Pipe; Type K; Solder Joints:
 - 1. Pipe: Type K annealed copper tube, ASTM B88.

2. Design Pressure: 150 psi. Maximum Design Temperature: 200°F.
3. Joints: Solder with 100% lead-free solder and flux ASTM B32BCuP silver braze, AWS A5.8.
4. Fittings: Wrought copper solder joint, ANSI B16.22.

D. Copper Pipe; Type K; Mechanical Press Connection:

1. Pipe: Type K annealed copper tube, ASTM B88.
2. Design Pressure: 150 psi. Maximum Design Temperature: 200°F.
3. Joints: Mechanical press connection.
4. Fittings: Copper, ANSI B-16.22, with embedded EPDM O-ring, NSF-61.
5. Manufacturers:
 - a. Viega ProPress
 - b. Or equal.

2.3 GALVANIZED STEEL PIPE

A. Galvanized Steel; Standard Weight; Threaded Joints:

1. Pipe: Galvanized; standard weight galvanized steel, ASTM A53, threaded and coupled.
2. Design Pressure: 175 psi; Maximum Design Temperature: 200°F.
3. Joints: screwed.
4. Fittings: Malleable iron, ASTM A47, Grade 32510, galvanized with grooved ends or 125# steam - 175# CWP, galvanized cast iron, ASTM A126, ANSI B16.4.
5. Flanges: Grooved end, galvanized flanged adapter nipples, Gustin Bacon No. 54, Victaulic No. 54 or 125# steam - 175# CWP, galvanized cast iron, screwed, ASTM A126, Grade B, ANSI B16.1, with galvanized or cadmium plated bolting.

2.4 PLASTIC PIPE

A. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints:

1. Pipe: Schedule 40 rigid, PVC-DWV, or ABS-DWV, normal impact Type I, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.
2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
3. Fittings: PVC-DWV, or ABS-DWV, normal impact Type I, with solvent-weld socket type ends for Schedule 40 pipe.
4. Limits: Schedule 40 PVC-DWV, or ABS-DWV pipe must not be threaded. Do not use where exposed or in return air plenums.
5. Use: Use PVC or ABS only where allowed by local jurisdiction. Comply with all special requirements or limitations.
6. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 22 05 16 for expansion joint requirements.

2.5 CONNECTIONS BETWEEN DISSIMILAR METALS

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.

- C. Aluminum, iron, steel, brass, copper, bronze, galvanized steel and stainless steel are commonly used and require isolation from each other with the following exceptions:
 - 1. Iron and steel connected to each other.
 - 2. Brass, copper, and bronze connected to each other.
 - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.

- D. Dielectric protection is required at connections to equipment of a material different than the piping.

- E. Screwed Joints (acceptable up to 2" size):
 - 1. Copper silicon dielectric waterway rated for 300 psi CWP and 225°F.
 - 2. Manufacturers:
 - a. Victaulic Series 647
 - b. Or equal.

- F. Flanged Joints (any size):
 - 1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
 - 2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
 - 3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
 - 4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
 - 5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
 - 6. Manufacturers:
 - a. EPCO
 - b. Or equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt, on inside and outside, before assembly.
- D. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- E. Connect to equipment with flanges or unions.
- F. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.

- G. Roof Penetration (Vent) Flashing:
 1. Built-up Roofing: Flash vents with 3# seamless sheet lead of sufficient size to extend 15" into roofing felts for built-up roofs.
 2. Membrane, Metal or Shingled Roofs: Flash vents with premolded pipe flashing cones for single-ply membrane roofs, metal roofs, or shingled roofs.
- H. Existing building sewers or building drains which are shown on the documents to be reused shall be inspected and recorded by closed circuit television for their condition. Report findings back to the Contracting Officer before proceeding with work so any necessary rework can take place if needed.

3.2 SYSTEM AND PIPING SCHEDULE

A. Cold Water, Hot Water, Tempered Water - Potable and Non-Potable (Above Ground):

1. Copper Pipe; Type L; Solder Joints: All Sizes
2. Copper Pipe; Type L; Mechanical Press Connection: 4" and Under
3. Galvanized Steel; Standard Weight; Threaded Joints: 6" and Over
4. Shutoff Valves: BF-1, BA-1
5. Throttling Valves: GL-1, GL-2
6. Check Valves: CK-1, CK-14
7. Strainers: ST-1, ST-7

B. Sanitary Waste and Vent, Gravity (Above Ground):

1. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"

C. Sanitary Indirect Drainage (Above Ground):

1. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
2. Copper Pipe: Type DWV; Solder Joints: 1-1/4" to 4"

D. Sanitary Waste - Pumped (Above Ground - Inside Building):

1. Copper Pipe; Type K; Solder Joints: All Sizes
2. Copper Pipe; Type K; Mechanical Press Connection: All Sizes
3. Galvanized Steel; Standard Weight; Threaded Joints: 4" and under
4. Shutoff Valves: BA-1, BA-1A, BF-1 Check Valves: CK-13

E. Condensate/Equipment Drainage:

1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
3. Copper Pipe: Type DWV; Solder Joints: 1-1/4" to 4"

3.3 TESTING PIPING

A. Sanitary Drainage, Sanitary Vent:

1. Test all piping with water to prove tight.
2. Test piping before insulation is applied.
3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
5. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.

6. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
7. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.

B. Hot Water - Potable and Non-Potable, Cold Water - Potable and Non-Potable, Tempered Water - Potable and Non-Potable, Service Water:

1. Test pipes underground or in chases and walls before piping is concealed.
2. Test all pipes before the insulation is applied. If insulation is applied before the pipe is tested and a leak develops which ruins the insulation, replace damaged insulation.
3. Test the pipe with 100 psig water pressure or equal inert gas such as nitrogen. Exception: Inert gas test shall not be used to test plastic piping.
4. Hold test pressure for at least 2 hours.
5. Test to be witnessed by the Contracting Officer.

C. All Other Piping:

1. Test piping at 150% of normal operating pressure.
2. Piping shall hold this pressure for one hour with no drop in pressure.
3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
4. Drain and clean all piping after testing is complete.

3.4 CLEANING PIPING

A. Assembly:

1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Contracting Officer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
3. Notify the Contracting Officer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Contracting Officer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.

B. Air Blow:

1. Blow out pipe and components with clean compressed air. Instrument air, argon, nitrogen and sulfuric acid lines shall be blown out with dry, oil free air or nitrogen gas. "Oil Free" is defined as air compressed in a centrifugal, Teflon ring, carbon ring or water pumped air compressor. Where air supply is judged to be inadequate to continually attain cleaning velocity, alternate pressurization and sudden relief procedure may be used until discharge at all blow out points is clean. Use 80-90 psig pressure unless otherwise indicated.
2. Air blow applies to the following systems:
 - a. Acetylene
 - b. Carbon Dioxide
 - c. Nitrogen (use oil free air or nitrogen gas)
 - d. Argon (use oil free air or nitrogen gas)
 - e. Instrument Air (use oil free air or nitrogen gas)

- f. Distilled Water (use maximum of 50 psig pressure)
- g. Chemical Feed
- h. Air Compressor Intakes
- i. Sulfuric Acid (use oil free air or nitrogen gas)

C. All Water Piping:

- 1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
- 2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
- 3. If necessary, remove valves to clean out all foreign material.

3.5 INSTALLATION

A. General Installation Requirements:

- 1. Provide dielectric connections between dissimilar metals.
- 2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
- 3. Group piping whenever practical at common elevations.
- 4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
- 5. Slope water piping and arrange to drain at low points.
- 6. Install bell and spigot piping with bells upstream.
- 7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- 8. Seal pipes passing through exterior walls with a wall seal per Section 22 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
- 9. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.
- 10. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted. For renovation projects, this Contractor is responsible for opening and patching existing walls for installation of piping. Wall patching shall match existing condition.

B. Installation Requirements in Electrical Rooms:

- 1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

C. Installation Requirements in MRI (Magnetic Resonance Imaging - Healthcare):

- 1. All piping in MRI rooms shall be non-ferrous regardless of materials described on Part 2.

D. Valves/Fittings and Accessories:

- 1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.
- 2. Provide clearance for installation of insulation and access to valves and fittings.
- 3. Provide access doors for concealed valves and fittings.
- 4. Install valve stems upright or horizontal, not inverted.
- 5. Provide one plug valve wrench for every ten plug valves 2" and smaller, minimum of one. Provide each plug valve 2-1/2" and larger with a wrench with set screw.
- 6. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

E. Underground Piping:

1. Install buried water piping outside the building with at least 5 feet of cover. Refer to Section 22 05 00 for Excavation, Fill, Backfill and Compaction requirements.
2. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.
3. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
4. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Contracting Officer with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.
5. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.

F. Sanitary and Storm Piping:

1. Install all sanitary and storm piping inside the building with a slope as shown on the drawings.
2. Install horizontal offset at all connections to roof drains to allow for pipe expansion.
3. Slope sanitary and storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 2 feet per second.
4. Sway Bracing: Where horizontal sanitary and/or storm pipes 4 inches and larger change flow direction greater than 45°, rigid bracing or thrust restraints shall be installed to resist movement of the upstream pipe in the direction of pipe flow. The rigid bracing or thrust restraint shall be connected to structure. A change of flow direction from horizontal into a vertical pipe does not require the upstream pipe to be braced.
5. All sanitary and storm piping shall have at least 42" of cover when leaving the building.
6. Starter fittings with internal baffles are not permitted.

3.6 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.
- D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.
- E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.
- F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.

- G. Provide flanges or unions at all final connections to equipment, traps and valves.
- H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.
- I. Use full and double lengths of pipe wherever possible.
- J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.
- K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.
- L. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.

3.7 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal water lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.
- D. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- E. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.
- F. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.
- G. All vent and drain piping shall be of same materials and construction for the service involved.

3.8 PLUMBING VENTS

- A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.
- B. Extend the high side of the soil and waste stacks at least 12" above roof.
- C. Flash pipes at the roof with 3# lead sheet. Extend flashing under roofing 15" in all directions from pipe to be flashed. Extend a lead collar up on the outside of pipe to be flashed and extend 1" beyond the top of the pipe. The 1" excess length of collar shall be turned down into the top of the pipe where it shall fit tight to the inside of the pipe.
- D. Flash pipes at roof with premolded EPDM pipe flashing cones adhered to roof membrane by General Contractor. Secure top of cone with stainless steel clamp and seal watertight.

- E. Increase vent pipes through the roof two pipe sizes with long increasers located at least 12" below the roof.
- F. In no case shall the vent through the roof be less than 4" in diameter.
- G. Vent pipes through the roof shall be located a minimum of 15 feet from any air intake opening on the roof.

3.9 BRANCH CONNECTIONS

- A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.
- D. Branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.
- E. Forged weld-on fittings are limited as follows:
 - 1. Must have at least same pressure rating as the main.
 - 2. Main must be 2-1/2" or larger.
 - 3. Branch line is at least two pipe sizes under main size.

3.10 JOINING OF PIPE

- A. Threaded Joints (Galvanized Steel Pipe):
 - 1. Threads shall conform to ANSI B2.1 "Pipe Threads".
 - 2. Ream pipe ends and remove all burrs and chips formed in cutting and threading.
 - 3. Protect plated pipe and valve bodies from wrench marks when making up joints.
 - 4. Apply thread lubricant to male threads as follows:
 - a. Vents and Roof Conductors: Red graphite
 - b. All Other Services: Teflon tape
- B. Solder Joints (Copper Pipe):
 - 1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.
 - 2. Flux shall be non-acid type.
 - 3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°F.

- C. Brazed Joints (Copper Pipe):
1. Make up joints with silver alloy brazing filler metal conforming to ASTM B260 "Brazing Filler Metal" BA_g-1 or BA_g-2. Cut copper tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to brazing. Apply non-corrosive flux of the type recommended by filler alloy manufacturer, evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly using oxygen-acetylene torch with tip size recommended by fitting manufacturer. Wipe and brush joint clean after alloy has set.
 2. Remove discs from solder end valves during brazing.
- D. Mechanical Press Connection (Copper and Stainless Steel Pipe):
1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
 2. Fully insert tubing into the fitting and mark tubing.
 3. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
 4. Joint shall be pressed with a tool approved by the manufacturer.
 5. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.
- E. Hub and Spigot Joints - Sanitary Pipe and Storm Pipe (Cast Iron and Stainless Steel Pipe):
1. Lead and Oakum Joints: Pack joint with oakum made of vegetable fiber, cotton, or hemp. Pour joint with molten lead up to top of hub. Ensure leak-free joints by working joint with inside and outside caulking irons.
 2. Compression Gasket Joints: Joint shall be one-piece double seal compression type gasket made specifically for joining cast iron soil pipe. Gasket shall be neoprene, permitting joint to flex as much as 5 degrees without loss of seal. Gasket shall be extra heavy weight class, conforming to ASTM C-564.
- F. Solvent Weld Joints (PVC):
1. Make joints with a two-step process. Use primer conforming to ASTM F656 and solvent cement conforming to ASTM D2564.
- G. No-Hub Sleeve Gaskets (No-Hub) (Cast Iron Pipe):
1. Gasket shall be heavy weight class, conforming to ASTM C564.
 2. The gasket shall have an internal center stop.
 3. The gasket shall be covered by a stainless steel band secured with a minimum of four stainless steel bands per fitting/joint.
 4. Sleeve gaskets shall be installed in accordance with the manufacturer's installation instructions.

END OF SECTION 22 10 00

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SECTION 23 05 00 - BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 23 Sections. Also refer to Division 01 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
 - 1. Plumbing Work: Refer to Section 22 05 00 "Basic Plumbing Requirements".
 - 2. Heating Work shall include, but is not necessarily limited to:
 - a. Furnish and install heating hydronic boilers and accessories.
 - b. Furnish and install complete heating water system including pumps, piping, insulation, air control equipment, terminal heating equipment, and specialties. Make final connections to all coils, including those furnished by others.
 - c. Furnish and install complete chilled water system including pumps, piping, insulation, air control equipment, terminal cooling equipment, and specialties. Make final connections to all coils, including those furnished by others.
 - d. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
 - e. Furnish and install condensate drain piping from cooling related equipment such as air handlers and cooling coil drain pans.
 - f. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
 - g. Complete all applicable tests, certifications, forms, and matrices.
 - 3. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:
 - a. Furnish and install package indoor air handling units complete with dampers, filters, coils, fans, and motors.
 - b. Furnish and install air-cooled condensing units and curbs.
 - c. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
 - d. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
 - e. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
 - f. Furnish and install mechanical room ventilation systems including louvers, ductwork, insulation, and fans.
 - g. Furnish and install gas flues, stacks, and breechings.

- h. Furnish and install all temperature control systems.
 - i. Furnish and install all fire dampers.
 - j. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
 - k. Complete all applicable tests, certifications, forms, and matrices.
4. Temperature Control Work shall include, but is not necessarily limited to:
- a. Furnish and install a complete temperature control system as specified in Section 23 09 00.
 - b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
 - c. Furnish automatic control valves and dampers for installation by others.
 - d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
5. Fire Protection Work: Refer to Section 21 05 00 "Basic Fire Suppression Requirements".
6. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:
- a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, hydronic systems, plumbing systems, and verification of control systems.
 - b. Complete all applicable tests, certifications, forms, and matrices.

1.3 WORK SEQUENCE

- A. All work that will produce excessive noise or interference with normal building operations, as determined by the Contracting Officer, shall be scheduled with the Contracting Officer. It may be necessary to schedule such work during unoccupied hours. The Contracting Officer reserves the right to determine when restricted construction hours will be required.

1.4 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

- A. Definitions:
 - 1. "Mechanical Contractors" refers to the following:
 - a. Plumbing Contractor.
 - b. Heating Contractor.
 - c. Air Conditioning and Ventilating Contractor.
 - d. Temperature Control Contractor.
 - e. Testing, Adjusting, and Balancing Contractor.
 - 2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
 - 3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
 - 4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.

5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
 - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
 - a. Light fixtures.
 - b. Gravity flow piping, including steam and condensate.
 - c. Electrical busduct.
 - d. Sheet metal.
 - e. Electrical cable trays, including access space.
 - f. Sprinkler piping and other piping.
 - g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor.
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Contractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Contracting Officer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. Control Contractor's Responsibility:
 - a. Wiring of all devices needed to make the Temperature Control System functional.
 - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor.
 - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.5 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each Contractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Contracting Officer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and Contractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the State of Indiana Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards of National Parks.
3. Conform to all State Codes.
4. If there is a discrepancy between the codes and regulations and these specifications, the Contracting Officer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Contracting Officer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Contracting Officer.
7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Contracting Officer or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the mechanical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Contracting Officer.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.

7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
 - a. Any item listed as furnished shall also be installed, unless otherwise noted.
 - b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Contractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.6 SUBMITTALS

- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

Referenced Specification Section	Submittal Item
23 05 00	Training Agenda
23 05 03	Fire Seal Systems
23 05 13	Motors
23 05 29	Hangers and Supports
23 05 29	Prefabricated Curbs
23 05 48	Vibration Isolation Equipment
23 05 50	Seismic Restraint Systems
23 05 53	HVAC Identification
23 05 93	Testing, Adjusting, and Balancing
23 31 00	Ductwork
23 31 00	Ductwork Layout Drawings
23 31 00	Duct Specialties (such as Turning Vanes)
23 33 00	Fire Dampers

B. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Contracting Officer
 - d. Contractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Contracting Officer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all Contractors' submittals as described above.
 - e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Contracting Officer.
11. Submittals not required by the contract documents may be returned without review.

12. The Contracting Officer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Contracting Officer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Contracting Officer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions, or deviation from the contract documents in submittals is not relieved by the Contracting Officer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Contracting Officer if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Contracting Officer or other contractors.
 - a. Allow at least two weeks for Contracting Officer's review and processing of each submittal.
16. Contracting Officer reserves the right to withhold action on a submittal which, in the Contracting Officer's opinion, requires coordination with other submittals until related submittals are received. The Contracting Officer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Contracting Officer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 23 XX XX.description.YYYYMMDD
 - b. Transmittal file name: 23 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.7 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
 1. Fire Seal Systems
- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Contracting Officer and include copies of Contracting Officer's Operation and Maintenance Manuals.

1.8 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Contracting Officer. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.9 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Contracting Officer.

1.10 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Contracting Officer for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Contracting Officer.
- C. Warranty requirements shall extend to correction, without cost to the Contracting Officer, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.11 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.12 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.

- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Contracting Officer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

1.13 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and provide all services as described in the Commissioning Plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Contracting Officer, nor the presence of the Contracting Officer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Contracting Officer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Contracting Officer and consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 CONTRACTING OFFICER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Contracting Officer prior to:
 1. Placing fill over underground and underslab utilities.
 2. Covering exterior walls, interior partitions and chases.
 3. Installing hard or suspended ceilings and soffits.

- B. The Contracting Officer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
 - 1. All work above the ceilings must be complete prior to the Contracting Officer's review. This includes, but is not limited to:
 - a. Pipe insulation is installed and fully sealed.
 - b. Pipe and duct wall penetrations are sealed.
 - c. Pipe identification and valve tags are installed.
 - d. Main, branch and flexible ducts are installed.
 - e. Diffusers, registers and grilles are installed and connected to ductwork.
 - f. Terminal air box reheat coil piping or wiring is complete.
 - g. Terminal air box control wiring is complete and all control boxes are closed.
 - 2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 - 3. It is understood that if the Contracting Officer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Contracting Officer may not recommend further payments to the contractor until such time as full access has been provided.

3.3 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 01.
- B. Final Jobsite Observation:
 - 1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
 - 3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Contracting Officer so that the final observation can be scheduled.
 - 4. It is understood that if the Contracting Officer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Contracting Officer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
- C. Before final payment is authorized, this Contractor must submit the following:
 - 1. Operation and maintenance manuals with copies of approved shop drawings.
 - 2. Record documents including marked-up or reproducible drawings and specifications.
 - 3. A report documenting the instructions given to the Contracting Officer's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Contracting Officer's representatives.
 - 4. Inspection by State Boiler Inspector.
 - 5. Start-up reports on all equipment requiring a factory installation inspection or start-up.
 - 6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Contracting Officer required prior to final payment approval.

3.4 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Contracting Officer's review and approval. The electronic copy shall be corrected as required to address the Contracting Officer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Contracting Officer.
2. Approved O&M manuals shall be completed and in the Contracting Officer's possession prior to Contracting Officer's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Contracting Officer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div23.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Contracting Officer with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Contracting Officer, all Contractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Contracting Officer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Refer to Section 23 09 00 for additional requirements for Temperature Control submittals.
5. Copy of final approved test and balance reports.
6. Copies of all factory inspections and/or equipment startup reports.
7. Copies of warranties.
8. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

9. Dimensional drawings of equipment.
10. Capacities and utility consumption of equipment.
11. Detailed parts lists with lists of suppliers.
12. Operating procedures for each system.
13. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
14. Repair procedures for major components.
15. List of lubricants in all equipment and recommended frequency of lubrication.
16. Instruction books, cards, and manuals furnished with the equipment.

3.5 SYSTEM STARTING AND ADJUSTING

- A. The mechanical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Operate all HVAC systems continuously for at least one week prior to occupancy to bring construction materials to suitable moisture levels. Areas with mechanical cooling shall be maintained below 60% RH.
- D. Contractor shall adjust the mechanical systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- E. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- F. The Contractor, Contractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Contracting Officer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Contracting Officer on a time and materials basis for services rendered at the Contracting Officer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Contracting Officer for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.6 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 01 requirements.
- B. Maintain at the job site a separate and complete set of mechanical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

- C. Mark drawings to indicate revisions to piping and ductwork, size and location, both exterior and interior; including locations of coils, dampers, other control devices, filters, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- D. Refer to Section 23 09 00 for additional requirements for Temperature Control documents.
- E. Before completion of the project, a set of reproducible mechanical drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- F. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- G. Record changes daily and keep the marked drawings available for the Contracting Officer's examination at any normal work time.
- H. Upon completing the job, and before final payment is made, give the marked-up drawings to the Contracting Officer.

3.7 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Contracting Officer's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- B. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- C. Paint all outdoor uninsulated steel piping the color selected by Contracting Officer.

3.8 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Contracting Officer's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed bare metal ductwork, piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.9 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.

- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Contracting Officer prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Contracting Officer will result in removal and reinstallation of the equipment at the Contractor's expense.

3.10 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
 - 1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
 - d. Protect stored on-site and installed absorptive materials from moisture damage.
 - 2. Request that the Contracting Officer designate an IAQ representative.
 - 3. Review and receive approval from the Contracting Officer's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
 - 4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
 - 5. Schedule activities that may cause IAQ conditions that are not acceptable to the Contracting Officer's IAQ representative during unoccupied periods.
 - 6. Request copies of and follow all of the Contracting Officer's IAQ and infection control policies.
 - 7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
 - 8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
 - 9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".
 - 10. If permanently installed air handlers are used to serve both construction and occupied areas, all return grilles throughout construction areas shall be sealed to prevent air from construction areas being supplied to occupied areas.
 - 11. If permanently installed air handlers are used during construction to serve only construction areas and do not supply air to adjacent occupied areas, MERV 8 filtration media shall be used to protect each return air grille or opening. The intent of this will be to prevent construction dust and debris from entering any return or supply air ductwork in the facility. All filtration media shall be replaced immediately prior to occupancy.

3.11 MAINTAINING CLEAN DUCTWORK THROUGHOUT CONSTRUCTION

- A. Throughout the duration of construction, all ductwork shall be capped or sealed with sheet metal caps, polyethylene film, or other airtight protective to keep dust, dirt, and construction debris out of ducts. Similar means shall be used to seal air-side connections of HVAC equipment to include, but not limited to, air handling units, fans, terminal air boxes, fan coil units, cabinet heaters, blower coils, and the like.

- B. When air terminal devices are installed, contractors shall seal all supply, return, and exhaust grilles with polyethylene film or other airtight protective to keep dust, dirt, and construction debris out of ducts.
- C. Should HVAC equipment be started during construction, Contractor shall remove airtight protectives and shall install one-inch thick MERV 8 filter media over all return and exhaust grilles to prevent dust, dirt, and construction debris from entering ductwork. Filter media shall cover the entire grille face and shall be secured such that air cannot bypass filter media.
- D. Should filter media become laden with dust and dirt, Contractor shall replace filter media with new media to prevent damage to air distribution system and equipment.
- E. The following steps shall be taken during testing, adjusting, and balancing of each air system:
 - 1. All construction activities in all spaces served by the air system shall stop.
 - 2. All airtight protectives and temporary filter media shall be removed from all portions of the air system.
 - 3. Testing, adjusting, and balancing work shall not commence until all construction activity is stopped and all airtight protectives and temporary filter media is removed.
 - 4. Once testing, adjusting, and balancing work is complete for the air system, airtight protectives or temporary filter media shall be installed over all ductwork openings and air terminals on the air system prior to resuming construction activities in any spaces served by the air system.
- F. The Contracting Officer shall agree the building is sufficiently clean prior to the removal of any filtration media and airtight protectives from air terminal devices.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All fans shall be operating and balanced.
3. All temperature control systems operating, programmed and calibrated.
- 4 Fire damper and fire/smoke damper access doors labeled in accordance with specifications.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Contracting Officer so that the final observation can be scheduled.

It is understood that if the Contracting Officer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Contracting Officer for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 23 05 00

SECTION 23 05 05 - HVAC DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Mechanical demolition.
- B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. THE DRAWINGS ARE INTENDED TO INDICATE THE GENERAL SCOPE OF WORK AND DO NOT SHOW EVERY PIPE, DUCT, OR PIECE OF EQUIPMENT THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY CONDITIONS PRIOR TO SUBMITTING A BID.
- B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.
- C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.
- D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.
- E. Coordinate work with all other Contractors and the Contracting Officer. Schedule removal of equipment to avoid conflicts.
- F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.
- G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

- A. Disconnect mechanical systems in walls, floors, and ceilings scheduled for removal.
- B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.

- C. Existing Heating System: Maintain existing system in service until new system is complete and ready for service. Drain system only to make switchovers and connections. Obtain permission from the Contracting Officer at least 48 hours before partially or completely draining system. Minimize outage duration.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. Demolish and extend existing mechanical work under provisions of Division 2 and this Section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned ducts and piping to source of supply and/or main lines.
- D. Remove exposed abandoned pipes and ducts, including abandoned pipes and ducts above accessible ceilings. Cut ducts flush with walls and floors, cap duct that remains, and patch surfaces. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.
- E. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.
- F. Repair adjacent construction and finishes damaged during demolition and extension work.
- G. Maintain access to existing mechanical installations which remain. Modify installation or provide access panels as appropriate.
- H. Remove unused sections of supply and return air ductwork back to mains. Patch opening with sheet metal and seal airtight. Patch existing insulation to match existing. Where existing ductwork is to be capped and reused, locate the end cap within 6" of the last branch. End caps shall be 3" pressure class and seal class "A".
- I. Extend existing installations using materials and methods compatible with existing installations, or as specified.

3.4 CUTTING AND PATCHING

- A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 23 05 29 for additional requirements.
- B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.
- C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.
- D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Contracting Officer prior to start of work.
- E. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.5 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Clean all systems adjacent to project which are affected by the dust and debris caused by this construction.
- C. MECHANICAL ITEMS REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE Contracting Officer. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE Contracting Officer IN A LOCATION COORDINATED WITH THE Contracting Officer. THE CONTRACTOR SHALL DISPOSE OF MATERIAL THE Contracting Officer DOES NOT WANT TO REUSE OR RETAIN FOR MAINTENANCE PURPOSES.

3.6 SPECIAL REQUIREMENTS

- A. Install temporary filter media over outside air intakes which are within 100 feet of the limits of construction. This Contractor shall complete any cleaning required for existing systems which are affected by construction dust and debris.
- B. Review locations of all new penetrations in existing floor slabs or walls. Determine construction type and review for possible interferences. Bring all concerns to the attention of the Contracting Officer before proceeding.

END OF SECTION 23 05 05

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SECTION 23 05 48 - HVAC VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Bases.
- B. Vibration Isolation.
- C. Flexible Connectors.

1.2 SUBMITTALS

- A. Submit shop drawings per Section 23 05 00 and the Vibration Isolation Submittal Form at the end of this section.
- B. Vibration isolation submittals may be included with equipment being isolated, but must comply with this section.
- C. Base submittals shall include equipment served, construction, coatings, weights, and dimensions.
- D. Isolator submittals shall include:
 - 1. Equipment served
 - 2. Type of Isolator
 - 3. Load in Pounds per Isolator
 - 4. Recommended Maximum Load for Isolator
 - 5. Spring Constants of Isolators (for Spring Isolators)
 - 6. Load vs. Deflection Curves (for Neoprene Isolators)
 - 7. Specified Deflection
 - 8. Deflection to Solid (at least 150% of calculated deflection)
 - 9. Loaded (Operating) Deflection
 - 10. Free Height
 - 11. Loaded Height
 - 12. Kx/Ky (horizontal to vertical stiffness ratio - for spring isolators)
 - 13. Materials and Coatings
 - 14. Spring Diameters
- E. Make separate calculations for each isolator on equipment where the load is not equally distributed.
- F. Flexible connector shop drawings shall include overall face-to-face length and all specified properties.
- G. Submit certification that equipment, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. 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."

- b. 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."
- 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 BASIC CONSTRUCTION AND REQUIREMENT

- A. Vibration isolation for this project is subject to seismic restraint requirements of Section 23 05 50.
- B. Vibration isolators shall have either known undeflected heights or other markings so deflection under load can be verified.
- C. All isolators shall operate in the linear portion of their load versus deflection curve. The linear portion of the deflection curve of all spring isolators shall extend 50% beyond the calculated operating deflection (e.g., 3" for 2" calculated deflection). The point of 50% additional deflection shall not exceed the recommended load rating of the isolator.
- D. The lateral to vertical stiffness ratio (K_x/K_y) of spring isolators shall be between 0.8 and 2.0.
- E. All neoprene shall have UV resistance sufficient for 20 years of outdoor service.
- F. All isolators shall be designed or treated for corrosion resistance. Steel bases shall be cleaned of welding slag and primed for interior use, and hot dip galvanized after fabrication for exterior use. All bolts and washers over 3/8" diameter located outdoors shall be hot dip galvanized per ASTM A153. All other bolts, nuts and washers shall be zinc electroplated. All ferrous portions of isolators, other than springs, for exterior use shall be hot dip galvanized after fabrication. Outdoor springs shall be neoprene dipped or hot dip galvanized. All damage to coatings shall be field repaired with two coats of zinc rich coating.
- G. Equip all mountings used with structural steel bases with height-saving brackets. Bottoms of the brackets shall be 1-1/2" to 2-1/2" above the floor or housekeeping pad, unless shown otherwise on the drawings. Steel bases shall have at least four points of support.
- H. Provide motor slide rails for belt-driven equipment per Section 23 05 13.
- I. All isolators, except M1, shall have provision for leveling.

2.2 MOUNTINGS

- A. Type M1:
 - 1. 0.75" thick waffled neoprene pad with minimum static deflection of 0.07" at calculated load and 0.11" at maximum load. For loads less than 15 pounds, the deflection at calculated load requirement is waived, but the isolator must have a maximum stiffness of the ratio of 45#/0.35".
 - 2. Units need not be bolted down unless called for or needed to prevent movement. If bolted down, prevent short circuiting with neoprene bushings and washers between bolts and isolators.

3. Manufacturers:
 - a. Mason "Super W"
 - b. Or equal.
- B. Type M2:
1. Double deflection neoprene with minimum static deflection of 0.15" at calculated load and 0.35" at maximum rated load.
 - a. All metal shall be neoprene covered. Mounting shall have friction pads both top and bottom.
 2. All units shall have bolt holes and be bolted down.
 3. Use steel rails above the mountings to compensate for the overhang of equipment such as small vent sets and close coupled pumps.
 4. Manufacturers:
 - a. Mason Industries "ND" or "DNR"
 - b. Or equal.
- C. Type M3:
1. Free standing, laterally stable spring isolators without housings and complete with 1/4" neoprene friction pads.
 2. Units shall have bolt holes but need not be bolted down unless called for or needed to prevent movement. If bolted down, prevent short circuiting with neoprene bushings and washers between bolts and isolators. Bolt holes shall not be within the springs.
 3. All mountings shall have leveling bolts.
 4. Manufacturers:
 - a. Mason "SLFH"
 - b. Or equal.
- D. Type M4:
1. Use restrained spring mountings for equipment with operating weight different from the installed weight such as chillers and boilers, and equipment exposed to the wind such as cooling towers.
 2. Spring isolators shall be free-standing with 1/4" neoprene acoustical friction pads.
 3. All units shall have bolt holes and be bolted down. Prevent short circuiting with neoprene bushings and washers between bolts and isolators.
 4. All mountings shall have leveling bolts.
 5. Housings with vertical resilient limit stops shall prevent spring extension when weight is removed. Housings shall serve as blocking during erection and the installed and operating heights shall be the same.
 6. Maintain a minimum clearance of 1/2" around restraining bolts and between the housings and the springs so as not to interfere with the spring action.
 7. Limit stops shall be out of contact during normal operation.
 8. Select isolators for equipment subjected to wind loads in conformance with ASCE 7-02.
 9. Manufacturers:
 - a. Mason "SLRS"
 - b. Or equal.

2.3 THRUST RESTRAINTS

A. Type TR1:

1. Horizontal thrust restraints shall consist of spring elements in neoprene cups with grommets to prevent short circuiting hanger rods and nuts and washers for pre-compression.
2. Select springs for deflection of 0.75" to 1.50" at maximum calculated thrust. Springs shall be field adjusted for 1/2" movement. Spring constant may not exceed 50% of the vertical stiffness of the mounts (M3, etc.).
3. Centrifugal fans shall incline slightly forward when off and discharge directly in line with the ductwork at maximum static pressure.
4. Fabricate structural supports as needed to attach thrust restraints.
5. If connected to a housing, check maximum thrust the housing can restrain and connections required.
6. Manufacturers:
 - a. Mason "WB" or "PC30"
 - b. Or equal.

2.4 HANGERS

A. Type H1:

1. Vibration hangers shall consist of a double-deflection neoprene element with a projecting bushing or oversized opening to prevent steel-to-steel contact.
2. Static deflection shall be at least 0.15" at calculated load and 0.35" at maximum rated load.
3. Provide hangers with end connections as required for hanging ductwork or piping.
4. Manufacturers:
 - a. Mason "HD"
 - b. Or equal.

B. Type H2:

1. Vibration hangers shall contain a steel spring in a neoprene cup with a grommet to prevent short circuiting the hanger rod.
2. The cup shall have a steel washer to distribute load on the neoprene and prevent its extrusion.
3. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the grommet and short circuiting the spring.
4. Provide end connections for hanging ductwork or piping.
5. Manufacturers:
 - a. Mason "30"
 - b. Or equal.

2.5 BASES

A. Type B1:

1. Rectangular structural steel bases.
2. All perimeter members shall be beams or channels with minimum depth of 10% of the longest base dimension or 14" maximum if rigidity is acceptable to the equipment manufacturer.
3. Use height saving brackets, unless noted otherwise.

4. Manufacturers:
 - a. Mason "WF"
 - b. Or equal.
- B. Type B2:
 1. Steel members welded to height-saving brackets to cradle machines having legs or bases that do not require complete supplementary bases.
 2. Members shall be sufficiently rigid to prevent strains in the equipment.
 3. Manufacturers:
 - a. Mason "ICS"
 - b. Or equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Provide vibration isolation as indicated on the drawings and as described herein.
- C. Clean the surface below all mountings that are not bolted down and apply adhesive cement equal to Mason Type WG between mounting and floor. If movement occurs, bolt mountings down. Isolate bolts from baseplates with neoprene washers and bushings.
- D. All static deflections listed in the drawings and specifications are the minimum acceptable actual deflection of the isolator under the weight of the installed equipment - not the maximum rated deflection of the isolator.
- E. Support equipment to be mounted on structural steel frames with isolators under the frames or under brackets welded to the frames. Where frames are not needed, fasten isolators directly to the equipment.
- F. Where a specific quantity of hangers is noted in these specifications, it shall mean hanger pairs for support points that require multiple hangers, such as rectangular ducts or pipes supported on a strut rack.

3.2 VIBRATION ISOLATION SCHEDULE

- A. AHU Fans:
 1. Base Type: B1 or B2
 2. Isolator Type: M3 and/or TR1
 3. Static Deflection: Refer to ASHRAE Table
 4. Flexible Connections: Per Section 23 33 00

END OF SECTION 23 05 48

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SECTION 23 05 50 - SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Seismic Requirements.

1.2 QUALITY ASSURANCE

A. General:

1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
3. These requirements are beyond those listed in Section 23 05 29 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Contracting Officer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

- C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

- D. Installer: Company specializing in performing the work of this Section.

1.3 REFERENCES

- A. International Building Code, 2021.
- B. ASHRAE - A Practical Guide to Seismic Restraint.
- C. ASCE 7-02, Chapter 9.
- D. ASCE 7-05, Chapter 13. ASCE 7-10, Chapter 13. SMACNA - Seismic Restraint Manual Guidelines for Mechanical Systems.
- E. NFPA 13 - Installation of Sprinkler Systems.

1.4 SUBMITTALS

- A. Submit under provisions of Section 23 05 00.

B. Shop Drawings:

1. Calculations, restraint selections, and installation details shall be designed and sealed by a Professional Structural Engineer licensed in the state where the project is located experienced in seismic restraint design and installation.
2. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of mechanical components with other systems and equipment in the vicinity, including other seismic restraints.
3. Manufacturer's Certifications: Professional Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
4. System Supports/Restraints - Submit for each condition requiring seismic bracing:
 - a. Calculations for each seismic brace and detail utilized on the project.
 - b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.
 - c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
 - d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Contracting Officer of Record.
5. Equipment - Submit for each piece of equipment supplied:
 - a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified.
 - b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
 - c. Engineering calculations and details for equipment anchorage and support structure.

- C. A seismic restraint designer shall be provided whether or not exceptions listed in the applicable building code are met. If seismic restraints are not provided for a system that requires seismic bracing, the seismic designer shall submit a signed and sealed letter to the Contracting Officer/Contracting Officer and Authorities Having Jurisdiction stating the exceptions, along with code reference, utilized for each item. Seismic designer shall review system installation for general conformance to the exception requirements stated in the code and document, in writing, the system has been installed in accordance to the exception.

1.5 TESTING AND INSPECTION

- A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the Building Code.
- B. The Contractor shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.
- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Contracting Officer of Record.

- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Contracting Officer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.7 DESIGN REQUIREMENTS

- A. This project is subject to the seismic bracing requirements of the International Building Code, 2021 edition.
- B. This project is subject to the seismic bracing requirements of California Building Code, Health Care Access and Information (HCAI).
- C. The following criteria are applicable to this project:
 - 1. Risk Category: III
 - 2. Seismic Importance Factor: $I_E = 1.25$ Seismic Design Category: B
 - 3. Component Amplification Factors (a_p) and Component Response Modification Factors (R_p) shall be taken from Table 1621.3 in IBC 200013.5-1 in ASCE 7-16 for the individual equipment or system being restrained.
 - 4. Component Importance Factors (I_p) shall be taken from Section 1621.1.6 in IBC 200013.1.3 in ASCE 7-16 for the individual equipment or system being restrained.
 - 5. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.
- D. Forces shall be calculated with the above requirements and Equation 16-67, 68, & 69 in section 1621.1.4 of IBC 2000, unless exempted by 1621.1.1 13.3-1, -2, and -3 of ASCE 7-16, unless exempted by 13.1.4. Equipment shall meet International Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

1.8 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

1.9 WARRANTY

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

PART 2 - PRODUCTS

2.1 SUPPLIERS

- A. Following is a partial list of manufacturer/supplier contact information for seismic restraints:
 - 1. B-Line Systems, Inc. (800) 851-7415, www.b-line.com.
 - 2. Or equal.

2.2 SEISMIC DESIGN CRITERIA

- A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.
- B. Definitions
 - 1. Stay in Place:
 - a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.

2.3 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
 - 1. Seismic restraint designer shall coordinate all attachments with the Structural Contracting Officer of Record; refer to submittal requirements.
 - 2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
 - 3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
 - 4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
 - 5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
 - 6. All seismic restraints and combination isolator/restraints shall have verification of their seismic capabilities witnessed by an independent testing agency.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.
- C. Housekeeping Pads:
 - 1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

2.4 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

- A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.
- B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:
 - 1. Centrifugal fans.

2.5 MATERIALS

- A. Use the following materials for restraints:
 - 1. Indoor Dry Locations: Steel, zinc plated.
 - 2. Outdoors and Damp Locations: Galvanized steel.
 - 3. Corrosive Locations: Stainless steel.

2.6 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.7 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
 - 1. Materials for Channel: ASTM A 1011, GR 33.
 - 2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.
 - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
- C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
 - 1. Arrange units for attachment to the braced component at one end and to the structure at the other end.

2. Wire Rope Cable: Comply with ASTM A 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.

D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of piping, ductwork, conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.
- D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- E. Installation of seismic restraints shall not cause any change in position of equipment, piping, or ductwork, resulting in stresses or misalignment.
- F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- G. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified.
- H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the Contracting Officer's attention prior to specific equipment selection.
- I. Prior to installation, bring to the Contracting Officer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.
- K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit.
- L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- M. Do not install cables over sharp corners.
- N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- O. Provide reinforced clevis bolts when required.

- P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
 - Q. Post-Installed anchors shall be provided to meet seismic requirements.
 - R. Vertical pipe risers flexibly supported to accommodate thermal motion and/or pipe vibration shall be guided to maintain pipe stability and provide horizontal seismic restraint.
 - S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
 - T. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent piping.
 - U. Do not brace a system to two different structures such as a wall and a ceiling.
 - V. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
 - W. Positively attach all roof mounted equipment to roof curbs. Positively attach all roof curbs to building structure.
 - X. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.
 - Y. Coordinate seismic bracing of architecturally exposed ductwork with the Contracting Officer.
- 3.2 SEISMIC RESTRAINT EXCLUSIONS
- A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

END OF SECTION 23 05 50

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SECTION 23 05 53 - HVAC IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Identification of products installed under Division 23.

1.2 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
- B. ASTM B-1, B-3, and B-8 for copper conductors.
- C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 - 2kV Cables.
- D. CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders for Medical Use.
- E. NFPA-99 - Health Care Facilities.
- F. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 23 05 00. Include list of items identified, wording, letter sizes, and color coding.
- B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Seton
- B. Or equal.

2.2 MATERIALS

- A. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- B. Ductwork Markers:
 - 1. Ductwork systems containing hazardous materials shall be provided with minimum 2" x 4" ANSI Z535.2 biohazard warning labels with custom labeling describing hazard. Refer to Part 3 for system and label description.
 - 2. Vinyl Markers: Colored vinyl with permanent pressure sensitive adhesive backing suitable for indoor and outdoor application.

- C. Maintenance Access Doors:
 - 1. Doors and roof hatches used to access equipment serving hazardous ductwork systems shall be provided with a minimum 4" x 6" ANSI Z535.2 biohazard warning label. Label shall read "WARNING - BIOHAZARD. ONLY AUTHORIZED PERSONNEL BEYOND THIS POINT".
 - 2. Coordinate location of warning label with Contracting Officer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Ductwork Markers:
 - 1. Apply ductwork markers on ductwork systems containing hazardous materials in the following locations where clearly visible:
 - a. On both sides of walls that ducts penetrate.
 - b. At least every 20 feet along all ducts.
 - c. On each riser and each leg of each branch connection.
 - d. At least once in every room and each story traversed.
 - e. At all ductwork access doors.
 - f. At all fans and equipment serving ductwork system. Markers shall be clearly visible from the normal maintenance access path to the equipment. Coordinate placement location with Contracting Officer.
- D. Equipment:
 - 1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function such as air handling units, exhaust fans, filters, reheat coils, dampers, etc.; shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
 - 2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.
 - 3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.
- E. Miscellaneous:
 - 1. Attach self-adhesive vinyl labels at all duct access doors used to reset fusible links or actuators on fire, fire/smoke, or smoke dampers. Lettering shall be a minimum of 1/2" high. Labels shall indicate damper type.
 - 2. Provide engraved plastic tags at all hydronic or steam system make-up water meters.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjusting, and balancing of air systems.
- B. Testing, adjusting, and balancing of heating systems.
- C. Testing, adjusting, and balancing of cooling systems.
- D. Testing, adjusting, and balancing of plumbing systems.
- E. Measurement of final operating condition of HVAC systems.

1.2 QUALITY ASSURANCE

- A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Contracting Officer, NEBB Certified Testing, Balancing and Adjusting Supervisor, SMARTA Certified Air and Hydronic Balancer, or TABB Certified Supervisor.
- B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

1.3 REFERENCES

- A. AABC - National Standards for Total System Balance, Seventh Edition.
- B. ADC - Test Code for Grilles, Registers, and Diffusers.
- C. AMCA - Publication 203-90; Field Performance Measurement of Fan Systems.
- D. ASHRAE - 2019 HVAC Applications Handbook; Chapter 39, Testing, Adjusting and Balancing.
- E. ASHRAE/ANSI - Standard 111-2008; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems.
- F. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, Ninth Edition, 2019.
- G. SMACNA - HVAC Systems; Testing, Adjusting and Balancing, Third Edition, 2002.
- H. TABB - International Standards for Environmental Systems Balance.

1.4 SUBMITTALS

- A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.

B. Electronic Copies:

1. Submit a certified copy of test reports to the Contracting Officer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
3. All text shall be searchable.
4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

1.5 REPORT FORMS

- A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Contracting Officer when needed to supply specified information.
- B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.
- C. Refer to PART 4 for required reports.

1.6 WARRANTY/GUARANTEE

- A. The TAB Contractor shall include an extended warranty of 90 days after Contracting Officer receipt of a completed balancing report, during which time the Contracting Officer may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.
- B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

1.7 SCHEDULING

- A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Contracting Officer prior to performing each test.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.

- B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g. submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.
- C. Recorded data shall represent actual measured or observed conditions.
- D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.
- E. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.
- G. The Balancing Contractor shall measure terminal air box air flow, and the TCC shall adjust DDC readout to match. Refer to Section 23 09 00 for additional information.
- H. Installations with systems consisting of multiple components shall be balanced with all system components operating.

3.2 EXAMINATION

- A. Before beginning work, verify that systems are complete and operable. Ensure the following:
 - 1. General Equipment Requirements:
 - a. Equipment is safe to operate and in normal condition.
 - b. Equipment with moving parts is properly lubricated.
 - c. Temperature control systems are complete and operable.
 - d. Proper thermal overload protection is in place for electrical equipment.
 - e. Direction of rotation of all fans and pumps is correct.
 - f. Access doors are closed and end caps are in place.
 - 2. Duct System Requirements:
 - a. All filters are clean and in place. If required, install temporary media.
 - b. Duct systems are clean and free of debris.
 - c. Fire/smoke and manual volume dampers are in place, functional and open.
 - d. Air outlets are installed and connected.
 - e. Duct system leakage has been minimized.
- B. Report any defects or deficiencies to Contracting Officer.
- C. Promptly report items that are abnormal or prevent proper balancing.
- D. If, for design reasons, system cannot be properly balanced, report as soon as observed.
- E. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Contracting Officer for spot checks during testing.

- B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

3.4 INSTALLATION TOLERANCES

- A. $\pm 10\%$ of scheduled values:
 - 1. Adjust air inlets and outlets to $\pm 10\%$ of scheduled values.
- B. $+ 5\%$ of scheduled values
 - 1. Adjust outdoor air intakes to within $+ 5\%$ of scheduled values.
- C. Adjust supply, return, and exhaust air-handling systems to $+10\% / -5\%$ of scheduled values.

3.5 ADJUSTING

- A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.
- B. Once balancing of systems is complete, at least one damper or valve must be 100% open.
- C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.
- D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.
- E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

3.6 SUBMISSION OF REPORTS

- A. Fill in test results on appropriate forms.

PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

4.1 GENERAL REQUIREMENTS

- A. Title Page:
 - 1. Project name.
 - 2. Project location.
 - 3. Project Architect.
 - 4. Project Engineer (IMEG Corp.)
 - 5. Project General Contractor.
 - 6. TAB Company name, address, phone number.
 - 7. TAB Supervisor's name and certification number.
 - 8. TAB Supervisor's signature and date.
 - 9. Report date.
- B. Report Index
- C. General Information:
 - 1. Test conditions.
 - 2. Nomenclature used throughout report.

3. Notable system characteristics/discrepancies from design.
4. Test standards followed.
5. Any deficiencies noted.
6. Quality assurance statement.

D. Instrument List:

1. Instrument.
2. Manufacturer, model, and serial number.
3. Range.
4. Calibration date.

4.2 AIR SYSTEMS

A. Duct Leakage Test:

1. Air system and fan.
2. Leakage class.
3. Test pressure.
4. Construction pressure.
5. Flow rate (cfm): specified and actual.
6. Leakage (refer to Section 23 31 00 in the specifications): specified and actual.
7. Statement that fire dampers, reheat coils and other accessories were included in the test.
8. Pass or Fail.
9. Test performed by.
10. Test witnessed by.

B. Air Moving Equipment:

1. General Requirements:
 - a. Drawing symbol.
 - b. Location.
 - c. Manufacturer, model, arrangement, class, discharge.
 - d. Fan RPM.
 - e. Multiple RPM fan curve with operating point marked. (Obtain from equipment supplier).
 - f. Final frequency of motor at maximum flow rate (on fans driven by VFD).
2. Flow Rate:
 - a. Supply flow rate (cfm): specified and actual.
 - b. Return flow rate (cfm): specified and actual.
 - c. Outside flow rate (cfm): specified and actual.
 - d. Exhaust flow rate (cfm): specified and actual.
3. Pressure Drop and Pressure:
 - a. Filter pressure drop: specified and actual.
 - b. Total static pressure: specified and actual. (Indicate if across fan or external to unit).
 - c. Inlet pressure.
 - d. Discharge pressure.

C. Fan Data:

1. Drawing symbol.
2. Location.
3. Manufacturer and model.
4. Flow rate (cfm): specified and actual.

5. Total static pressure: specified and actual. (Indicate measurement locations).
6. Inlet pressure.
7. Discharge pressure.
8. Fan RPM.

D. Electric Motors:

1. Drawing symbol of equipment served.
2. Manufacturer, Model, Frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps in each phase.

E. Duct Traverse:

1. System zone/branch/location.
2. Duct size.
3. Free area.
4. Velocity: specified and actual.
5. Flow rate (cfm): specified and actual.
6. Duct static pressure.
7. Air temperature.
8. Air correction factor.

END OF SECTION 23 05 93

SECTION 23 31 00 - DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Galvanized Ductwork
- B. Ductwork Reinforcement
- C. Ductwork Sealants
- D. Rectangular Ductwork
- E. Round and Flat Oval Ductwork
- F. Exposed Ductwork (Rectangular, Round, or Oval)
- G. Flexible Duct
- H. Leakage Testing
- I. Ductwork Penetrations
- J. Painting

1.2 REFERENCES: Conform to all applicable requirements of the following publications:

- A. ADC Flexible Duct Performance and Installation Standards, 3rd Edition 1996.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/AWS A5.11M (1997) - Specification for Nickel and Nickel Alloy Welding Electrodes for Shielded Metal Arc Welding.
- D. ASHRAE - Handbook 2012 Systems and Equipment; Chapter 19 - Duct Construction.
- E. ASHRAE - Handbook 2013 Fundamentals; Chapter 21 - Duct Design.
- F. ASHRAE 170 (latest published edition) - Ventilation of Health Care Facilities.
- G. ASTM A90 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- H. ASTM A167- Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet, & Strip.
- I. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- J. ASTM A924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- K. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

- L. ASTM E90-02 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
 - M. ASTM E413-87 - Classification for Rating Sound Insulation.
 - N. AWS A5.14M (1997) - Specification for Nickel and Nickel Alloy Bare Welding Electrodes and Rods.
 - O. AWS D9.1M/D9.1 - Sheet Metal Welding Code.
 - P. IECC - International Energy Conservation Code (latest published edition)
 - Q. NADCA ACR 2002 - Assessment, Cleaning, and Restoration of HVAC Systems.
 - R. NADCA Standard 05 1997 - Requirements for the Installation of Service Openings in HVAC Systems.
 - S. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
 - T. NFPA 90B - Installation of Warm Air Heating and Air- Conditioning Systems.
 - U. NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Equipment.
 - V. SMACNA - Air Duct Leakage Test Manual.
 - W. SMACNA - HVAC Duct Construction Standards.
 - X. SMACNA - Phenolic Duct Construction Standard 022.
 - Y. SMACNA - Round Industrial Duct Construction Standards - 1999 Edition.
 - Z. UL 181 - Factory-Made Air Ducts and Air Connectors.
 - AA. UL 181A - Closure Systems for Use with Rigid Air Ducts and Air Connectors
 - BB. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors.
 - CC. UL 1978 - Standard for Grease Ducts.
 - DD. UL 2221 - Standard for Tests of Fire Resistive Grease Duct Enclosure Assemblies.
- 1.3 SUBMITTALS
- A. Submit shop drawings per Section 23 05 00.
 - B. Submit duct fabrication standards in compliance with SMACNA and these specifications. Clearly indicate metal gauges, reinforcement, and joining methods intended for use for each pressure classification. Furnish details of all common duct fittings and joint connections to be used on this project.
 - C. The Contracting Officer may require field verification of sheet metal gauges and reinforcing to verify compliance with these specifications. At the request of the Contracting Officer, the contractor shall remove a sample of the duct for verification. The contractor shall repair as needed.

- D. Duct Leakage Test Summary Report: Upon completion of the pressure test described in Part 3, the Contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.

1.4 DEFINITIONS

- A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.
- B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.
- C. Exterior Duct: Ductwork located outside the conditioned envelope including exposed ductwork above the roof, outside exterior walls, in attics above insulated ceilings, inside parking garages, and crawl spaces.
- D. Interior Duct: Ductwork located within the conditioned envelope including return air plenums and indirectly conditioned spaces.

PART 2 - PRODUCTS

2.1 SHAPE

- A. Rectangular Duct - Single Wall:
 - 1. General Requirements:
 - a. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.
 - b. Transitions shall not exceed the angles in Figure 4-7.
 - 2. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:
 - a. All ducts shall be cross-broken or beaded.
 - b. Snap lock seams are not permitted.
 - c. Turning vanes shall be used in all 90° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:
 - 1) Type 1:
 - a) Description: Single wall type with 22-gauge (0.029") or heavier vanes, 3-1/4" blade spacing, and 4" to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.
 - b) Usage: Limited to 3,000 fpm and vane lengths 36" and under.
 - 2) Type 2:
 - a) Description: Double wall type with 3-1/4" blade spacing, 4-1/2" radius, 24-gauge minimum, and SMACNA Type 1 runners. C-value below 0.27.
 - b) Usage: No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.

- 3) Type 3 (acoustical - where acoustical lagging is located or as noted on drawings):
 - a) Description: Same as Type 2, except filled with fiberglass and with slotted or perforated inner curve. Minimum insertion loss of 9 dB at 250 Hz and 6 dB at 1 KHz.
 - b) Usage: No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.
 - 4) Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.
 - 5) Runners must be installed at a 45° angle. Elbows with different size inlet and outlet must be radius type.
 - 6) Omitting every other vane is prohibited.
- d. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA r/W=0.1). RE1 or RE3 elbows may be used where mitered elbows are shown if space permits. Mitered elbows (with or without turning vanes) may not be substituted for radius elbows. Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.
 - e. Rectangular branch and tee connections in ducts over 1" pressure class shall be 45° entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1" pressure class.
 - f. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.
 - g. Round taps off rectangular unlined ducts shall be 45° rectangular with transition to round (equal to Sheet Metal Connectors Inc. High Efficiency Takeoff, or equal). Straight taps are acceptable if pressure class is 1" or less, round duct is 12" diameter or less, and the tap is not located between fans and TAB devices.
 - h. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30° maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30° angle shall be formed of radius elbows with centerline radius R/W=1.0 or greater. SMACNA Type 1 offsets are not permitted.
 - i. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.
 - j. Cushion heads are acceptable only downstream of TAB devices in ducts up to ± 2" pressure class, and must be less than 6" in length.
 - k. Slide-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class. Roll formed flanges, corner pieces, adhesive butyl gasket and cleats
 - 1) Apply sealant to all inside corners. Holes at corners are not acceptable.
 - 2) Manufacturers:
 - a) Ductmate Industries - 25/35/45
 - b) Or equal.
 - c) Other manufacturers must submit test data and fabrication standards and receive Contracting Officer's approval before any fabrication begins.

- I. Formed-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
 - 1) Apply sealant to all inside corners. Holes at corners are not acceptable.
 - 2) Flanges shall be 24-gauge minimum (not 26 gauge).
 - 3) Manufacturers:
 - a) Lockformer TDC
 - b) Or equal.
 - c) Other manufacturers must submit test data and fabrication standards and receive Contracting Officer's approval before any fabrication begins.

B. Round and Flat Oval Spiral Seam Ductwork - Single Wall:

1. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Contracting Officer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.
2. Flat oval duct in negative pressure applications shall have flat sides reinforced as required for rectangular ducts of the same gauge with dimensions equal to the flat span of the oval duct.
3. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
4. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.
5. Ductwork shall be suitable for velocities up to 5,000 fpm.
6. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
7. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
8. Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
9. Reinforce flat oval ducts with external angles. Internal tie rods are permitted only as indicated for rectangular ductwork.
10. Transverse Joint Connections:
 - a. Crimped joints are not permitted.
 - b. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.
 - c. Ducts and fittings larger than 36" shall have flanged connections.
 - d. Secure all joints with at least 3 sheet metal screws before sealing.
 - e. Manufacturers, Slide-on Flanges:
 - 1) Ductmate Industries - SpiralMate
 - 2) Or equal.

2.2 MATERIAL AND APPLICATION SPECIFIC

A. Galvanized Steel:

1. General Requirements:

- a. Duct and reinforcement materials shall conform to ASTM A653 and A924.
- b. Interior Ductwork and reinforcements: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.
- c. Exterior Ductwork: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise. G60 is not acceptable for exterior use.
- d. Ductwork reinforcement shall be of galvanized steel.

2. Duct Hangers and Support:

- a. Ductwork supports shall be of galvanized or painted steel.
- b. All fasteners shall be galvanized or cadmium plated.
- c. Strap Hangers: Strap hanger shall be a minimum of 1 inch, 18 gauge galvanized steel attached to the bottom of ducts with spacing as required by SMACNA.
- d. Cable Hangers:
 - 1) Aircraft cable and slip cable hangers are acceptable for ducts up to 18" diameter. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork.
 - 2) Manufacturers; Supports:
 - a) Gripple
 - b) Or equal
 - 3) Aircraft cable with 2-point support in standard horseshoe arrangement. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. 8'-0" OC and as required by CMC/UMC and SMACNA guidelines.
- e. Integral Corner Connector Hanger: Integral hanger and corner assembly for use with TDC/TDF style duct flanges. Die stamped offset hanger connects to the flanged corner assembly. For use with aircraft cable or 1/4" or 3/8" diameter threaded rods. Tested to hold up to 1,400 lbs. Install per manufacturer's ratings and instructions.

B. Exposed Ductwork (Rectangular, Round, and Flat Oval):

1. The following applies to all ductwork exposed in finished areas in addition to requirements noted above:
 - a. Provide extra shipping protection. Use Cardboard or other protective means to prevent dents and deformed ends.
 - b. Provide cardboard or other means of protection during field fabrication. Protect from scratches. Provide stiffeners to retain shape during fabrication.
 - c. Remove all identification stickers and thoroughly clean exterior of all ducts.
 - d. Locate fitting seams on least visible side of duct.
 - e. Provide exterior finish suitable for field painting without further oil removal.
 - f. Provide ramp-type internal joint couplings. Provide bead of sealant around the inside of the duct about 1/2" from the end of the duct.
 - g. Manufacturers, Slide-on Flanges:
 - 1) Ductmate Industries
 - 2) Or equal.

- h. The system shall be free of visible dents and scratches when viewed from normal occupancy.
- 2. In addition to the paragraphs above, this section applies to all ductwork specified or shown as "Architecturally Exposed":
 - a. All spiral ductwork fittings shall be carbon arc welded.
 - b. Grind all welds to remove irregularities.
 - c. Conical taps shall be one piece. Taps for grilles and takeoffs shall be factory installed with a continuous weld and ground smooth.
 - d. Welds shall be ground smooth and painted.
 - e. All architecturally exposed ducts shall be round or flat oval except where not possible (grilles, reheat coils, etc.).
- 3. Alternate manufacturers, including shop fabricated duct, must be reviewed before installation. The following information is required:
 - a. Metal gauge of duct and fittings.
 - b. Fitting type and construction.
 - c. Type and size of reinforcement.
- 4. Hangers for Exposed Ductwork:
 - a. Round Ducts:
 - 1) Threaded rod with duct fixing bracket and metal strap. Provide single threaded rod centered on the duct. Strap hanger shall be a minimum of 1 inch, 18 gauge galvanized steel wrapping the circumference of the duct. Spacing as required by SMACNA guidelines.
 - 2) Aircraft cable and slip cable hangers are acceptable for ducts up to 18" diameter. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Spacing and cable size as required by SMACNA guidelines.
 - a) Manufacturers, Supports: Grippler, Ductmate, Duro Dyne, Contracting Officer approved.
 - 3) Aircraft cable with 2-point support in standard horseshoe arrangement. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation.
 - b. Rectangular Ducts:
 - 1) Aircraft cable and slip cable hangers are acceptable for ducts up to 18" in maximum dimension. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork. Spacing and cable size as required by SMACNA guidelines.
 - a) Manufacturers, Supports: Grippler, Ductmate, Duro Dyne, Contracting Officer approved.
 - 2) Aircraft cable with 2-point support in standard horseshoe arrangement. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork.
 - c. Strut-channel and all-thread rod is not acceptable for exposed ductwork.
 - d. All fasteners shall be galvanized or cadmium plated.

2.3 DUCTWORK REINFORCEMENT

- A. All reinforcement shall be external to the duct except that tie rods may be used with the following limitations.
 1. Ducts must be over 18" wide.
 2. Duct dimensions must be increased 2" in one dimension (h or w) for each row of tie rods installed.
 3. Tie rods must not exceed 1/2" diameter.
 4. Manufacturer of tie rod system must certify pressure classifications of various arrangements, and this must be in the shop drawings.

2.4 DUCTWORK SEALANTS

- A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F to +175°F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide openings in ducts for thermometers and controllers.
- B. Locate ducts with space around equipment for normal operation and maintenance.
- C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.
- D. Provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork.
- E. Supply ductwork shall be free of construction debris, and shall comply with Level "B" of the SMACNA Duct Cleanliness for New Construction Guidelines.
- F. Repair all duct insulation and liner tears.
- G. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.
- H. Insulate terminal air box reheat coils. Seal insulation tight to form a tight vapor barrier.
- I. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.
- J. Flexible duct shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required, to include, but not limited to, all connections to air inlets, air outlets, and terminal air boxes.
- K. Install all exterior ductwork per SMACNA Fig. 6-3. Where drawings do not indicate otherwise, ductwork seams and joints shall be sealed watertight and pitched to shed water.

- L. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible and the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, where applicable. Refer to Section 23 05 50 for seismic requirements.
- M. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.
- N. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers unless coordinated with piping contractor prior to installation. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.

3.2 DUCTWORK APPLICATION SCHEDULE

A. General:

- 1. Seal Class is per SMACNA HVAC Air Duct Leakage Test Manual
- 2. Insulation:
 - a. Refer to Section 23 07 13 for insulation types.
 - b. Type A insulation (Flexible Fiberglass Wrap) R-values noted are based on installed values (25% compression).

B. General Exhaust Duct:

- 1. Shape:
 - a. Rectangular Duct - Single Wall
 - b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
- 2. Material: Galvanized Steel
- 3. Pressure Class: -1"
- 4. Seal Class: A
- 5. Insulation: None
- 6. Additional Requirements: None

C. Ductwork Accessories (Fabric Flex Connectors, Equipment Flanges, etc.):

- 1. Insulation:
 - a. ASHRAE 90.1-2019: 1-1/2" thick Type A (R=4.5)
 - b. IECC-2021: 1-1/2" thick Type A (R=4.5)

3.3 DUCTWORK SEALING

A. General Requirements:

- 1. Openings, such as rotating shafts, shall be sealed with bushings or similar.
- 2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
- 3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.
- 4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.

- B. All ducts systems, regardless of pressure class, shall be Seal Class A as defined by Section 5-1 of SMACNA HVAC Air Duct Leakage Test Manual per the Energy Code, unless specifically noted otherwise. Seal Class A shall include sealing of all transverse joints, longitudinal seams, and duct wall penetrations with welds, gaskets, mastics, or fabric-embedded mastic system. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.
- C. Double-wall ductwork: Install insulation end fittings at all transitions from double to single-wall construction.

3.4 TESTING

- A. Interior Duct - Less than 3" WG (positive or negative):
 - 1. Leak testing of these pressure classes is not normally required for interior ductwork (inside the building envelope). However, leak tests will be required if, in the opinion of the Contracting Officer, the leakage appears excessive. All exterior ductwork shall be tested. If duct has outside wrap, testing shall be done before it is applied.
 - 2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
 - 3. Seal ducts to bring the air leakage into compliance.
 - 4. Contractor shall notify the Contracting Officer five business days prior to pressurizing ductwork for testing.
- B. Test Procedure:
 - 1. Testing shall be as listed in the latest edition of the SMACNA HVAC Duct Leakage Manual, with the following additional requirements:
 - a. The required leakage class for Seal Class A, rectangular ducts, shall be 4; round shall be 2.
 - b. Test pressure shall be the specified duct pressure class. Testing at reduced pressures and converting the results mathematically is not acceptable. This is required to test the structural integrity of the duct system.
 - c. If any leak causes discernible noise at a distance of 3 feet, that leak shall be eliminated, regardless of whether that section of duct passed the leakage test.
 - d. All joints shall be felt by hand, and all discernible leaks shall be sealed.
 - e. Totaling leakage from several tested sections and comparing them to the allowable leakage for the entire system is not acceptable. Each section must pass the test individually.
 - f. Contractor shall notify the Contracting Officer five business days prior to pressurizing ductwork for testing. Failure to notify the Contracting Officer of pressure testing may require the contractor to repeat the duct pressure test after proper notification.
 - g. Upon completion of the pressure test, the contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.
 - h. All access doors, taps to terminal air boxes, and other accessories and penetrations must be installed prior to testing. Including terminal air boxes in the test is not required.
 - i. Positive pressure leakage testing is acceptable for negative pressure ductwork.

3.5 DUCTWORK PENETRATIONS

- A. All duct penetrations of firewalls shall have fire or fire/smoke dampers where required by code.

- B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Contracting Officer.
- C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install trim strip to cover vacant space and raw construction edges of all openings in finished rooms. Install escutcheon ring at all round duct openings in finished rooms. Trim strips and rings shall be same material and finish as exposed duct.

3.6 PAINTING

- A. Paint interior of ducts black within twice the largest duct dimension of inlets and outlets where interior of duct is visible.
- B. Paint bottom of ducts black within twice the largest duct dimension where a duct is routed above an unducted perforated grille and the duct is visible.

END OF SECTION 23 31 00

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SECTION 23 33 00 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fabric Connectors.
- B. Drip Pans.
- C. Duct Access Doors.
- D. Duct Test Holes.

1.2 REFERENCES

- A. ASTM E477-06a - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
- B. ASTM E2336-04 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
- C. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
- D. SMACNA - HVAC Duct Construction Standards - Third Edition - 2005.
- E. UL 33 - Heat Responsive Links for Fire-Protection Service.
- F. UL 555 - Fire Dampers and Ceiling Dampers.
- G. UL 555C - Ceiling Dampers.
- H. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Section 23 05 00.
- B. Submit manufacturer's installation instructions.
- C. Submit certification that ductwork accessories will withstand seismic forces defined in Section 23 05 50. Include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - a. 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."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 FABRIC CONNECTORS

- A. Fabric connectors shall be installed between all fans or fan units and metal ducts or casings to prevent transfer of fan or motor vibration.
- B. The fabric connectors shall be completely flexible material which shall be in folds and not drawn tight.
- C. Fabric connectors shall be of glass fabric double coated with neoprene, with UL approval. Weight = 30 oz. per square yard minimum. Fabric shall not be affected by mildew and shall be absolutely waterproof, airtight and resistant to acids, alkalis, grease and gasoline, and shall be noncombustible.
- D. Fabric connections shall not exceed 6" in length on ductwork that has a positive pressure. On ductwork that has a negative pressure, the length shall not exceed 2" in length.
- E. All corners shall be folded, sealed with mastic and stapled on 1" centers.
- F. Fabric connectors shall not be painted.
- G. Unless otherwise shown on the drawings, the fabric connection at the inlet to centrifugal fans shall be at least one duct diameter from the fan to prevent inlet turbulence.
- H. Materials:
 - 1. Durodyne MFN-4-100
 - 2. Or equal.
- I. Fabric connectors exposed to sunlight and weather shall be as described above, except the coating shall be hypalon in lieu of neoprene.
- J. Materials:
 - 1. Durodyne "Duralon MFD-4-100"
 - 2. Or equal.

2.2 DUCT ACCESS DOORS

- A. Fabricate per Fig. 7-2 and 7-3 of the SMACNA HVAC Duct Construction Standards and as indicated.
- B. Review locations prior to fabrication. Install access doors at fire dampers, smoke dampers, motorized dampers, fan bearings, filters, automatic controls, humidifiers, louvers, duct coils and other equipment requiring service inside the duct.
- C. Construction shall be suitable for the pressure class of the duct. Fabricate rigid, airtight, and close-fitting doors of materials identical to adjacent ductwork with sealing gaskets butt or piano hinges, and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.
- D. Access doors with sheet metal screw fasteners are not acceptable.
- E. Minimum size for access doors shall be 24" x 16" or full duct size, whichever is less.

- F. Provide duct access door in all horizontal return ductwork at 20 foot intervals per NFPA 90A.
- G. Fire Damper, Fire/Smoke Damper Access Provide quantity of access doors such that two hands can fit inside ductwork to manually reset fire dampers. For ducts larger than 12x12 , provide one access door. For ducts 12" x 12" and smaller, provide one access door on bottom and one on side.

2.3 DUCT TEST HOLES

- A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.4 DUCTWORK ACCESSORY SEALANTS

- A. Ductwork accessory sealants and adhesives shall conform to Section 23 31 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation Requirements:
 1. Install accessories in accordance with manufacturer's instructions.
 2. Provide access doors for all equipment requiring maintenance or adjustment above an inaccessible ceiling. Minimum size shall be 24" x 24".
 3. Provide duct test holes where indicated and as required for testing and balancing purposes.

END OF SECTION 23 33 00

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SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Interior Communications Pathways Section 27 05 28. This section is also applicable to Fire Alarm and Detection Systems Section 28 31 00.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)

1.3 SCOPE OF WORK

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.
- C. Separate contracts will be awarded for the following work.
- D. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- E. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.
- F. Description of Systems shall be as follows:
 - 1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
 - 2. Electrical power service system from the Utility Company to and including service entrance equipment, distribution and metering.
 - 3. Grounding system.
 - 4. Fire alarm system.
 - 5. Security system.
 - 6. Wiring system for temperature control system as shown on the drawings.
 - 7. Lightning protection system.
 - 8. Wiring of equipment furnished by others.
 - 9. Removal work and/or relocation and reuse of existing systems and equipment.
 - 10. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
- G. Work Not Included:
 - 1. Telecommunications cabling will be by Division 27, in raceways and conduits furnished and installed as part of the Electrical work.
 - 2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

1.4 WORK SEQUENCE

- A. All work that will produce excessive noise or interference with normal building operations, as determined by the Contracting Officer, shall be scheduled with the Contracting Officer. It may be necessary to schedule such work during unoccupied hours. The Contracting Officer reserves the right to determine when restricted construction hours are required.
- B. Itemize all work and list associated hours and pay scale for each item.

1.5 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, and CONTROL CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate Contractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
 - 1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
 - 2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
 - 3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
 - 4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
 - 5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
 - 6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
 - 7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
 - 8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
 - 9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
 - 10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
4. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
 - a. Luminaires.
 - b. Gravity flow piping, including steam and condensate.
 - c. Electrical bus duct.
 - d. Sheet metal.
 - e. Cable trays, including access space.
 - f. Other piping.
 - g. Conduits and wireway.

D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Contractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor's or Contractor's Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Contractor.
3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

G. General (Electrical/Technology):

1. "Electrical Contractor" as referred to herein shall be responsible for scope listed in Division 27/28 of this specification when the "Suggested Matrix of Scope Responsibility" indicated work shall be furnished and installed by the EC. Refer to the Contract Documents for this "Suggested Matrix of Scope Responsibility".
2. The purpose of these Specifications is to outline the Electrical and Technology Contractor's work responsibilities as related to Telecommunications Rough-in, conduit, cable tray, power wiring and Low Voltage Technology Wiring.
3. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals approved. Therefore, only known wiring, conduits, raceways and electrical power related to such items is shown on the Technology drawings. Other wiring, conduits, raceways, junction boxes and electrical power not shown on the Technology Drawings but required for operation of the systems is the responsibility of the Technology Contractor and included in said Contractor's bid.
4. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Technology systems, the final installation shall not be until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
5. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Technology Wiring, installation shall not begin prior to a coordination review of the cable tray shop drawings by the Technology Contractor.

H. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being furnished and installed by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility".
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the telecommunications ground bar.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.6 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
 - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
 - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
 - d. Maintenance clearances and code-required dedicated space shall be included.
 - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Contracting Officer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Contracting Officer.
 - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
 - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Contracting Officer.
 - a. Scale of drawings:
 - 1) General plans: 1/4 Inch = 1'-0" (minimum).
 - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
 - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
 - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
 - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Contracting Officer's. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
 - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
 - b. Potential layout changes shall be made to avoid additional access panels.
 - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
 - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Contracting Officer.
 - e. When additional access panels are required, they shall be provided without additional cost to the Contracting Officer.

10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or Contractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.7 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Contracting Officer any deficiencies the Contractor may discover. The Contractor further agrees to require each Contractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Contracting Officer/ prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Contracting Officer will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers as determined by the Contracting Officer are acceptable.
2. All Contractors and Contractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the State of Indiana Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards of National Parks.
3. If there is a discrepancy between the codes and regulations and these specifications, the Contracting Officer shall determine the method or equipment used.
4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Contracting Officer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
5. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Contracting Officer.
6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
7. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.

2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Contracting Officer or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
8. Pay all telephone company charges related to the service or change in service.

E. Utility Company Requirements:

1. Secure from the private or public utility company all applicable requirements.
2. Comply with all utility company requirements.
3. The Contracting Officer shall make application for and pay for new electrical service equipment and installation. The Contractor shall coordinate schedule and requirements with the Contracting Officer and Utility Company.
4. The contractor is responsible for completing utility requested forms and sharing utility requested load data from the construction documents.
5. Furnish the meter socket metering. Verify approved manufacturers and equipment with the Utility Company.
6. The Contracting Officer shall apply and pay for any changes for removal of existing electrical service by the utility company. The Contractor shall verify approved manufacturers and equipment with the Utility Company.

F. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Contracting Officer.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Contractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

H. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.8 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
26 05 03	Through Penetration Firestopping
26 05 13	Wire and Cable
26 05 26	Grounding and Bonding
26 05 33	Conduit and Boxes
26 05 48	Seismic Requirements for Equipment and Supports
26 05 53	Electrical Identification
26 27 26	Wiring Devices

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
 - a. Date
 - b. Project title and number
 - c. Contractor's name and address
 - d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
 - e. Description of items submitted and relevant specification number
 - f. Notations of deviations from the contract documents
 - g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
 - a. Date
 - b. Project title and number
 - c. Contracting Officer
 - d. Contractor and Contractors' names and addresses
 - e. Supplier and manufacturer's names and addresses
 - f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
 - g. Description of item submitted (using project nomenclature) and relevant specification number
 - h. Notations of deviations from the contract documents
 - i. Other pertinent data
 - j. Provide space for Contractor's review stamps
3. Composition:
 - a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
 - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
 - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
 - a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Contracting Officer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
 - b. Unstamped submittals will be rejected.
 - c. The Contractor's review shall include, but not be limited to, verification of the following:
 - 1) Only approved manufacturers are used.
 - 2) Addenda items have been incorporated.
 - 3) Catalog numbers and options match those specified.
 - 4) Performance data matches that specified.
 - 5) Electrical characteristics and loads match those specified.
 - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
 - 7) Dimensions and service clearances are suitable for the intended location.
 - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
 - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
 - d. The Contractor shall review, stamp and approve all Contractors' submittals as described above.

- e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
 - a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
 - b. The Contractor shall clearly indicate the size, finish, material, etc.
 - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
 - d. All marks and identifications on the submittals shall be unambiguous.
 7. Schedule submittals to expedite the project. Coordinate submission of related items.
 8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 9. Reproduction of contract documents alone is not acceptable for submittals.
 10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Contracting Officer.
 11. Submittals not required by the contract documents may be returned without review.
 12. The Contracting Officer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Contracting Officer to recheck and handle the additional shop drawing submittals.
 13. Submittals shall be reviewed and approved by the Contracting Officer before releasing any equipment for manufacture or shipment.
 14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Contracting Officer's approval.
 15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Contracting Officer if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Contracting Officer or other contractors.
 - a. Allow at least two weeks for Contracting Officer's review and processing of each submittal.
 16. Contracting Officer reserves the right to withhold action on a submittal which, in the Contracting Officer's opinion, requires coordination with other submittals until related submittals are received. The Contracting Officer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Contracting Officer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. Submittal file name: 26 XX XX.description.YYYYMMDD

- b. Transmittal file name: 26 XX XX.description.YYYYMMDD
- 5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.9 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
 - 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Contracting Officer/.
 - 2. Submit in Excel format.
 - 3. Support values given with substantiating data.
- C. Preparation:
 - 1. Itemize work required by each specification section and list all providers. All work provided by Contractors and major suppliers shall be listed on the Schedule of Values. List each Contractor and supplier by company name.
 - 2. Break down all costs into:
 - a. Material: Delivered cost of product with taxes paid.
 - b. Labor: Labor cost, excluding overhead and profit.
 - 3. Itemize the cost for each of the following:
 - a. Overhead and profit.
 - b. Bonds.
 - c. Insurance.
 - d. General Requirements: Itemize all requirements.
 - 4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
 - a. Each piece of equipment requiring shop drawings. Use the equipment nomenclature (SB-1, PANEL P-1, etc.) on the Schedule of Values.
 - b. Each type of small unitary equipment (e.g., FDS, FCS, CS, etc.). Multiple units of the same type can be listed together provided quantities are also listed so unit costs can be determined.
 - c. Each conduit system (medium voltage, normal, emergency, low voltage systems, etc.). In addition, for larger projects breakdown the material and labor for each conduit system based on geography (building, floor, and/or wing).
 - d. Fire alarm broken down into material and labor for the following:
 - 1) Engineering
 - 2) Controllers, devices, sensors, etc.
 - 3) Conduit
 - 4) Wiring
 - 5) Programming
 - 6) Commissioning
 - e. Site utilities (5' beyond building)
 - f. Seismic design
 - g. Testing
 - h. Commissioning
 - i. Record drawings
 - j. Punchlist and closeout

- D. Update Schedule of Values when:
 - 1. Indicated by Contracting Officer.
 - 2. Change of Contractor or supplier occurs.
 - 3. Change of product or equipment occurs.

1.10 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated Contractors.
- C. Change order work shall not proceed until authorized.

1.11 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.
- B. Keep all materials clean, dry and free from damaging environments.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Contracting Officer. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.12 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Contracting Officer.

1.13 WARRANTY

- A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Contracting Officer. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Contracting Officer.

- C. Warranty requirements extend to correction, without cost to the Contracting Officer, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Contracting Officer.

1.14 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.15 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Contracting Officer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Contracting Officer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.
- D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.
- E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

1.16 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 26 08 00 and provide all services as described in the Commissioning Plan.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Contracting Officer, nor the presence of the Contracting Officer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Contracting Officer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Contracting Officer and the Contracting Officer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Contracting Officer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Contracting Officer, and do no further work until the Contracting Officer gives further instructions.
9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.

12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.

C. Dewatering:

1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Contracting Officer.

E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding or CA6 crushed stone. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope around utilities to 6" above utilities: Place and compact sand or CA6 to a height of 6" over utilities in 6" layers. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill from 6" above utilities to earthen grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
4. Backfill from 6" above utilities to below slabs or paved area: Where the fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials: Native soil materials may be used as backfill if approved by the Geotechnical Contracting Officer. Backfill material shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Water shall not be permitted to rise in unbackfilled trenches.
6. Dispose of excess excavated earth as directed.
7. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
8. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.3 CONTRACTING OFFICER OBSERVATION OF WORK

- A. The contractor shall provide seven (7) calendar days' notice to the Contracting Officer prior to:
 - 1. Placing fill over underground and underslab utilities.
 - 2. Covering exterior walls, interior partitions and chases.
 - 3. Installing hard or suspended ceilings and soffits.
- B. The Contracting Officer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation:
 - 1. All work above the ceilings must be complete prior to the Contracting Officer's review. This includes, but is not limited to:
 - a. All junction boxes are closed and identified in accordance with Section 26 05 53 Electrical Identification.
 - b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
 - c. Luminaire whips are supported above the ceiling.
 - d. Conduit identification is installed in accordance with Section 26 05 53 Electrical Identification.
 - e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
 - f. All wall penetrations have been sealed.
 - 2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
 - 3. It is understood that if the Contracting Officer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Contracting Officer may not recommend further payments to the contractor until full access has been provided.

3.4 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. IDPH Pre-Occupancy Requirements:
 - 1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Contracting Officer.
- C. Final Jobsite Observation:
 - 1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
 - 2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Contracting Officer so that the final observation can be scheduled.
 - 3. It is understood that if the Contracting Officer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Contracting Officer will be deducted from the Contractor's final payment.
 - 4. Contractor shall notify Contracting Officer 96hours prior to installation of ceilings or lay-in ceiling tiles.

- D. The following must be submitted before Contracting Officer recommends final payment:
1. Operation and maintenance manuals with copies of approved shop drawings.
 2. Record documents including marked-up drawings and specifications.
 3. A report documenting the instructions given to the Contracting Officer's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Contracting Officer's representatives.
 4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to and place in location as directed and submit receipt to Contracting Officer/Contracting Officer.
 5. Inspection and testing report by the fire alarm system manufacturer.
 6. Start-up reports on all equipment requiring a factory installation or start-up.
- E. Circuit Directories:
1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEIPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. General:
1. Provide an electronic copy of the O&M manuals as described below for Contracting Officer's review and approval. The electronic copy shall be corrected as required to address the Contracting Officer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Contracting Officer.
 2. Approved O&M manuals shall be completed and in the Contracting Officer's possession prior to Contracting Officer's acceptance and at least 10 days prior to instruction of operating personnel.
- B. Electronic Submittal Procedures:
1. Distribution: Email the O&M manual as attachments to all parties designated by the Contracting Officer/Contracting Officer.
 2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
 3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
 4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
 - a. O&M file name: O&M.div26.contractor.YYYYMMDD
 - b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD
 5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
 6. Provide the Contracting Officer with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.

7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Contracting Officer, , all Contractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Contracting Officer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.6 INSTRUCTING THE CONTRACTING OFFICER

- A. Adequately instruct the Contracting Officer in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Contracting Officer by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Contractor shall make a DVD video recording of instructions to the Contracting Officer while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Contracting Officer.
- D. The Contracting Officer has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- E. The instructions shall include:
 1. Maintenance of equipment.
 2. Start-up procedures for all major equipment.
 3. Description of emergency system operation.
 4. Insert.

- F. Notify the Contracting Officer of the time and place for the verbal instructions to be given to the Contracting Officer's representative so a representative can be present if desired.
- G. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.
- H. Operating Instructions:
 - 1. Contractor is responsible for all instructions to the Contracting Officer for the electrical and specialized systems.
 - 2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Contracting Officer for the to perform these services.

3.7 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Contracting Officer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Contracting Officer's hourly rates in effect at the time of work.
- D. Record changes daily and keep the marked drawings available for the Contracting Officers examination at any normal work time.
- E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Contracting Officer.
- F. Record actual routing of conduits exceeding 1 inches.

3.8 PAINTING

- A. Paint all equipment that is marred or damaged prior to the Contracting Officer's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.
- B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.
- C. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.

- D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Contracting Officer the color preference before ordering.
- E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, and storage rooms. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- F. All electrical conduit and equipment, fittings, hangers, structural supports, etc., in unfinished areas, such as equipment and storage room area, shall be painted two (2) coats of oil paint of colors selected by the Contracting Officer.
- G. Do NOT paint electric conduits in crawl spaces, tunnels, or spaces above suspended ceilings except that where conduit is in a damp location give exposed threads at joints two coats of sealer after joint is made up.
- H. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:
 - 1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
 - 2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.
 - 3. Color of paint shall be as follows:
 - a. To match adjacent surfaces.

3.9 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Contracting Officer's final acceptance of the project.
- B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

- A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.
- B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Contracting Officer's representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Contracting Officer's representative will result in removal and reinstallation of the equipment at the Contractor's expense.
- D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.
 - 1. Elevator machine rooms and hoistways.
 - 2. Exit enclosures.
 - 3. Other areas restricted by code.
 - 4. Technology, data, server rooms.

5. Fire pump and sprinkler rooms.
6. Normal power in emergency power equipment rooms: Limited to feeders and branch circuits serving the emergency power equipment located in the room.
7. Emergency power in normal power equipment rooms: Limited to feeders and branch circuits serving the normal power equipment located in the room.

3.11 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Within the Limits of Construction:

1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.

B. Outside the Limits of Construction:

1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.
3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the Contracting Officer's IAQ representative.

C. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. General Contractor shall erect and maintain dust barriers throughout the construction work. These barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.
2. The Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01" w.g. minimum relative to all adjacent areas of the building.
 - a. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed specifically for this purpose. All filtration for air recirculated back into the building shall be HEPA (99.97% DOP efficiency) for work adjacent to healthcare or elderly facilities. If no work is adjacent to these areas, 95% filtration is acceptable. Filtering air discharged to outdoors shall be accomplished with 30% filters.
 - b. If air is discharged outdoors, maintain all required distances to doors, windows, air intakes, etc.
 - c. If high levels of Volatile Organic Compounds (VOC's) or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.
 - d. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Contracting Officer and the authority having jurisdiction.
 - e. Seal return, exhaust, and supply air openings in or near the construction zone that serve existing air handling systems, and rebalance the systems for proper operation. If this is impractical, add filters at the intakes of sufficient cross sectional area to minimize the pressure drop and avoid the need for rebalancing.

- f. Maintain pressure control one hour before and after all construction periods, and 24 hours per day in healthcare or elderly facilities.
3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
 - a. Minimizing the amount of dust generated.
 - b. Reducing solvent fumes and VOC emissions.
 - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
4. Request that the Contracting Officer designate an IAQ representative.
5. Review and receive approval from the Contracting Officer's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
7. Schedule activities that may cause IAQ conditions that are not acceptable to the Contracting Officer's IAQ representative during unoccupied periods.
8. Request copies of and follow all Contracting Officer's IAQ and infection control policies.
9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
11. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings under Construction".

3.12 SYSTEM STARTING AND ADJUSTING

- A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.
- D. The Contractor, Contractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Contracting Officer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Contracting Officer on a time and materials basis for services rendered at the Contracting Officer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Contracting Officer for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.13 FIELD QUALITY CONTROL

- A. General:
 1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.

2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Contracting Officer or authority having jurisdiction deems necessary.

B. Ground Resistance:

1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Contracting Officer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)
2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain.
3. If the ground resistance value obtained is more than the value set forth in Section 26 05 26, the following shall be done to obtain the value given:
 - a. Verify that all connections in the service ground system are secure.
 - b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
 - c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
 - d. Review results with the Contracting Officer.
4. Before final payment is made to the Contractor submit a written report to the Contracting Officer including the following:
 - a. Date of test.
 - b. Number of hours since the last rain.
 - c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
 - d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
 - e. Make, model, and calibration date of test equipment.
 - f. Tabulation of measurements taken and calculations made.

C. Ground-Fault Equipment Performance Testing:

1. Test: Perform ground-fault performance testing when system is installed. The test process shall use primary current injection per manufacturer instruction and procedures. Perform test for the following:
 - a. Service disconnects.
 - b. Solid state molded case circuit breakers and solid-state insulated case circuit breakers equipped with ground fault protection.
 - c. Fusible switches with ground fault relay protection.
 - d. Outside branch circuits and feeders.
 - e. Code required.

2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.
- D. Arc Energy Reduction Equipment Performance Testing:
1. Test: Perform arc energy protection performance testing when system is installed. The test process shall use primary current injection or approved method per manufacturer instructions and procedures. Perform test for the following:
 - a. All arc energy reduction systems installed.
 2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.
- E. Other Equipment:
1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.
- F. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Contracting Officer or authority having jurisdiction deem necessary.
- G. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Contracting Officer to have a Contracting Officer present during testing.
- H. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.
- I. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Contracting Officer for "benchmark" amperages.
- 3.14 UTILITY REBATE
- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
 - B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Per Section 26 05 00, cable insulation test results have been submitted.
4. Per Section 26 05 00, ground resistance test results have been submitted.
5. Operation and Maintenance manuals have been submitted as per Section 26 05 00.
6. Bound copies of approved shop drawings have been submitted as per Section 26 05 00.
7. Report of instruction of Contracting Officer's representative has been submitted as per Section 26 05 00.
8. Fire alarm inspection and testing report has been submitted as per Sections 26 05 00 and 28 31 00.
9. Start-up reports from factory representative have been submitted as per Section 26 05 00.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Contracting Officer so that the final observation can be scheduled.

It is understood that if the Contracting Officer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Contracting Officer for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 26 05 00

SECTION 26 05 03 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. The Building Officials and Code Administrators National Building Code
- J. 1997 Uniform Building Code
- K. Wisconsin Administrative Code
- L. 2021 International Building Code
- M. NFPA 5000 - Building Construction Safety Code
- N. HCAI - Health Care Access and Information (California)

1.4 SUBMITTALS

- A. Submit under provisions of Section 26 05 00.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Interek / Warnock Hersey Assembly number.

- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
1. Types of penetrating items.
 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
 4. F ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Contracting Officer at the end of construction as part of the O&M Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.7 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Contractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Contracting Officer.
 - 1. Review foreseeable methods related to firestopping work.
 - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
 - 1. 3M; Fire Protection Products Division, Or Equal.

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- E. Provide firestopping systems allowing continuous insulation for all insulated pipes.
- F. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.
- G. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Contracting Officer, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 IDENTIFICATION

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
 - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."

2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.5 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Contracting Officer and manufacturer's factory representative. The Contracting Officer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Contracting Officer's discretion and the contractor's expense.

END OF SECTION 26 05 03

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SECTION 26 05 05 - ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrical demolition

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. THE DRAWINGS ARE INTENDED TO INDICATE THE SCOPE OF WORK REQUIRED AND DO NOT INDICATE EVERY BOX, CONDUIT, OR WIRE THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING A BID AND VERIFY EXISTING CONDITIONS.
- B. Where walls, ceilings, structures, etc., are indicated as being removed on general or electrical drawings, the Contractor shall be responsible for the removal of all electrical equipment, devices, fixtures, raceways, wiring, systems, etc., from the removed area.
- C. Where ceilings, walls, structures, etc., are temporarily removed and replaced by others, this Contractor shall be responsible for the removal, storage, and replacement of equipment, devices, fixtures, raceways, wiring, systems, etc.
- D. Where mechanical or technology equipment is indicated as being removed on electrical, mechanical, or technology drawings, the Contractor shall be responsible for disconnecting the equipment and removing all starters, VFD, controllers, electrical equipment, raceways, wiring, etc. associated with the device.
- E. Verify that abandoned wiring and equipment serve only abandoned equipment or facilities. Extend conduit and wire to facilities and equipment that will remain in operation following demolition. Extension of conduit and wire to equipment shall be compatible with the surrounding area. Extended conduit and conductors to match existing size and material.
- F. Coordinate scope of work with all other Contractors and the Contracting Officer at the project site. Schedule removal of equipment and electrical service to avoid conflicts.
- G. Bid submittal shall mean the Contractor has visited the project site and has verified existing conditions and scope of work.

3.2 PREPARATION

- A. The Contractor shall obtain approval from the Contracting Officer before turning off power to circuits, feeders, panels, etc. Coordinate all outages with Contracting Officer.
- B. Coordinate utility service outages with Utility Company.

- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations. Assume all equipment and systems must remain operational unless specifically noted otherwise on drawings.
- D. Disconnect electrical systems in walls, floors, structures, and ceilings scheduled for removal.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of Division 1 of Specifications and this Section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring and raceway to source of supply. Existing conduit in good condition may be reused in place by including an equipment ground conductor in reused conduit. Reused conduit and boxes shall have supports revised to meet current codes. Relocating conduit shall not be allowed.
- D. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal.
- E. Disconnect and remove outlets and devices that are to be demolished. Remove outlet or devices' associated back box, supports, and conduit and conductors back to source. Patch opening created from removal of device to match surrounding finishes.
- F. Disconnect and remove abandoned panelboards and distribution equipment.
- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories. Ballasts in light fixtures installed prior to 1980 shall be incinerated in EPA approved incinerator or disposed of in EPA certified containers and deposited in an EPA landfill certified for PCB disposal or recycled by permitted ballast recycler. Punctured or leaking ballasts must be disposed of according to Federal Regulations under the Toxic Substance Control Act. Provide Contracting Officer with a Certificate of Destruction to verify proper disposal.
- I. Repair adjacent construction and finishes damaged during demolition and extension work. Patch openings to match existing surrounding finishes.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide junction boxes and access panel as appropriate.
- K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. Extended conduit and conductors to match existing size and material.
- L. HID and fluorescent lamps, determined by the Toxicity Characteristic Leachate procedure (TCLP), to be hazardous waste shall be disposed of in an EPA-permitted hazardous waste disposal facility or by a permitted lamp recycler.

- M. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- N. Floor slabs may contain conduit systems. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This includes x-ray or similar non-destructive means. Where conduit is in concrete slab, cut conduit flush with floor, pull out conductors, and plug conduit ends.
- O. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. ELECTRICAL ITEMS (E.G., LIGHTING FIXTURES, RECEPTACLES, SWITCHES, CONDUIT, WIRE, ETC.) REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE Contracting Officer. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE Contracting Officer IN A LOCATION COORDINATED WITH THE Contracting Officer. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF MATERIAL THE Contracting Officer DOES NOT WANT.

3.5 INSTALLATION

- A. Install relocated materials and equipment under the provisions of Division 1 of Specifications.

END OF SECTION 26 05 05

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SECTION 26 05 13 - WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Building wire

1.2 RELATED WORK

- A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

- A. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
- B. NFPA 70 - National Electrical Code (NEC)
- C. UL 44 - Thermoset-Insulated Wires and Cables
- D. UL 83 - Thermoplastic-Insulated Wires and Cables
- E. UL 854 - Service-Entrance Cables
- F. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords
- G. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.
- B. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or XHHW-2.
- C. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings.
- D. Each 120 volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

PART 3 - EXECUTION

3.1 WIRE AND CABLE INSTALLATION SCHEDULE

- A. Above Accessible Ceilings:
 - 1. Building wire shall be installed in raceway.
 - 2. Metal clad cable, Type MC, 1/2" size with minimum #12 conductors and ground, shall be allowed for flexible whips to individual luminaires on non-essential circuits. The flexible whips shall be between 18" to 72" in length per Electrical Code.

- B. All Other Locations: Building wire in raceway.
- C. Above Grade: All conductors installed above grade shall be type "THHN".
- D. Underground or In Slab: All conductors shall be type "THWN".

3.2 CONTRACTOR CHANGES

- A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)). Service entrance and fire pump feeder conductors are based on copper conductor installed in underground electrical ducts, NEC Table B.2(7) (2011 - 2017 edition Table B310.15(B)(2)(7); 2008 or later edition B.301.7) or calculated in accordance with Annex B Application Information for Ampacity Calculation.
- B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.
- C. Underground electrical duct ampacity rating shall be in accordance with NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)) or calculated in accordance with Annex B Application Information for Ampacity Calculation. The calculations and a sketch of the proposed installation shall be submitted prior to any conduit being installed.
- D. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.
- E. Record drawing shall include the calculations and sketches.

3.3 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
- B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.
- C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.
- D. Use no wire smaller than 8 AWG for outdoor lighting circuits.
- E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.
- F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.
- G. Splice only in junction or outlet boxes.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- I. Make conductor lengths for parallel circuits equal.

- J. All conductors shall be continuous in conduit from last outlet to their termination.
- K. Terminate all spare conductors on terminal blocks, and label the spare conductors.
- L. Cables or wires shall not be laid out on the ground before pulling.
- M. Cables or wires shall not be dragged over earth or paving.
- N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
- O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.
- P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.4 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires. Do not use wire pulling lubricant for isolated (ungrounded) power system wiring.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.
- D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.
- E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.
- F. Only nylon rope shall be permitted to pull cables into conduit and ducts.
- G. Completely and thoroughly swab raceway system before installing conductors.
- H. Conductor Supports in Vertical Raceways:
 1. Support conductors in vertical raceways in accordance with the Electrical Code Spacing of Conductors Supports.
 2. Supports shall be of insulated wedge type (OZ Gedney Type S, Or Equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip Or Equal).

3.5 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice and tap only in accessible junction boxes.

- B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.
- C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.
- D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.
- E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Cold shrink connector insulator with 1kV rating shall be used in damp and wet locations.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.
- I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
 - 1. Facing the front and operating side of the equipment, the phase identification shall be:
 - a. Left to Right - A-B-C
 - b. Top to Bottom - A-B-C
- J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.
- K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Building Wire Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.
- C. MI cable shall have the insulation resistance of each cable tested with a 500-volt dc megohmmeter prior to energizing the cables. Tabulate resistance values and submit to Contracting Officer for acceptance.
- D. Inspect wire and cable for physical damage and proper connection.

- E. Torque test conductor connections and terminations to manufacturer's recommended values.
- F. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.
- G. Provide documentation of the manufacturer's recommended lug torque value for
Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.
- H. Protection of wire and cable from foreign materials:
 - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.
 - I. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION 26 05 13

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SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Equipment grounding system
- B. Bonding system
- C. Grounding electrode system
- D. Grounding of systems over 1kV
- E. Substation grounding

1.2 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
- B. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with UL 467 Grounding and Bonding Equipment.
- E. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- F. Comply with Electrical Code; for overhead-line construction and medium-voltage underground construction, comply with IEEE/ANSI C2 National Electrical Safety Code (NESC).

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)
- B. NFPA 99 - Standard for Healthcare Facilities

1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 26 05 00.
- B. Product Data: For the following:
 - 1. Ground rods.
- C. Product Data: For each type of product indicated.
- D. Field Test Reports: Submit written test reports to include 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.

E. Indicate layout of ground field, location of system grounding electrode connections, and routing of grounding electrode conductor and ground ring.

1.5 SUMMARY

A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section 26 05 13 "Wire and Cable".
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated. Refer to Section 26 05 53 for insulation color.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Copper Bonding Conductors: As follows:
 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTOR PRODUCTS

- A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Connectors: Hydraulic compression type Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.
- C. Substation connectors shall comply with IEEE 837 listed for use for specific types, sizes, and combinations of conductors and connected items.

PART 3 - EXECUTION

3.1 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- D. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- E. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- F. Structural Steel Connection: Exothermic-welded connections to structural steel. Coordinate with structure to provide physical protection.
- G. Underground Connections: Exothermic-welded connections. Use for underground connections, except those at test wells.
- H. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity.
- I. Tighten screws and bolts for grounding and bonding 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.
- J. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.
- 3.2 INSTALLATION
- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.
- C. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.
- D. In raceways, use insulated equipment grounding conductors.
- E. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

3.3 EQUIPMENT GROUNDING SYSTEM

- A. Comply with Electrical Code, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by Electrical Code are indicated.
- B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by Electrical Code:
 1. Lighting and receptacle circuits. Terminate each end on a grounding lug or bus.
 2. Single-phase and three-phase motor and appliance branch circuits.
 3. Flexible raceway runs, including FMC and LFMC.
 4. Armored and metal-clad cable runs.
- D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

3.4 BONDING SYSTEM

- A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.
- B. Isolated Equipment Enclosure: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment bonding conductor.
- C. Exterior Metallic Pull and Junction Box Covers, Metallic Hand Rails: Bond to grounding system using flexible grounding conductors.
- D. Equipment Circuits: Install a bonding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, dampers, and heaters. Bond conductor to each unit and to air duct. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps or copper conductor sized equal to the equipment grounding conductor.

- E. Bond metal ducts of dust collectors, particulate conveying, fume hoods, and other hazardous materials to the equipment grounding conductors of associated pumps, fans, or blowers. Use braided-type bonding straps. Provide braided bare copper bonding conductor in nonmetallic dust collector ductwork to each equipment inlet location, and bond to equipment.
- F. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.
- G. Terminal Cabinets: Terminate bonding conductor on cabinet grounding terminal.
- H. Remote control, signaling, and fire alarm circuits shall be bonded in accordance with the most recent version of the National Electric Code.
- I. Metal Poles Supporting Outdoor Lighting Fixtures > 15 feet: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.
- J. Common Ground Bonding 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.

3.5 EQUIPOTENTIAL (MULTI-POINT) GROUNDING SYSTEM

- A. Provide an equipotential grounding system in the following locations:
 1. Class I Div 1 and Div 2 locations as required in Electrical Code.
- B. The non-current-carrying metal parts of equipment, raceways and other enclosures shall be bonded to the grounding system.

3.6 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
 1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.
 2. Testing: Contracting Officer will engage a qualified testing agency to perform the following field quality-control testing:
 3. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
 4. Testing: Perform the following field quality-control testing:
 - a. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - b. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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. Perform tests, by the fall-of-potential method according to IEEE 81.

- c. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 - 1) Equipment Rated 500 kVA and Less: 10 ohms.
 - 2) Equipment Rated 500 to 1000 kVA: 5 ohms.
 - 3) Equipment Rated More Than 1000 kVA: 3 ohms.
 - 4) Substations and Pad-Mounted Switching Equipment: 5 ohms.
 - 5) Manhole Grounds: 10 ohms.
- d. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Contracting Officer promptly and include recommendations to reduce ground resistance.

3.7 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2. Maintain restored surfaces. Restore disturbed paving.

END OF SECTION 26 05 26

SECTION 26 05 27 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Concrete Housekeeping Pads
- B. Foundation and Underground Sleeves and Seals

1.2 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.3 COORDINATION

- A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Allied Support Systems, Or Equal.

2.2 MATERIAL

A. Anchorage and Structural Attachment Components:

1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.
 - a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
2. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
3. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.
4. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
5. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

B. Conduit Sleeves and Lintels:

1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor's work in masonry walls and conduit sleeves for floors, unless specifically shown as being by others.
2. Refer to Structural General Notes for lintel requirements in masonry construction.
3. Refer to Structural plans and specifications for lintel requirements and sizes.

4. Lintels:
 - a. Lintels in non-bearing masonry wall openings can be sized in accordance with the note below. Lintels that occur in existing bearing walls are to be sized according to similar conditions and spans in the new construction and lintel schedule. Bottom plate size shall be a minimum of 3/8" thick. The width of the plate shall be 3/4" less than the field verified wall thickness. The plate shall be the full length of the lintel member. Lintels are not required over openings that are 12" wide or less and at least 1 course below the top of the wall.
 - b. All lintels shall have a minimum of 8" end bearing.
 - c. All lintels in exterior wall construction shall be hot-dip galvanized.
 - d. For all openings not otherwise detailed or scheduled, minimum lintels shall be for each 4 inch of masonry width:
 - 1) 0 to 2'-0" span: 5/16" plate (3/4" less than wall width)
 - 2) 2'-0" to 4'-0" span: L 3 1/2 x 3 1/2 x 1/4
 - 3) 4'-0" to 6'-0" span: L4 x 3 1/2 x 5/16 (Ilv)
 - 4) 6'-0" to 8'-0" span: L5 x 3 1/2 x 5/16 (Ilv)
 - e. All angles that are back to back shall be welded top and bottom 3" at 12" minimum.
5. Fabricate all lintels from structural steel shapes or as indicated on the drawings. All lintels and grouped wall openings shall be approved by the Contracting Officer or Structural Contracting Officer.
6. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.
7. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
8. Sleeves shall not penetrate structural members without approval from the Structural Contracting Officer.
9. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
10. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
11. Where conduits rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
12. Size sleeves large enough to allow expansion and contraction movement.

C. Concrete Housekeeping Pads:

1. Concrete bases for all floor mounted equipment and wall mounted equipment which is surface mounted and extends to within 6" of the finished floor, unless shown otherwise on the drawings, shall be 3-1/2" thick concrete.
2. Bases shall extend 3" on all sides of the equipment (6" larger than factory base).
3. Where the base is less than 12" from a wall, the base shall be carried to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6" x 6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at twenty-eight days.

2.3 FOUNDATION - UNDERGROUND SLEEVES AND SEALS

A. Wall Seals ("Link-Seals"):

1. Where shown on the drawings, raceways passing through foundation walls to an underground condition shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing element consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve.
3. Sleeves shall be at least 2 trade sizes larger than the penetrating raceway.
4. Pressure shall be maintained by stainless steel bolts and accessories. Pressure plates may be of composite materials for Models S and OS.
5. Sealing Elements shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant / Stainless	Nitrile	-40°F to 210°F

6. Approved Manufacturers:
 - a. Thunderline Corporation "Link-Seals", Or Equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.
- B. Trapeze support installation: Cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- D. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.
- E. Do not use powder-actuated anchors without specific permission.
- F. Do not drill structural steel members.
- G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.

- I. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting. Provide steel channel supports to stand surface-mounted panelboard or cabinet one inch off wall.
- J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- K. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- L. Refer to Section 26 05 33 for special conduit supporting requirements.

3.2 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
- B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

END OF SECTION 26 05 27

SECTION 26 05 33 - CONDUIT AND BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Rigid metallic conduit and fittings (RMC)
- B. Flexible metallic conduit and fittings (FMC)
- C. Liquidtight flexible metallic conduit and fittings (LFMC)
- D. Rigid polyvinyl chloride conduit and fittings (PVC)
- E. Wall and ceiling outlet boxes
- F. Pull and junction boxes
- G. Rough-ins
- H. Handholes
- I. Accessories

1.2 RELATED WORK

- A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
 - 2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
 - 3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
 - 4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated
 - 5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
 - 6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- B. Federal Specifications (FS):
 - 1. A-A-50553A - Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
 - 2. A-A-55810 - Specification for Flexible Metal Conduit
- C. NECA "Standards of Installation"
- D. National Electrical Manufacturers Association (NEMA):
 - 1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
 - 2. RN 1 - Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit
 - 3. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
 - 4. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation

- E. NFPA 70 - National Electrical Code (NEC)
- F. Underwriters Laboratories (UL): Applicable Listings
 - 1. UL 1 - Flexible Metal Conduit
 - 2. UL 6 - Rigid Metal Conduit
 - 3. UL 360 - Liquid Tight Flexible Steel Conduit
 - 4. UL514-B - Conduit Tubing and Cable Fittings
 - 5. UL651-A - Type EB and a PVC Conduit and HDPE Conduit
 - 6. UL651-B - Continuous Length HDPE Conduit
 - 7. UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
 - 8. UL797 - Electrical Metal Tubing
 - 9. UL1242 - Intermediate Metal Conduit
- G. American Standard of Testing and Materials (ASTM):
 - 1. ASTM D 570 - Standard Test Method for Water Absorption of Plastics
 - 2. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics
 - 3. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
 - 4. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
 - 5. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
 - 6. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material
- H. Definitions:
 - 1. Fittings: Conduit connection or coupling.
 - 2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
 - 3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
 - 4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
 - 5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
 - 6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
 - 7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

1.4 SUBMITTALS

- A. Include fittings and conduits 1.0" and larger in coordination files. Include all in-floor and underfloor conduit in coordination files. Refer to Section 26 05 00 for coordination drawing requirements.

PART 2 - PRODUCTS

2.1 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

- A. Manufacturers:
 - 1. Allied, Or Equal.
- B. Manufacturers of RMC Conduit Fittings:
 - 1. Appleton Electric, Or Equal.
- C. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.
- D. Fittings and Conduit Bodies:
 - 1. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
 - 2. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
 - 3. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
 - 4. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

2.2 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.
- B. Manufacturers of EMT Conduit:
 - 1. Allied, Or Equal.
- C. Fittings and Conduit Bodies:
 - 1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.
 - 2. 1/2" and 3/4" Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.
 - 3. Larger than 2": Compression type of steel designed for their specific application.
 - 4. Manufacturers of EMT Conduit Fittings:
 - a. Appleton Electric, Or Equal.

2.3 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.
- B. Manufacturers:
 - 1. American Flex, Or Equal.

- C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.
- D. Fittings and Conduit Bodies:
 - 1. Screw-in type, galvanized zinc coated cadmium plated malleable cast iron.
 - 2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
 - 3. Manufacturers:
 - a. O-Z/Gedney Co., Or Equal.

2.4 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

- A. Manufacturers:
 - 1. Anaconda Type UA, Or Equal.
- B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.
- C. Fittings and Conduit Bodies:
 - 1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
 - 2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
 - 3. Manufacturers:
 - a. Appleton Electric, Or Equal.

2.5 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

- A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.
- B. Acceptable Manufacturers:
 - 1. Cantex, J.M. Mfg., Or Equal.
- C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.
- D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
- E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

ASTM Test	Description	Values HDPE
D-1505	Density g/CM 3	less than 0.941
D-1238	Melt Index, g/10 min Condition E	greater than 0.55 grams/10 min.
D-638	Tensile Strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B, F 20	96 hrs.
D-790	Flexural Modulus, MPa (psi)	less than 80,000
D-746	Brittleness Temperature	-75°C Max

2.6 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, 16 gauge (approximately 0.0625 inches), with 1/2-inch male fixture studs where required.
- B. Cast Boxes: NEMA FB1, Type FD, Aluminum, cast ferrous alloy, or stainless steel deep type, gasketed cover, threaded hubs.
- C. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.
- D. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.
- E. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.
- F. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

2.7 JB; PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.
- B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.
- C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.
- E. Flanged type boxes shall be used where installed flush in wall.

2.8 ROUGH-IN

- A. Provide with one (1) flush mount double gang box with single gang plaster ring and appropriate cover plate,
- B. Conduit stubbed to above the lay-in ceiling.
- C. RI-TECH; Technology Rough-in:
 - 1. Rough-in shall have one (1) 1" conduit.

- D. RI-TECH-W; Technology Rough-in - Wall Phone:
 - 1. Mount on wall +54" or as noted in plans. Rough-in shall have one (1) 1" conduit.
- E. RI-TECH-C; Technology Rough-in - Ceiling Flush Mounted:
 - 1. Mount flush in finished ceiling or as noted in plans. Rough-in shall have one (1) 1" conduit.
- F. RI-TV; Television Antenna Outlet Box Rough-in:
 - 1. Rough-in shall have one (1) 3/4" conduit.

2.9 HANDHOLES

- A. Handhole, concrete traffic box and galvanized steel checkered cover. Stainless steel hardware. Bolted cover and box rated for H/20 vehicular traffic. Reinforced concrete slab for bottom. 11"W, 18"L, 24"D or dimensions as shown on plans.
 - 1. Manufacturer:
 - a. Oldcastle Precast B1017 Box, Or Equal.

2.10 ACCESSORIES

- A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control - IsoBacker Pad, Or Equal.
- B. Sound Barrier Insulation Pads: Mastic, non-hardening, sheet material, minimum 1/8" thickness applied to all five sides of back boxes. Kinetics Noise Control - SealTight Backer Pad, Or Equal.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION SCHEDULE AND SIZING

- A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Contracting Officer/Contracting Officer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.
- B. Installation Schedule: Refer to drawings.
- C. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.
- D. Minimum Conduit Size (Unless Noted Otherwise):
 - 1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
 - 2. Below Grade 5' or less from Building Foundation: 3/4 inch.
 - 3. Below Grade More than 5' from Building Foundation: 3/4 inch.
 - 4. Telecommunication Conduit: 1 inch.
 - 5. Controls Conduit: 1/2 inch.

- E. Conduit Embedded in Slabs above Grade:
 - 1. Embedded installation NOT allowed in elevated slabs with metal composite decks nor structural pour in place slabs less than 6 inches in depth unless specifically noted or shown on drawings otherwise.
 - 2. Maximum size 1-1/4 inch for conduits crossing each other.
- F. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.2 CONDUIT ARRANGEMENT

- A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.
- B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Contracting Officer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.
- C. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.
- D. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Contracting Officer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.
- E. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Contracting Officer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.3 CONDUIT SUPPORT

- A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.
 - 1. Support wire used to independently support raceway and wiring systems above suspending ceilings shall be supported on both ends, minimum 12 gauge suspended ceiling support wire, and distinguishable from ceiling support systems by color (field paint), tagging, or equivalent means.
- B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Contracting Officer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.

- C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.
- D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1-1/2" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.
- F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.
- G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.
- J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.
- K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the Electrical Code requirements.
- L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.
- M. Finish:
 - 1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
 - 2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.4 CONDUIT INSTALLATION

- A. Conduit Connections:
 - 1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.

2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
 3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
 4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.
- B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.
- C. Conduit Bends:
1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
 2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
 3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
 4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.
 - a. A third bend is acceptable if:
 - 1) The total run is not longer than (33) feet.
 - 2) The conduit size is increased to the next trade size.
 5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
 6. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
 7. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
 8. Use conduit bodies to make sharp changes in direction (i.e. around beams).
- D. Conduit Placement:
1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
 2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
 3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
 4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
 5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.

6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. Seal penetrations with intumescent caulk, putty, or sheet installed per manufacturer's recommendations. All materials used to seal penetrations of firewalls and floors shall be tested and certified as a system per ASTM E814 Standard for fire tests or through-penetration fire stops as manufactured by 3M, Or Equal.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.
8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system, equal to O-Z/Gedney type EYD.
9. Horizontal conduit routing through slabs above grade
 - a. Conduits, if run in concrete structure, shall be in middle one-third of slab thickness, and leave at least 3" min. concrete cover. Conduits shall run parallel to each other and spaced at least 8" apart centerline to centerline. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Maximum conduit outside diameter 1".
 - b. No conduits are allowed in concrete on metal deck unless expressly approved in writing by the Structural Contracting Officer.
 - c. No conduits are allowed to be routed horizontally through slabs above grade.
10. Do not route conduits across each other in slabs on grade.
11. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
12. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel or PVC-coated steel conduit shall be installed before conduit exits earth. The metallic conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
13. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
14. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
15. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
16. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
17. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

3.5 CONDUIT TERMINATIONS

- A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Or Equal.
- B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.

- C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.
- D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.
- E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the Electrical Code, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.
- F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.
- G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.6 UNDERGROUND CONDUIT INSTALLATION

- A. Conduit Connections:
 - 1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.
- B. Conduit Bends (Lateral):
 - 1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
 - 2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Contracting Officer prior to conduit installation to determine bend radius.
- C. Conduit Elbows (vertical):
 - 1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.
- D. Conduit Placement:
 - 1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
 - 2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
 - 3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum f'c = 2500 and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.

4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
8. All non-metallic conduit installed underground outside of a slab shall be rigid.

E. Horizontal Directional Drilling:

1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.
2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.

F. Raceway Seal:

1. Where a raceway enters a building or structure, it shall be sealed with a sealing bushing or duct seal to prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceway shall also be sealed.
2. All telecommunications conduits and innerducts, including those containing cables, shall be plugged at the building and vault with "JackMoon" Or Equal duct seal, capable of withstanding a 10-foot head of water (5 PSI).
3. Duct Seal Alternative Option: Inflatable duct seal system. Capable of withstanding a 10-foot head of water (5 PSEI).
 - a. Manufacturers:
 - 1) Raychem Rayflate Duct Sealing Systems RDSS, Or Equal.

3.7 BOX INSTALLATION SCHEDULE

A. Galvanized steel boxes may be used in:

1. Concealed interior locations above ceilings and in hollow studded partitions.
2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
3. Direct contact with concrete except slab on grade.
4. Recessed in stud wall of kitchens and laundries.

B. Cast boxes shall be used in:

1. Exterior locations.
2. Hazardous locations.
3. Exposed interior locations within 8' of the highest platform level.
4. Direct contact with earth.
5. Direct contact with concrete in slab on grade.
6. Wet locations.
7. Kitchens and laundries when exposed on wall surface.

3.8 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Contracting Officer and General Contractor.
- D. Locate and install to maintain headroom and to present a neat appearance.
- E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

3.9 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls.
 - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
 - 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.
- C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)
- D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.
- E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- F. Provide knockout closures for unused openings.
- G. Support boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

- I. Install boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.
- K. Position outlets to locate luminaires as shown on reflected ceiling drawings.
- L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- N. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.10 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.
- C. Do not install boxes back-to-back in walls.
 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

3.11 EXPOSED BOX INSTALLATION

- A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.
- B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Or Equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.
- C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.
- D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.

- E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)
- F. Wood, plastic, or fiber plugs shall not be used for fastenings.
- G. Explosive devices shall not be used unless specifically allowed.

END OF SECTION 26 05 33

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SECTION 26 05 48 - SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Seismic Requirements.

1.2 QUALITY ASSURANCE

A. General:

1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
3. These requirements are beyond those listed in Section 26 05 27 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Contracting Officer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

- C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

- D. Installer: Company specializing in performing the work of this Section.

1.3 REFERENCES

- A. International Building Code, 2021.
- B. ASHRAE - A Practical Guide to Seismic Restraint.
- C. Technical Manual 5-809-10, NAVFAC P-355, Air Force Manual 88-3, Chapter 13.
- D. ASCE 7-02, Chapter 9.
- E. ASCE 7-05, Chapter 13.
- F. ASCE 7-10, Chapter 13.
- G. ASCE 7-16, Chapter 13.

1.4 SUBMITTALS

- A. Submit under provisions of Section 26 05 00.

- B. Shop Drawings:
1. Calculations, restraint selections, and installation details shall be designed and sealed by a Professional Structural Contracting Officer licensed in the state where the project is located experienced in seismic restraint design and installation.
 2. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of electrical components with other systems and equipment in the vicinity, including other seismic restraints.
 3. Manufacturer's Certifications: Professional Structural Contracting Officer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
 4. System Supports/Restraints - Submit for each condition requiring seismic bracing:
 - a. Calculations for each seismic brace and detail utilized on the project.
 - b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.
 - c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
 - d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Contracting Officer of Record.
 5. Equipment - Submit for each piece of equipment supplied:
 - a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified. Equipment certification is to be provided by the manufacturer.
 - b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
 - c. Engineering calculations and details for equipment anchorage and support structure.
- C. A seismic restraint designer shall be provided whether or not exceptions listed in the applicable building code are met. If seismic restraints are not provided for a system that requires seismic bracing, the seismic designer shall submit a signed and sealed letter to the Contracting Officer and Authorities Having Jurisdiction stating the exceptions, along with code reference, utilized for each item. Seismic designer shall review system installation for general conformance to the exception requirements stated in the code and document, in writing, the system has been installed in accordance to the exception.

1.5 TESTING AND INSPECTION

- A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the Building Code.
- B. The Contractor shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.
- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Contracting Officer of Record.

- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Contracting Officer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.7 DESIGN REQUIREMENTS

- A. This project is subject to the seismic bracing requirements of the International Building Code, 2021 edition.
- B. The following criteria are applicable to this project:
 - 1. Risk Category: I
 - 2. Seismic Importance Factor: $I_E = 1.0$
 - 3. Seismic Design Category: A
 - 4. Component Amplification Factors (a_p) and Component Response Modification Factors (R_p) shall be taken from Table 1621.3 in IBC 2000 for the individual equipment or system being restrained.
 - 5. Component Importance Factors (I_p) shall be taken from Section 1621.1.6 in IBC 2000 for the individual equipment or system being restrained.
 - 6. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.
- C. Forces shall be calculated with the above requirements and Equation 16-67, 68, & 69 in section 1621.1.4 of IBC 2000, unless exempted by 1621.1.1.
- D. Equipment shall meet International Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.
- E. All seismic anchorage and bracing shall comply with the St. Louis County Rules & Regulations on Anchorage & Sway Bracing - Mechanical, Electrical & Plumbing (MEP) System Components.
- F. All seismic anchorage and bracing shall comply with FM Global Property Loss Prevention Data Sheet 1-11, Fire Following Earthquakes.

1.8 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.

1.9 WARRANTY

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

PART 2 - PRODUCTS

2.1 SUPPLIERS

- A. Following is a partial list of manufacturer/supplier contact information for seismic restraints:
 - 1. B-Line Systems, Inc. (800) 851-7415, www.b-line.com., Or Equal.

2.2 SEISMIC DESIGN CRITERIA

- A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.
- B. Definitions:
 - 1. Stay in Place:
 - a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.

2.3 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
 - 1. Seismic restraint designer shall coordinate all attachments with the Structural Contracting Officer of Record; refer to submittal requirements.
 - 2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
 - 3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
 - 4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
 - 5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
 - 6. All seismic restraints and combination isolator/restraints shall have verification of their seismic capabilities witnessed by an independent testing agency.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.
- C. Housekeeping Pads:
 - 1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

2.4 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

- A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.
- B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:
 - 1. Switchboards, Distribution Panelboards, Panelboards, Load Centers
 - 2. Emergency Feeders
 - 3. Cable tray, Busway, Ductbank

4. Transformers
5. Disconnect Switches
6. Magnetic, Manual, Combination Starters
7. Variable Frequency Drives
8. Automatic/Manual Transfer Switches
9. Interior Luminaires
10. Emergency Luminaires and Exit Signs
11. Emergency Power Supply
12. Engine Generator Systems
13. Uninterruptible Power Supplies
14. Fire Alarm Panel, Initiating and Notification Appliances
15. Area of Rescue Assistance
16. Nurse Call
17. Intercom, Sound System, Clock, TV Distribution
18. Security System

2.5 MATERIALS

- A. Use the following materials for restraints:
 1. Indoor Dry Locations: Steel, zinc plated.
 2. Outdoors and Damp Locations: Galvanized steel.
 3. Corrosive Locations: Stainless steel.

2.6 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
 1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.7 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.

1. Materials for Channel: ASTM A 1011, GR 33.
 2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.
 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
- C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
 2. Wire Rope Cable: Comply with ASTM A 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.
- D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- E. Installation of seismic restraints shall not cause any change in position of equipment lighting or conduits resulting in stresses or misalignment.
- F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- G. Do not install any equipment or conduit that makes rigid connections with the building unless isolation is not specified.
- H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or conduit due to inadequate space or other unforeseen conditions shall be brought to the Contracting Officer's attention prior to specific equipment selection.
- I. Prior to installation, bring to the Contracting Officer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

- J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.
- K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment or conduit.
- L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- M. Do not install cables over sharp corners.
- N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- O. Provide reinforced clevis bolts when required.
- P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
- Q. Post-Installed anchors shall be provided to meet seismic requirements.
- R. Vertical conduit risers flexibly supported to accommodate thermal motion and/or conduit vibration shall be guided to maintain conduit stability and provide horizontal seismic restraint.
- S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- T. Conduit crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the conduit, equipment connections, or support connections. Conduit offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent conduit.
- U. Do not brace a system to two different structures such as a wall and a ceiling.
- V. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- W. Positively attach all roof-mounted equipment to roof curbs. Positively attach all roof curbs to building structure.
- X. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.

3.2 SEISMIC RESTRAINT EXCLUSIONS

- A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

END OF SECTION 26 05 48

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SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Adhesive Markings and Field Labels
- B. Nameplates and Signs
- C. Product Colors

1.2 REFERENCES

- A. NFPA 70E - National Electrical Safety Code
- B. NFPA 70 - National Electrical Code (NEC)
- C. ANSI A13.1 - Standard for Pipe Identification
- D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Division 1 Specification Sections and under provisions of Section 26 05 00.
 - 1. Product Data for each type of product specified.
 - 2. Schedule of nomenclature to be used for identification signs and labels for each piece of equipment including, but not limited to, the following equipment types as specified in Division 26.
 - 3. Samples of each color, lettering style and other graphic representation required for identification materials including samples of labels and signs.
 - 4. Identification required in this section shall apply to equipment furnished in Division 26 and any other applicable Divisions including Division 21/22/23.

PART 2 - PRODUCTS

2.1 ADHESIVE MARKINGS AND FIELD LABELS

- A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).
 - 1. Label Size as follows:
 - a. Raceways: Kroy, Or Equal labels 1-inch high by 12-inches long (minimum).
 - 2. Color: As specified for various systems.
- B. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

- C. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application. Provide ties in specified colors when used for color coding. Cable ties shall be listed and identified for the application, securement, and support.
- D. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.
- E. Text Sizes:
 - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
 - a. Font: Normal 721 Swiss Bold
 - b. Adhesive Labels: 3/16 inch minimum text height
 - c. Vinyl / Plastic Laminate Labels: 3/4" inch minimum text height

2.2 NAMEPLATES AND SIGNS

- A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.
- B. Text Sizes:
 - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
 - a. Text Height: 3/8 inch minimum
- C. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.3 PRODUCT COLORS

- A. Adhesive Markings and Field Labels:
 - 1. Normal Power and General Labels: Black letters on white face
 - 2. Control Labels: Black letters on white face
 - 3. Fire Alarm: Red letters on white face
- B. Nameplates and Signs:
 - 1. NORMAL POWER: Black letters on white face
 - 2. Control Labels: Black letters on white face
 - 3. EMERGENCY: White letters on red face
 - 4. GROUNDING: White letters on green face.
- C. Raceways and Conduit:
 - 1. Provide color coded conduit as indicated below. Conduit shall be colored by the manufacturer:
 - a. Normal Power and General Distribution: Silver
 - b. Emergency Power Distribution System:
 - 1) All Emergency: Orange
 - c. Fire Alarm System: Red
 - d. Temperature Controls: Refer to mechanical cover sheet for color

- e. Ground: Green
- f. Low Voltage and Telephone: Purple
- g. Security System: Black

D. Box Covers:

1. Box covers shall be painted to correspond with system type as follows:
 - a. Normal Power and General: Silver
 - b. Emergency Power and Distribution:
 - 1) All Emergency: Orange
 - c. Fire Alarm System: Red
 - d. Temperature Controls: Refer to mechanical cover sheet for color
 - e. Ground: Green
 - f. Low Voltage and Telephone: Purple
 - g. Security System: Black
2. Box cover colors shall match conduit colors listed above.

E. Conductor Color Identification: Refer to Part 3 for additional information.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
- B. Exposed Ceilings and Finished Spaces: The project includes exposed ceilings in finished spaces. The installation of colored raceways and labeling may not be aesthetically desirable in finished spaces. The contractor shall coordinate identification requirements in exposed ceilings of finished spaces with the A/E prior to installation and ordering of materials.
- C. Electrical System Color Chart: This Contractor shall furnish and install framed 8" x 12" charts of the color-coded identification scheme used for the electrical system in all electrical rooms and next to the main fire alarm panel.
- D. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.
- E. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.
- F. Circuit Identification: Tag or label conductors as follows:
 1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
 2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
 3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

- G. Apply warning, caution and instruction signs as follows:
 - 1. Install warning, caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 - 2. Emergency Operating Signs: Install, where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
- H. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.
- I. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

3.2 CONDUCTOR COLOR CODING

- A. Products:
 - 1. All wire and cables shall be color coded by the manufacturer.
 - 2. All wires and cables, 6 AWG or larger, used in motor circuits, main feeders, sub-main feeders, and branch circuits shall be coded by the application of plastic tape. The tape shall be 3-M, Or Equal in colors specified below. The tape shall be applied at each conductor termination with two 1-inch tape bands at 6-inch centers. Contractor option to use colored cabling in lieu of the tape at each end for conductor 6 AWG to 500 KCM. Wire and cables smaller than 6 AWG shall be color coded by the manufacturer.
- B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.
- C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches from the termination and spaced at 3- inches centers. Tighten to a snug fit, and cut off excess length.
- D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.
- E. Conductors shall be color coded as follows:
 - 1. 208Y/120 Volt, 4-Wire:
 - a. A-Phase - Black
 - b. B-Phase - Red
 - c. C-Phase - Blue
 - d. Neutral - White
 - e. Ground Bond - Green

2. Grounding Conductors:
 - a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
 - b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.
3. Cabling for Remote Control, Signal, and Power Limited Circuits:
 - a. Fire Alarm: Refer to Fire Alarm and Automatic Detection Section 28 31 00 for cable color requirements.
 - b. Low Voltage Switching: Per manufacturer recommendations and code requirements.
 - c. Building Automation Systems and Control: Refer to the Temperature Control Contactor notes located on the mechanical cover sheet.
 - d. Audio/Visual Systems: Refer to Division 27.
 - e. Structured Cabling: Refer to Division 27.

END OF SECTION 26 05 53

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SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Device plates and box covers
- B. Receptacles (REC-#)
- C. Poke-through fittings (PT-#)

1.2 QUALITY ASSURANCE

- A. Provide similar devices from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Electrical Code, by a testing agency to Authorities Having Jurisdiction and marked for intended use.
- C. Comply with the Electrical Code.

1.3 REFERENCES

- A. DSCC W-C-896F - General Specification for Electrical Power Connector
- B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
- C. NEMA WD 1 - General Color Requirements for Wiring Devices
- D. NEMA WD 6 - Wiring Devices - Dimensional Requirements
- E. NFPA 70 - National Electrical Code (NEC)
- F. UL 498 - Standard for Attachment Plugs and Receptacles
- G. UL 943 - Standard for Ground Fault Circuit Interrupters

1.4 COORDINATION

- A. Receptacles for Contracting Officer Furnished Equipment: Match plug configurations.
- B. Cord and Plug Sets: Match equipment requirements.
- C. Coordinate installation of receptacle assemblies in countertops with the Contractor providing the countertop. Contractor shall coordinate penetrations and conduit routing in countertops with drawings and other obstacles below the installation surface.

PART 2 - PRODUCTS

2.1 DEVICE COLOR

- A. All switch, receptacle, and outlet colors shall be verified with Contracting Officer, unless indicated otherwise.

2.2 COVERPLATES

- A. All switches, receptacles, and outlets shall be complete with the following:
 - 1. Unbreakable thermoplastic/thermoset plastic and match device color coverplates in finished spaces where walls are finished.
 - 2. Decorator Grade - Public: Decorator wallplates in public finished spaces where walls are finished.
 - 3. #302 stainless steel coverplates in unfinished spaces for flush boxes.
 - 4. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 26 05 53.
- D. Plate securing screws shall be metal with head color matching the wall plate finish.

2.3 RECEPTACLES

- A. Refer to Electrical Symbols List for device type.
- B. Devices that are shaded on the drawings shall be red.
- C. REC-DUP: NEMA 5-20R Duplex Receptacle:
 - 1. Decorator Grade: Provide decorative style duplex receptacles in public spaces where walls are finished.
 - a. Manufacturers:
 - 1) Leviton 16362, Or Equal.
 - 2. Spec Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and brass back strap.
 - a. Manufacturers:
 - 1) Leviton 5362-S, Or Equal.
- D. REC-DUP-GFI: NEMA 5-20R Ground Fault Duplex Receptacle:
 - 1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face.
 - a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 - b. Manufacturers:
 - 1) Leviton GFNT2, Or Equal.
 - 2) Hubbell GFCI type devices are not allowed.
- E. REC-DUP-WP: NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:
 - 1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use cast aluminum cover.
 - 2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
 - a. Manufacturers:
 - 1) Leviton GFWT2 with aluminum housing M5979, Or Equal.
 - 2) Hubbell GFCI type devices are not allowed.

- F. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.
- G. Side wired devices shall have four binding screws that are undercut for positive wire retention.
- H. Ground fault circuit interrupter (GFCI) receptacles shall comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.
- I. Hazardous (Classified) location receptacles shall comply with NEMA FB 11.

2.4 POKE-THROUGH FITTINGS

- A. Cover Color and Style: Verify with Contracting Officer from manufacturer standard options.
- B. Refer to Technology drawings for voice/data, Audio/Video outlet, and coordination requirements.
- C. UL listed as fire-rated poke-through device for 1, 2, 4-hour rated floors: include fire stops and smoke barriers in through-floor component. UL514A listed for scrub locations and approved for use in the City of Chicago.
- D. Terminate in 4-inch square by 2-1/2-inch deep junction box.
- E. Suitable for installation with a floor thickness of 2-1/4 to 7 inches.
- F. PT-#: 3" Fire Rated Poke-Through:
 - 1. Semi-flush mounted, hinged covers, for use with 3-inch core holes, provide complete with appropriate outlet coverplates and hardware. UL 514 scrub rated listed.
 - 2. Gang / Outlet Descriptions, route conduit in ceiling space of lower level. Provide provisions to core drill floor to route power circuits to panel on same floor as poke through. Route low voltage raceways to scheduled technology room:
 - a. 125 Volt, 20 amp, NEMA 5-20R duplex receptacle.
 - b. Voice/Data outlet.
 - c. Voice/Data furniture/equipment feed with flexible whip.
 - d. Conduit Raceway (in ceiling space below floor):
 - 1) Power: 3/4-inch conduit.
 - 2) Voice/Data: 3/4-inch conduit.
 - 3) 3/4
 - e. Refer to Technology drawings for additional information related to voice/data and audio/visual outlet requirements.
 - 3. Manufacturers:
 - 1) Hubbell PT2X2, Or Equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.

- B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.
- C. Ground Fault Protection: Provide ground fault protection for all branch circuit breakers serving 120/208 receptacle outlets rated 21 - 50 amps single phase and 21-100 amps three phase in the following locations, as shown on drawings, or required by adopted code:
 - 1. Bathrooms, locker rooms, shower rooms
 - 2. Kitchens
 - 3. Rooftops
 - 4. Interior/Exterior locations subject to damp/wet conditions
 - 5. When located within 6 feet of sinks, bathtubs, and shower stalls
 - 6. Garages, accessory buildings, service bays
- D. Tamper Resistant Protection: Provide tamper resistant protection for all 15 / 20-amp 120/208 straight blade wiring devices in the following locations, as shown on the drawings, or required by adopted code.
 - 1. Dwelling units, dormitory units
 - 2. Guest rooms and suites
 - 3. Childcare, preschool, elementary, middle, high school, educational facilities
 - 4. Business Office: Corridors, waiting rooms, common areas
 - 5. Public Buildings: Corridors, waiting rooms, common areas
 - 6. Assisted living
- E. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This may include X-ray or similar non-destructive means.
- F. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- I. Install devices and wall plates flush and level.
- J. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 05 53 - Electrical Identification.
- K. Test receptacles and modular wiring connectors for proper polarity, ground continuity and compliance with requirements.

END OF SECTION 26 27 26

APPENDIX A

Asbestos and Lead-Containing Paint Inspection Report

Buckstaff Bathhouse - Roof

509 Central Avenue

Hot Springs, Garland County, AR

September 22, 2023

Terracon Project No. 35237083



Prepared for:

Strata Architecture and Preservation.
Kansas City, Missouri

Prepared by:

Terracon Consultants, Inc.
Bryant, Arkansas

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September 22, 2023

Strata Architecture and Preservation
1701 Oak Street, Suite 100
Kansas City, MO 64108

Attn: Ms. Angie Geist-Gaebler
President
P: 816-474-0900
E: angie@strata-arch.com

Re: Asbestos and Lead-Containing Paint Inspection
Buckstaff Bathhouse - Roof
509 Central Avenue
Hot Springs, Arkansas
Terracon Project No. 35237083

Dear Ms. Geist-Gaebler:

The purpose of this report is to present the results of an asbestos and lead-containing paint inspection performed on March 14, 2023, at the above-referenced site roof in Hot Springs, Arkansas. This inspection was conducted in accordance with our contractor services agreement with Strata Architecture and Preservation. (Strata) dated February 18, 2023. We understand that this inspection was requested to facilitate the planned renovation of the roof.

Asbestos was not identified in samples collected and analyzed for this project. **Lead-containing paint was identified** in the samples collected and analyzed for this project.

Terracon appreciates the opportunity to provide this service to Strata Architecture and Preservation. If you have questions regarding this report, please contact Jody Adams in our Bryant, Arkansas Office at 501.870.9292.

Sincerely,
Terracon Consultants, Inc.

Prepared by:

Jody Adams

Jody Adams, P.G.
Project Manager

Reviewed by:

A handwritten signature in black ink, appearing to read "William L. Wright".

William L. Wright
Project Manager

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**ASBESTOS AND LEAD-CONTAINING PAINT
INSPECTION REPORT
Buckstaff Bathhouse - Roof
509 Central Avenue
Hot Springs, Arkansas**

EXECUTIVE SUMMARY

Terracon Consultants, Inc. (Terracon) conducted an asbestos and lead-containing paint inspection of the roof of the Buckstaff Bathhouse located at 509 Central Avenue, Hot Springs, Arkansas. The subject building consists of a three-story historical bath house. The purpose of this inspection was to identify and sample suspect asbestos-containing materials (ACM) and lead-containing paints (LCP) and to provide information regarding the identity, locations, condition and approximate quantities of ACM and LCP that may require special handling and waste disposal as part of planned building demolition.

The asbestos inspection was performed on March 14, 2023, by a State of Arkansas certified asbestos inspector in general accordance with the sampling protocols established in Environmental Protection Agency (EPA) 40 Code of Federal Regulations (CFR) 763, the Asbestos Hazard Emergency Response Act (AHERA), and in general accordance with our contractor services agreement with Strata Architecture and Preservation.

Terracon collected 20 bulk samples from six homogenous areas of suspect ACM observed. Asbestos was not identified in the samples collected and analyzed for the project.

Terracon collected five samples from various painted surfaces observed. Analysis of these samples yielded results above the limit of detection (LOD) for the analytical method. All of the five samples identified lead concentrations above the analytical detection limit.

Please refer to the main report for details.

**ASBESTOS AND LEAD-CONTAINING PAINT
INSPECTION REPORT**
Buckstaff Bathhouse
509 Central Avenue
Hot Springs, Arkansas
Terracon Project No. 35237083

1.0 INTRODUCTION

Terracon Consultants, Inc. (Terracon) conducted an asbestos and lead-containing paint inspection of the roof of the Buckstaff Bathhouse located at 509 Central Avenue in Hot Springs, Arkansas. It is our understanding the inspection was conducted to facilitate the planned renovation of the roof of the structure. This inspection was conducted in general accordance with our contractor services agreement with Strata Architecture and Preservation.

Exterior building components on the roof were inspected, and homogeneous areas of suspect asbestos-containing materials (ACM) were visually identified and documented. Although reasonable effort was made to inspect accessible suspect materials, additional suspect but unsampled materials could be located in walls, in voids or in other concealed areas. Suspect ACM samples were collected in general accordance with the sampling protocols outlined in Environmental Protection Agency (EPA) regulation 40 CFR 763, the Asbestos Hazard Emergency Response Act (AHERA). Samples were delivered to an accredited laboratory for analysis by Polarized Light Microscopy (PLM).

In addition, paint chip samples were collected to determine the presence or absence of lead content in observed paint on the roof.

1.1 Project Objective

The purpose of this inspection was to identify and sample suspect ACM and Lead Containing Paint (LCP). This inspection provides information regarding the identity, locations, condition, and approximate quantities of ACM and LCP that may require special handling and waste disposal as part of the renovation of the roof.

We understand this asbestos inspection was requested to facilitate the planned renovation of the roof of the subject building. EPA regulation 40 CFR 61, Subpart M, National Emission Standards for Hazardous Air Pollutants (NESHAP), prohibits the release of asbestos fibers to the atmosphere during renovation or demolition activities. The asbestos NESHAP requires that potentially regulated ACM (RACM) be identified, classified and quantified prior to planned disturbances or demolition activities.

1.2 Reliance

This report is for the exclusive use of Strata for the project being discussed. Reliance by any other party on this report is prohibited without written authorization of Terracon and Strata. Reliance on this report by Strata and all authorized parties will be subject to the terms, conditions, and limitations stated in the proposal, this report and our contractor services agreement with Strata.

2.0 BUILDING DESCRIPTION

Residential Structure	
Building Description	Three-story historical bath house. The building is approximately 27,000 square feet
Survey area	Exterior roof
Exterior walls	Brick and concrete
Roof	Rolled TPO roofing membrane

3.0 ASBESTOS INSPECTION FIELD ACTIVITIES

The inspection was conducted by Mr. Jody Adams, State of Arkansas certified asbestos inspector; copies of the asbestos inspector training certificate are attached in Appendix G. The inspection was conducted in general accordance with the sample collection protocols established in EPA regulation 40 CFR 763, the AHERA. A summary of inspection activities is provided below.

3.1 Visual Assessment

Our inspection activities began with visual observation of the exterior roof of the building to identify homogeneous areas of suspect ACM. A homogeneous area (HA) consists of building materials that appear similar throughout in terms of color, texture and date of application. Exterior assessment was conducted throughout visually accessible areas of the roof. Building materials identified as concrete, glass, wood, masonry, metal or rubber were not considered suspect ACM.

Terracon observed below roofing materials in several areas, where possible, and did not observe additional coverings/layers, however; additional roofing material may be concealed in isolated areas.

3.2 Physical Assessment

A physical assessment of each HA of suspect ACM was conducted to assess the friability and condition of the materials. A friable material is defined by the EPA as a material which can be crumbled, pulverized or reduced to powder by hand pressure when dry. Friability was assessed by physically touching suspect materials.

3.3 Sample Collection

Based on results of the visual observation, bulk samples of suspect ACM were collected in general accordance with EPA sampling protocols. Random samples of suspect ACM were collected from each HA. Terracon collected bulk samples using wet methods as applicable to reduce the potential for fiber release. Samples were placed in sealable containers and labeled with unique sample numbers using an indelible marker.

Terracon collected 20 bulk samples from six HAs of suspect ACM observed. A summary of suspect ACM samples collected is included as Appendix A.

3.4 Sample Analysis

Bulk samples were submitted under chain of custody to Moody Labs of Farmers Branch Texas for analysis by PLM with dispersion staining techniques per USEPA's *Method for the Determination of Asbestos in Bulk Building Materials* (600/R-93-116). The percentage of asbestos, where applicable, was determined by microscopic visual estimation. Moody is accredited under the National Voluntary Laboratory Accreditation Program (Accreditation No. 102056-0).

4.0 LEAD-CONTAINING PAINT FIELD ACTIVITIES

Mr. Jody Adams conducted the lead containing paint inspection to identify LCP that may be present in the building prior to demolition activities. This information is necessary for contractors to comply with OSHA regulation 29 CFR 1926.62 Safety and Health Regulations for Construction – Lead.

Terracon collected five paint chip samples from representative paint coatings observed. These samples were submitted under chain-of-custody to IATL International of Mount Laurel, New Jersey for analysis by Atomic Absorption Spectrophotometry (EPA SW846 3050B; 7000B); the analytical results are reported in percent by weight. IATL participates and is accredited by the National Lead Laboratory Program (NLLAP).

4.1 Site Limitations

It should be noted that suspect LCP, other than those identified during the sampling, may be present in the building. This LCP testing is not considered comprehensive in nature, and the results are not intended to identify all lead hazards present in the building or to be used to prepare detailed cost estimates for abatement. Based on information provided by the client, the subject building is proposed for demolition. Suspect LCP which have not been specifically evaluated should be tested prior to disturbance of the material. If additional suspect LCP is identified during the renovation process, those materials should be assumed LCP pending sampling and laboratory analysis to rebut the presence of lead.

Painted surfaces other than those observed on the roof of the building were not included in the inspection.

4.2 Methodology and Analysis

The lead-containing paint testing was conducted by scraping approximately 2 square inches of paint from the supporting substrate. Sample results reported below the limit of detection may contain lead at a concentration below the analytically defined limit. A summary of the lead-containing paint samples and analysis is included in Appendix C.

No materials were assumed to be LCP. Any inaccessible areas that contain painted surfaces should be tested when access permits or should be assumed to contain lead.

5.0 REGULATORY OVERVIEW

5.1 Asbestos Regulatory Overview

The asbestos NESHAP (40 CFR Part 61, Subpart M) regulates asbestos fiber emissions and asbestos waste disposal practices. It also requires the identification and classification of existing building materials prior to demolition or renovation activity. Under NESHAP, asbestos-containing building materials are classified as either friable, Category I nonfriable or Category II non-friable ACM. Friable materials are those that, when dry, may be crumbled, pulverized or reduced to powder by hand pressure. Category I non-friable ACM includes packings, gaskets, resilient floor coverings and asphalt roofing products containing more than 1% asbestos. Category II nonfriable ACM are any materials other than Category I materials that contain more than 1% asbestos.

Friable ACM, Category I and Category II nonfriable ACM which is in poor condition and has become friable or which will be subjected to drilling, sanding, grinding, cutting or abrading and which could be crushed or pulverized during anticipated renovation or demolition activities are considered regulated ACM (RACM). A memo issued by the Arkansas Department of Environmental Quality (ADEQ) on December 19, 2006, clarifies that Category I nonfriable ACM becomes RACM if it has become friable or it will be or has been subjected to sanding, grading, cutting, or abrading, whether by manual or mechanical means.

RACM must be removed prior to renovation or demolition activities which will disturb the materials. In the state of Arkansas, asbestos activities are regulated by the ADEQ. The ADEQ requires that asbestos-related activities conducted in a public building be performed by personnel licensed by the ADEQ. The owner or operator must provide the ADEQ with written notification of planned removal activities at least 10 working days prior to the commencement of asbestos abatement activities. Asbestos abatement must be performed by ADEQ-licensed asbestos abatement contractors in accordance with a Project Design prepared by an ADEQ-licensed Asbestos Consultant. Air monitoring must be conducted during the abatement activities; a third-party air

Asbestos and Lead Paint Inspection

Buckstaff Bathhouse - Roof ■ Hot Springs, Arkansas

September 22, 2023 ■ Project No. P35237083



monitor is recommended. Management Plans developed for the in-place management of asbestos-containing materials must be developed by an ADEQ-licensed Management Planner.

The Occupational Safety and Health Administration (OSHA) Asbestos standard for construction (29 CFR 1926.1101) regulates workplace exposure to asbestos. The OSHA standard requires that employee exposure to airborne asbestos fibers be maintained below the Permissible Exposure Limit (PEL) of 0.1 fibers per cubic centimeter (f/cc) of air as an 8-hour Time Weighted Average (TWA). The OSHA standard classifies construction and maintenance activities which could disturb ACM and specifies work practices and precautions which employers must follow when engaging in each class of regulated work.

5.2 Lead Paint Regulatory Overview

OSHA regulations govern exposure of workers to lead, regardless of the concentration of lead identified. The OSHA regulations, which have been established for general and construction industries, cover any type of workplace activity that could expose an employee to potential lead contamination (OSHA Standards 29 CFR 1926.62 and 1910.1025).

Any contractor and/or workers conducting any renovation, repair or demolition activities should be notified of these findings and the contractor should be tasked with determining whether lead-safe work practices are to be employed and/or whether personnel should be provided personal protective equipment (PPE).

All occupational exposure to lead occurring in the course of construction work, including maintenance activities, painting, alteration and repairs is subject to the OSHA Lead Exposure in Construction standard (29 CFR 1926.62).

Construction work covered by 29 CFR 1926.62 includes any repair or renovation activities or other activities that disturb in-place lead-containing materials but does not include routine cleaning and repainting where there is insignificant damage, wear, or corrosion of existing lead-containing coatings or substrates. Employers must assure that no employee will be exposed to lead at concentrations greater than 50 micrograms per cubic meter averaged over an 8-hour period without adequate protection. Utilizing lead-safe work practices is recommended to reduce employee exposure during activities that disturb or generate lead dust.

The Resource Conservation and Recovery Act (RCRA) gives the USEPA authority to regulate the waste status of demolition or renovation debris, including lead-containing materials. The USEPA has stated that components removed with intact lead-based paint (LBP) that is not delaminating from the substrate may be disposed as general demolition debris. If the LBP is stripped from components, or if it is delaminating from the substrate, the waste may be subject to hazardous waste rules [i.e., TCLP]. Lead containing wastes are considered hazardous waste under RCRA if TCLP results exceed 5 milligrams per liter (mg/L). USEPA exempts from most RCRA requirements

those generators whose combined hazardous waste generation is less than 100 kilograms (kg) per month.

The above overview is not intended to be inclusive of all potentially pertinent regulatory information. The relevant USEPA and OSHA standards should be consulted prior to undertaking activities involving the demolition, renovation, or maintenance of surfaces coated with lead-containing paints.

6.0 FINDINGS AND RECOMMENDATIONS

6.1 Asbestos Sample Results

Asbestos **was not** identified in the samples collected and analyzed for this project.

A summary of the suspect ACM materials sampled are presented in Appendix A. Laboratory analytical reports are included in Appendix B.

It should be noted that suspect materials, other than those identified during the March 14, 2023, inspection may exist within the building or below existing roofing material. Should suspect materials other than those which were identified during this inspection be uncovered prior to or during the abatement and/or demolition process, those materials should be assumed asbestos-containing until sampling and analysis can confirm or deny their asbestos content.

6.2 Lead Sample Results

The following materials were determined to **contain concentrations of lead** above the limit of detection for the analytical method performed and classified as lead containing under the OSHA Lead Standard for Construction:

- White on wood and metal windows, frames, and doors
- White on concrete roof parapet and roof protrusions
- Silver on roof vents and sky lights
- Gray on metal ladders
- Black on metal drainpipes

The lead paint sample summary is provided in Appendix C; the laboratory analytical report is provided in Appendix D.

Any Contractor and/or workers conducting any renovation, repair or demolition activities should be notified of these findings and the contractor should be tasked with determining whether lead-safe work practices are to be employed and/or whether personnel should be provided personal protective equipment (PPE).

Asbestos and Lead Paint Inspection

Buckstaff Bathhouse - Roof ■ Hot Springs, Arkansas

September 22, 2023 ■ Project No. P35237083



It should be understood, however, that OSHA regulations govern exposure of workers to lead, regardless of the concentration of lead identified. The OSHA regulations, which have been established for general and construction industries, cover any type of workplace activity that could expose an employee to potential lead contamination (OSHA Standards 29 CFR 1926.62 and 1910.1025).

7.0 GENERAL COMMENTS

The results, findings, conclusions and recommendations expressed in this report are containing on conditions observed during our inspection of the subject buildings. The information contained in this report is relevant to the date on which this inspection was performed and should not be relied upon to represent conditions at a later date. This report has been prepared on behalf of and exclusively for use by the Strata for specific application to their project as discussed. This report is not a bidding document. Contractors or consultants reviewing this report must draw their own conclusions regarding further investigation or remediation deemed necessary.

APPENDIX A
ASBESTOS INSPECTION SAMPLE SUMMARY

APPENDIX A
ASBESTOS INSPECTION SAMPLE SUMMARY
Buckstaff Bathhouse
509 Central Avenue
Hot Springs, Arkansas
Terracon Project No. 35237083

HA	SAMPLE NO.	DESCRIPTION	SAMPLE LOCATION	NESHAP CATEGORY	ASBESTOS CONTENT
1	1	Roof core	Main roof, northwest	NA	ND
1	2	Roof core	Main roof, east	NA	ND
1	3	Roof core	Main roof southwest	NA	ND
1	4	Roof core	Upper roof, central		
1	5	Roof core	Lower roof, east		
2	1	Window glaze	Lower roof windows	NA	ND
2	2	Window glaze	Lower roof windows	NA	ND
2	3	Window glaze	Lower roof windows	NA	ND
3	1	Window glaze	Main roof windows	NA	ND
3	2	Window glaze	Main roof windows	NA	ND
3	3	Window glaze	Main roof windows	NA	ND
4	1	Caulk (white)	Roof perimeter	NA	ND
4	2	Caulk (white)	Roof perimeter	NA	ND
4	3	Caulk (white)	Roof perimeter	NA	ND
5	1	Roof membrane with adhesive	Roof parapet, central	NA	ND
5	2	Roof membrane with adhesive	Roof parapet, north	NA	ND
5	3	Roof membrane with adhesive	Roof parapet, south	NA	ND
6	1	Roofing tar	North central roof protrusion	NA	ND
6	2	Roofing tar	North central roof protrusion	NA	ND
6	3	Roofing tar	Main roof brick wall	NA	ND

APPENDIX B
ASBESTOS LABORATORY ANALYTICAL REPORTS



PLM Summary Report

NVLAP Lab Code 102056-0

TDSHS License No. 300084

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

Client :	Terracon - Bryant	Lab Job No. :	23B-03268
Project :	Buckstaff Roof	Report Date :	03/24/2023
Project # :	35237083	Sample Date :	03/14/2023
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

On 3/20/2023, twenty (20) bulk material samples were submitted by a representative of Terracon - Bryant for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
1-1	Roof Core, Main Roof, Northwest	None Detected - Roofing Membrane None Detected - Felt Facing None Detected - Foam Insulation
1-2	Roof Core, Main Roof, East	None Detected - Roofing Membrane None Detected - Felt Facing None Detected - Foam Insulation
1-3	Roof Core, Main Roof, Southwest	None Detected - Felt Facing None Detected - Foam Insulation
1-4	Roof Core, Upper Roof, Central	None Detected - Felt Facing None Detected - Foam Insulation
1-5	Roof Core, Lower Roof, East	None Detected - Roofing Membrane None Detected - Felt Facing None Detected - Foam Insulation
2-1	Window Glaze, Lower Roof Windows	None Detected - Window Glazing
2-2	Window Glaze, Lower Roof Windows	None Detected - Window Glazing
2-3	Window Glaze, Lower Roof Windows	None Detected - Window Glazing
3-1	Window Glaze, Main Roof Window	None Detected - Window Glazing
3-2	Window Glaze, Main Roof Window	None Detected - Window Glazing
3-3	Window Glaze, Main Roof Window	None Detected - Window Glazing
4-1	Caulk (White), Roof Perimeter	None Detected - Caulking
4-2	Caulk (White), Roof Perimeter	None Detected - Caulking
4-3	Caulk (White), Roof Perimeter	None Detected - Caulking
5-1	Roof Membrane with Adhesive, Roof Parapet Central	None Detected - Roofing Membrane None Detected - Yellow Adhesive
5-2	Roof Membrane with Adhesive, Roof Parapet North	None Detected - Roofing Membrane None Detected - Yellow Adhesive



PLM Summary Report

NVLAP Lab Code 102056-0

TDSHS License No. 300084

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

Client :	Terracon - Bryant	Lab Job No. :	23B-03268
Project :	Buckstaff Roof	Report Date :	03/24/2023
Project # :	35237083	Sample Date :	03/14/2023
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

Page 2 of 2

On 3/20/2023, twenty (20) bulk material samples were submitted by a representative of Terracon - Bryant for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
5-3	Roof Membrane with Adhesive, Roof Parapet South	None Detected - Roofing Membrane None Detected - Yellow Adhesive
6-1	Roofing Tar, North Central Roof Protrusion	None Detected - Roofing Tar
6-2	Roofing Tar, North Central Roof Protrusion	None Detected - Roofing Tar
6-3	Roofing Tar, Main Roof Brick Wall	None Detected - Roofing Tar

These samples were analyzed by layers. Quantification, unless otherwise noted, is performed by calibrated visual estimate. The test report shall not be reproduced except in full without written approval of the laboratory. The results relate only to the items tested. These test results do not imply endorsement by NVLAP or any agency of the U.S. Government. Accredited by the National Voluntary Laboratory Accreditation Program for Bulk Asbestos Fiber Analysis under Lab Code 102056-0.



Analyst(s): Hannah Wall

Lab Manager : Heather Lopez

Lab Director : Bruce Crabb

Approved Signatory : *Heather Lopez*

Approved Signatory : *Bruce Crabb*

Thank you for choosing Moody Labs

Moody Labs
 2051 Valley View Lane
 Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report
 Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
 TDSHS License No. 300084

Client : Terracon - Bryant
 Project : Buckstaff Roof
 Project # : 35237083

Lab Job No. : 23B-03268
 Report Date : 03/24/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
1-1	Roofing Membrane (White / Black)	50%	Synthetic Fiber Mesh	15%	03/24	HW
			Vinyl Binders	85%		
	Felt Facing (Brown)	20%	Glass Wool Fibers	20%		
			Cellulose Fibers	80%		
	Foam Insulation (Light Yellow)	30%	Synthetic Foam	100%		
1-2	Roofing Membrane (White / Black)	25%	Synthetic Fiber Mesh	15%	03/24	HW
			Vinyl Binders	85%		
	Felt Facing (Brown)	25%	Glass Wool Fibers	20%		
			Cellulose Fibers	80%		
	Foam Insulation (Light Yellow)	50%	Synthetic Foam	100%		
1-3	Felt Facing (Black)	35%	Glass Wool Fibers	20%	03/24	HW
			Cellulose Fibers	80%		
	Foam Insulation (Light Yellow)	65%	Synthetic Foam	100%		
1-4	Felt Facing (Black)	85%	Glass Wool Fibers	20%	03/24	HW
			Cellulose Fibers	80%		
	Foam Insulation (Light Yellow)	15%	Synthetic Foam	100%		
1-5	Roofing Membrane (White / Black)	25%	Synthetic Fiber Mesh	15%	03/24	HW
			Vinyl Binders	85%		
	Felt Facing (Brown)	45%	Glass Wool Fibers	20%		
			Cellulose Fibers	80%		
	Foam Insulation (Light Yellow)	30%	Synthetic Foam	100%		
2-1	Window Glazing (Grey / White)	100%	Calcite	60%	03/24	HW
			Binders / Fillers	40%		
2-2	Window Glazing (Grey / White)	100%	Calcite	60%	03/24	HW
			Binders / Fillers	40%		
2-3	Window Glazing (Grey / White)	100%	Calcite	60%	03/24	HW
			Binders / Fillers	40%		
3-1	Window Glazing (Grey / White)	100%	Calcite	60%	03/24	HW
			Binders / Fillers	40%		

Moody Labs
 2051 Valley View Lane
 Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report
 Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
 TDSHS License No. 300084

Client : Terracon - Bryant
 Project : Buckstaff Roof
 Project # : 35237083

Lab Job No. : 23B-03268
 Report Date : 03/24/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
3-2	Window Glazing (Grey / White)	100%	Calcite	60%	03/24	HW
			Binders / Fillers	40%		
3-3	Window Glazing (Grey / White)	100%	Calcite	60%	03/24	HW
			Binders / Fillers	40%		
4-1	Caulking (White)	5%	Calcite	50%	03/24	HW
			Binders / Fillers	50%		
	Plaster (White)	95%	Aggregate	65%		
			Calcite / Binders	35%		
4-2	Caulking (White)	100%	Calcite	50%		
			Binders / Fillers	50%		
4-3	Caulking (White)	5%	Calcite	50%	03/24	HW
			Binders / Fillers	50%		
	Plaster (White)	95%	Aggregate	65%		
			Calcite / Binders	35%		
5-1	Roofing Membrane (Tan / Black)	97%	Synthetic Fiber Mesh	15%	03/24	HW
	Yellow Adhesive (Yellow)	3%	Vinyl Binders	85%		
			Glue Binders	100%		
5-2	Roofing Membrane (Tan / Black)	97%	Synthetic Fiber Mesh	15%	03/24	HW
	Yellow Adhesive (Yellow)	3%	Vinyl Binders	85%		
			Glue Binders	100%		
5-3	Roofing Membrane (Tan / Black)	99%	Synthetic Fiber Mesh	15%	03/24	HW
	Yellow Adhesive (Yellow)	1%	Vinyl Binders	85%		
			Glue Binders	100%		
6-1	Roofing Tar (Black)	100%	Tar Binders	100%	03/24	HW
6-2	Roofing Tar (Black)	100%	Tar Binders	100%	03/24	HW
6-3	Roofing Tar (Black)	100%	Tar Binders	100%	03/24	HW



Chain of Custody

Lab Job # 23B-03268 PLM 20
Lab Job #
Lab Job #

AFTER HOURS / WEEKEND WORK: [] YES [] NO
Please call in advance for after hours / immediate pricing & availability

Page ___ of ___

ASBESTOS PLM

Bulk [] Immediate [] 1 day [] 2 day [] 3 day [] 5-7 day
[] Analyze All [] Positive Stop

Jody Adams

MOLD

Direct Exam [] Immed [] 1 day [] 2 day [] 5 day
Standard Air [] Immed [] 1 day [] 2 day [] 5 day
Expanded Air [] Immed [] 1 day [] 2 day [] 5 day
TPC w/ Yeast & Mold (TYMC)** [] 5 day
Culture** [] 10-14 days
Analyze Blanks [] Yes [] No

PCM Air (7400)

[] Immediate [] 1 day [] 2 day [] 3 day [] 5 day
Analyze Blanks [] Yes [] No

TOTAL DUST(0500/0600)

[] 1 day [] 2 day

BACTERIA**

Total Plate Count (TAMC) [] 2 day
Coliform & E. coli (P/A) [] 1 day
Coliform & E. coli (Q) [] 1 day
Enterococci (P/A) [] 1 day

Please note Bateria / Mold Culture turnarounds are approximate and subject to analytical requirements

ASBESTOS TEM

Air AHERA Method [] Late Night* [] 6 hr [] 12 hr [] 24 hr
Air 7402 (Modified) [] 1 day [] 2 day [] 3 day
Bulk [] 1 day [] 2 day [] 3 day [] 5 day
Water/Wipe/Micro Vac [] 1 day [] 2 day [] 3 day
Analyze Blanks [] Yes [] No

*Late night analysis surcharges apply

OTHER:

Billing Company / City: Terraco/Biyant

of Samples: Sample Date: 3-14-23

Project: Bucks Bldg roof

Project #: 35237083

Contact Information: Name: Jody Adams

Phone #:

E-mail Results to: Jody.Adams

Mobile #:

Invoice Address:

P.O. #:

Please review paperwork and samples before submitting to lab. Unsealed / improperly packaged / damaged / expired samples or excessive administrative requests may incur additional fees

Notes:

Table with 4 columns: Sample #, Sample Description, Vol. / Area (if applicable), Location / Notes. Contains handwritten entries for roof core, window glaze, and caulk samples.

Released By: [Signature] Date/Time: 3/17/23/1100
Received By: [Signature] Date/Time: 3/20/23 9:25

APPENDIX C
LEAD PAINT SAMPLE SUMMARY

APPENDIX C
LEAD-CONTAINING PAINT SAMPLE SUMMARY
Buckstaff Bathhouse
509 Central Avenue
Hot Springs, Arkansas
Terracon Project No. 35237083

Sample No.	Paint Color	Paint Substrate	Material Location	Analytical Result (% wt)
B-L-1	White	Wood and metal	Windows and doors	0.43
B-L-2	White	Concrete	Roof parapet	0.13
B-L-3	Silver	Metal	Vents and sky lights	10
B-L-4	Grey	Metal	Ladders	0.91
B-L-5	Black	Metal	Drainpipes	5.6

APPENDIX D
LEAD PAINT ANALYTICAL LABORATORY DATA

CERTIFICATE OF ANALYSIS

Client: Terracon
25809 I-30 South
Bryant AR 72022

Report Date: 3/24/2023
Report No.: 680156 - Lead Paint
Project: Buckstaff
Project No.: 35237083

Client: TER908

LEAD PAINT SAMPLE ANALYSIS SUMMARY

Lab No.: 7587889 **Description:** White On Wood And Metal **Result (% by Weight):** 0.43
Client No.: B-L-1 **Location:** **Result (ppm):** 4300
Comments:


Lab No.: 7587890 **Description:** White On Concrete **Result (% by Weight):** 0.13
Client No.: B-L-2 **Location:** **Result (ppm):** 1300
Comments:


Lab No.: 7587891 **Description:** Silver On Metal **Result (% by Weight):** 10
Client No.: B-L-3 **Location:** **Result (ppm):** 100000
Comments:

Lab No.: 7587892 **Description:** Grey On Metal **Result (% by Weight):** 0.091
Client No.: B-L-4 **Location:** **Result (ppm):** 910
Comments: *

Lab No.: 7587893 **Description:** Black On Metal **Result (% by Weight):** 5.6
Client No.: B-L-5 **Location:** **Result (ppm):** 56000
Comments: *

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 3/20/2023
Date Analyzed: 03/24/2023
Signature: 
Analyst: Chad Shaffer

Approved By: 
Frank E. Ehrenfeld, III
Laboratory Director

CERTIFICATE OF ANALYSIS

Client: Terracon
25809 I-30 South
Bryant AR 72022

Report Date: 3/24/2023
Report No.: 680156 - Lead Paint
Project: Buckstaff
Project No.: 35237083

Client: TER908

Appendix to Analytical Report:

Customer Contact: Jody Adams

Method: ASTM D3335-85a, US EPA SW846 3050B:7000B

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com

iATL Office Manager: wchampion@iatl.com

iATL Account Representative: Semih Kocahasan

Sample Login Notes: See Batch Sheet Attached

Sample Matrix: Paint

Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and in our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by ASTM D3335-85a by AAS

Certification:

- National Lead Laboratory Program (NLLAP): AIHA-LAP, LLC No. 100188

- NYSDOH-ELAP No. 11021

This report meets the standards set forth in the EPA's National Lead Laboratory Accreditation Program (NLLAP) through the Laboratory Quality System Requirements (LQSR) Revision 3.0 November 5, 2007. All Environmental Lead Proficiency Analytical Testing (ELPAT) is through the AIHA-PAT established program.

Regulatory limit is 0.5% lead by weight (EPA/HUD guidelines). Recommend multiple sampling for all samples less than regulatory limit for confirmation.

All results are based on the samples as received at the lab. iATL assumes that appropriate sampling methods have been used and that the data upon which these results are based have been accurately supplied by the client.

Method Detection Limit (MDL) per EPA Method 40CFR Part 136 Appendix B.

Reporting Limit (RL) based upon Lowest Standard Determined (LSD) in accordance with AIHA-ELLAP policies.

LSD=0.2 ppm MDL=0.006% by weight. RL= 0.010% by weight (based upon 100 mg sampled).

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a complete list with highlighted disclaimers pertinent to this project. For a full explanation of these and other disclaimers, please inquire at customerservice@iatl.com.

CERTIFICATE OF ANALYSIS

Client: Terracon
25809 I-30 South
Bryant AR 72022

Report Date: 3/24/2023
Report No.: 680156 - Lead Paint
Project: Buckstaff
Project No.: 35237083

Client: TER908

- * Insufficient sample provided to perform QC reanalysis (<200 mg)
- ** Not enough sample provided to analyze (<50 mg)
- *** Matrix / substrate interference possible.

< less than sign, signifies none-detected below the empirical value based upon sub-sampled mass. This is often below the Reporting Limit (see above).

Chain of Custody

– Environmental Lead –

Contact Information

Client Company: <u>Terracon</u>	Project Number: <u>Buckstaff</u>
Office Address: <u>25809 I-30 S</u>	Project Name: <u>35237083</u>
City, State, Zip: <u>Bryant, AR 72022</u>	Primary Contact: <u>Jody Adams</u>
Fax Number: _____	Office Phone: _____
Email Address: <u>Jody.Adams@Terracon.com</u>	Cell Phone: <u>477-970-0290</u>

iATL is accredited by the National Lead Laboratory Accreditation Program (NLLAP) to perform analytical testing of environmental samples for lead (Pb). The accreditation is through AIHA-LAP, LLC and several other nationally recognized state programs.

Matrix/Method:

- Paint by AAS: ASTM D3335-85a, 2009
- Wipe/Dust by AAS: SW 846: 3050B: 700B, 2010
- Air by AAS: NIOSH 7082, 1994
- Soil by AAS: EPA SW 846 (Soil)
- Water by AAS-GF: ASTM D3559-03D, US EPA 200.9
- Other Metals (Cd, Zn, Cr) by AAS
- Toxicity Characteristic Leaching Procedure (TCLP) by AAS: US EPA 1311
- Other _____

Special Instructions:

Turnaround Time

Preliminary Results Requested Date: _____ Verbal Email Fax

Specific date / time

10 Day 5 Day 3 Day 2 Day 1 Day* 12 Hour** 6 Hour** RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization): _____	Date: <u>3-17-23</u>	Time: <u>CEIVED</u>
Received (Name / iATL): _____	Date: _____	Time: _____
Sample Login (Name / iATL): _____	Date: _____	Time: <u>h</u>
Analysis(Name(s) / iATL): <u>L3/24/23</u>	Date: _____	Time: _____
QA/QC Review (Name / iATL): <u>L3/24/23</u>	Date: _____	Time: <u>MAR 23 2023</u>
Archived / Released: _____	QA/QC InterLAB Use: _____	Date: _____
		Time: _____

IATL - BY _____

Sample Log

-Environmental Lead -

Client: Terracon

Project: Buck staff

Sampling Date/Time: 3-14-23

Client Sample #	iATL #	Location/ Description	Flow Rate	Start End	Sampling time (min)	Area (ft ²) Volume (L)	Results ()
B-L-1	7587889	white on wood & metal					
B-L-2	7587890	white on concrete					
B-L-3	7587891	silver on metal					
B-L-4	7587892	grey on metal					
B-L-5	7587893	black on metal					

* = Insufficient Sample Provided to Perform QC Reanalysis (<200mg)
 ** = Insufficient Sample Provided to Analyze (<50mg) *** = Matrix / Substrate Interference Possible
 FB = Method Requires the submittal of blank(s). ML = Multi Layered Sample. May result in inconsistent results.
 These preliminary results are issued by iATL to expedite procedures by clients based upon the above data. iATL assumes that all of the sampling methods and data upon which these results are based, has been accurately supplied by the client. These results may not have been reviewed by the Laboratory Director. Final Certificate of Analysis will follow these preliminary results. The signed COA is to be considered the official results. All EPA, HUD, and NJDEP conditions apply.

APPENDIX E
FIELD DIAGRAM



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY GOOGLE MAPS

Project Manager: JBA	Project No. 35237083	 25809 I 30 Bryant, AR 72022-9313	Sample Location Diagram	Figure
Drawn by: JBA	Scale: N.T.S.		Buckstaff Bath House 509 Central Avenue Hot Springs, AR	
Checked by: JBA	File Name:			
Approved by: JBA	Date:			

APPENDIX F
PHOTO LOG



Photo #1 Buckstaff Bathhouse located at 509 Central Avenue in Hot Springs, Arkansas.



Photo #2 Overview of the roof.



Photo #3 Example of roof core sample location



Photo #4 Overview of the roof.



Photo #5 Roof vent.



Photo #6 Roof vent.



Photo #7 Example of window observed on roof.



Photo #8 Roof parapet



Photo #9 Sky light.



Photo #10 Remnant roofing tar observed on the wall.



Photo #11 Metal drain pipe and windows.



Photo #12 Roof penetration with remnant roofing tar.

APPENDIX G
CERTIFICATIONS

STATE OF ARKANSAS DEPARTMENT OF ENERGY AND ENVIRONMENT

Division of Environmental Quality

OFFICE OF AIR QUALITY, ASBESTOS PROGRAM

TERRACON CONSULTANTS, INC.

*having qualified as required by law in accordance with the rules adopted by the
Arkansas Pollution Control and Ecology Commission's Rule 21 pursuant to A.C.A. 20-27-1001, et seq.,
relative to performing asbestos related work within the State of Arkansas is licensed as an*

Asbestos Abatement Consultant

License Number: 000311

Issue Date: 2/2/2023

Expiration Date: 2/2/2024



Caleb J. Osborne
Division of Environmental Quality, Director
Chief Administrator, Environment
Arkansas Department of Energy & Environment

STATE OF ARKANSAS DEPARTMENT OF ENERGY AND ENVIRONMENT

Division of Environmental Quality

OFFICE OF AIR QUALITY, ASBESTOS PROGRAM

JODY B. ADAMS

having satisfied the requirements necessary to meet the provisions of AHERA/ASHARA under TSCA Title II and the Arkansas Pollution Control and Ecology Commission's Rule 21 pursuant to A.C.A. § 20-27-1001, et seq., within the State of Arkansas is hereby certified to perform activities related to asbestos containing material in the following discipline(s)

Discipline	Issue Date	Effective Date	Expiration Date
Inspector	10/13/2022	10/21/2022	10/31/2023
Project Designer	04/07/2022	05/04/2022	04/30/2023



Certification Number: 013888

Julie Linck

Julie Linck

Chief Administrator, Environment
Arkansas Department of Energy and Environment

APPENDIX B

Asbestos and Lead-Containing Paint Inspection Report

Fordyce Bathhouse - Roof
369 Central Avenue
Hot Springs, Garland County, AR

September 22, 2023

Terracon Project No. 35237083



Prepared for:
Strata Architecture and Preservation.
Kansas City, Missouri

Prepared by:
Terracon Consultants, Inc.
Bryant, Arkansas

terracon.com

Terracon

Environmental



Facilities



Geotechnical



Materials



25809 I-30 South
Bryant, Arkansas
P (501) 847-9292
F (501) 847-9210
Terracon.com

September 22, 2023

Strata Architecture and Preservation
1701 Oak Street, Suite 100
Kansas City, MO 64108

Attn: Ms. Angie Geist-Gaebler
President
P: 816-474-0900
E: angie@strata-arch.com

Re: Asbestos and Lead-Containing Paint Inspection
Fordyce Bathhouse - Roof
369 Central Avenue
Hot Springs, Arkansas
Terracon Project No. 35237083

Dear Ms. Geist-Gaebler:

The purpose of this report is to present the results of an asbestos and lead-containing paint inspection performed on March 14 and April 11, 2023, at the above-referenced site roof in Hot Springs, Arkansas. This inspection was conducted in accordance with our contractor services agreement with Strata Architecture and Preservation. (Strata) dated February 18, 2023. We understand that this inspection was requested to facilitate the planned renovation of the roof.

Asbestos was not identified in samples collected and analyzed for this project. **Lead-containing paint was identified** in the samples collected and analyzed for this project.

Terracon appreciates the opportunity to provide this service to Strata Architecture and Preservation. If you have questions regarding this report, please contact Jody Adams in our Bryant, Arkansas Office at 501.870.9292.

Sincerely,
Terracon Consultants, Inc.

Prepared by:

Jody Adams

Jody Adams, P.G.
Project Manager

Reviewed by:

A handwritten signature in black ink, appearing to read "William L. Wright".

William L. Wright
Project Manager

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**ASBESTOS AND LEAD-CONTAINING PAINT
INSPECTION REPORT
Fordyce Bathhouse - Roof
369 Central Avenue
Hot Springs, Arkansas**

EXECUTIVE SUMMARY

Terracon Consultants, Inc. (Terracon) conducted an asbestos and lead-containing paint inspection of the roof of the Fordyce Bathhouse located at 369 Central Avenue, Hot Springs, Arkansas. The subject building consists of a three-story historical bath house. The purpose of this inspection was to identify and sample suspect asbestos-containing materials (ACM) and lead-containing paints (LCP) and to provide information regarding the identity, locations, condition and approximate quantities of ACM and LCP that may require special handling and waste disposal as part of planned building demolition.

The asbestos inspection was performed on March 14 and April 11, 2023, by a State of Arkansas certified asbestos inspector in general accordance with the sampling protocols established in Environmental Protection Agency (EPA) 40 Code of Federal Regulations (CFR) 763, the Asbestos Hazard Emergency Response Act (AHERA), and in general accordance with our contractor services agreement with Strata Architecture and Preservation.

Terracon collected 18 bulk samples from six homogenous areas of suspect ACM observed. Asbestos was not identified in the samples collected and analyzed for the project.

Terracon collected four samples from various painted surfaces observed. Analysis of these samples yielded results above the limit of detection (LOD) for the analytical method. All of the five samples identified lead concentrations above the analytical detection limit.

Please refer to the main report for details.

ASBESTOS AND LEAD-CONTAINING PAINT INSPECTION REPORT

**Fordyce Bathhouse
369 Central Avenue
Hot Springs, Arkansas
Terracon Project No. 35237083**

1.0 INTRODUCTION

Terracon Consultants, Inc. (Terracon) conducted an asbestos and lead-containing paint inspection of the roof of the Fordyce Bathhouse located at 369 Central Avenue in Hot Springs, Arkansas. It is our understanding the inspection was conducted to facilitate the planned renovation of the roof of the structure. This inspection was conducted in general accordance with our contractor services agreement with Strata Architecture and Preservation.

Exterior building components on the roof were inspected, and homogeneous areas of suspect asbestos-containing materials (ACM) were visually identified and documented. Although reasonable effort was made to inspect accessible suspect materials, additional suspect but unsampled materials could be located in walls, in voids or in other concealed areas. Suspect ACM samples were collected in general accordance with the sampling protocols outlined in EPA regulation 40 CFR 763, the Asbestos Hazard Emergency Response Act (AHERA). Samples were delivered to an accredited laboratory for analysis by Polarized Light Microscopy (PLM).

In addition, paint chip samples were collected to determine the presence or absence of lead content in observed paint on the roof.

1.1 Project Objective

The purpose of this inspection was to identify and sample suspect ACM and Lead Containing Paint (LCP). This inspection provides information regarding the identity, locations, condition, and approximate quantities of ACM and LCP that may require special handling and waste disposal as part of the renovation of the roof.

We understand this asbestos inspection was requested to facilitate the planned renovation of the roof of the subject building. EPA regulation 40 CFR 61, Subpart M, National Emission Standards for Hazardous Air Pollutants (NESHAP), prohibits the release of asbestos fibers to the atmosphere during renovation or demolition activities. The asbestos NESHAP requires that potentially regulated ACM (RACM) be identified, classified and quantified prior to planned disturbances or demolition activities.

1.2 Reliance

This report is for the exclusive use of Strata for the project being discussed. Reliance by any other party on this report is prohibited without written authorization of Terracon and Strata. Reliance on this report by Strata and all authorized parties will be subject to the terms, conditions, and limitations stated in the proposal, this report and our contractor services agreement with Strata.

2.0 BUILDING DESCRIPTION

Residential Structure	
Building Description	Three-story historical bath house. The building is approximately 28,000 square feet
Survey area	Exterior roof
Exterior walls	Brick and concrete
Roof	Rolled EPDM roofing membrane and terracotta shingles

3.0 ASBESTOS INSPECTION FIELD ACTIVITIES

The inspection was conducted by Mr. Jody Adams, State of Arkansas certified asbestos inspector; copies of the asbestos inspector training certificate are attached in Appendix G. The inspection was conducted in general accordance with the sample collection protocols established in EPA regulation 40 CFR 763, the AHERA. A summary of inspection activities is provided below.

3.1 Visual Assessment

Our inspection activities began with visual observation of the exterior roof of the building to identify homogeneous areas of suspect ACM. A homogeneous area (HA) consists of building materials that appear similar throughout in terms of color, texture and date of application. Exterior assessment was conducted throughout visually accessible areas of the roof. Building materials identified as concrete, glass, wood, masonry, metal or rubber were not considered suspect ACM.

Terracon observed below roofing materials in several areas, where possible, and did not observe additional coverings/layers, however; additional roofing material may be concealed in isolated areas.

3.2 Physical Assessment

A physical assessment of each HA of suspect ACM was conducted to assess the friability and condition of the materials. A friable material is defined by the EPA as a material which can be crumbled, pulverized or reduced to powder by hand pressure when dry. Friability was assessed by physically touching suspect materials.

3.3 Sample Collection

Based on results of the visual observation, bulk samples of suspect ACM were collected in general accordance with EPA sampling protocols. Random samples of suspect ACM were collected from each HA. Terracon collected bulk samples using wet methods as applicable to reduce the potential for fiber release. Samples were placed in sealable containers and labeled with unique sample numbers using an indelible marker.

Terracon collected 18 bulk samples from six HAs of suspect ACM observed. A summary of suspect ACM samples collected is included as Appendix A.

3.4 Sample Analysis

Bulk samples were submitted under chain of custody to Moody Labs of Farmers Branch Texas for analysis by PLM with dispersion staining techniques per USEPA's *Method for the Determination of Asbestos in Bulk Building Materials* (600/R-93-116). The percentage of asbestos, where applicable, was determined by microscopic visual estimation. Moody is accredited under the National Voluntary Laboratory Accreditation Program (Accreditation No. 102056-0).

4.0 LEAD-CONTAINING PAINT FIELD ACTIVITIES

Mr. Jody Adams conducted the lead paint inspection to identify lead-containing paint (LCP) that may be present in the building prior to demolition activities. This information is necessary for contractors to comply with OSHA regulation 29 CFR 1926.62 Safety and Health Regulations for Construction – Lead.

Terracon collected four paint chip samples from representative paint coatings observed. These samples were submitted under chain-of-custody to IATL International of Mount Laurel, New Jersey for analysis by Atomic Absorption Spectrophotometry (EPA SW846 3050B; 7000B); the analytical results are reported in percent by weight. IATL participates and is accredited by the National Lead Laboratory Program (NLLAP).

4.1 Site Limitations

It should be noted that suspect LCP, other than those identified during the sampling, may be present in the building. This LCP testing is not considered comprehensive in nature, and the results are not intended to identify all lead hazards present in the building or to be used to prepare detailed cost estimates for abatement. Based on information provided by the client, the subject building is proposed for demolition. Suspect LCP which have not been specifically evaluated should be tested prior to disturbance of the material. If additional suspect LCP is identified during the renovation process, those materials should be assumed LCP pending sampling and laboratory analysis to rebut the presence of lead.

Painted surfaces other than those observed on the roof of the building were not included in the inspection.

4.2 Methodology and Analysis

The lead-containing paint testing was conducted by scraping approximately 2 square inches of paint from the supporting substrate. Sample results reported below the limit of detection may contain lead at a concentration below the analytically defined limit. A summary of the lead-containing paint samples and analysis is included in Appendix C.

No materials were assumed to be LCP. Any inaccessible areas that contain painted surfaces should be tested when access permits or should be assumed to contain lead.

5.0 REGULATORY OVERVIEW

5.1 Asbestos Regulatory Overview

The asbestos NESHAP (40 CFR Part 61, Subpart M) regulates asbestos fiber emissions and asbestos waste disposal practices. It also requires the identification and classification of existing building materials prior to demolition or renovation activity. Under NESHAP, asbestos-containing building materials are classified as either friable, Category I nonfriable or Category II non-friable ACM. Friable materials are those that, when dry, may be crumbled, pulverized or reduced to powder by hand pressure. Category I non-friable ACM includes packings, gaskets, resilient floor coverings and asphalt roofing products containing more than 1% asbestos. Category II nonfriable ACM are any materials other than Category I materials that contain more than 1% asbestos.

Friable ACM, Category I and Category II nonfriable ACM which is in poor condition and has become friable or which will be subjected to drilling, sanding, grinding, cutting or abrading and which could be crushed or pulverized during anticipated renovation or demolition activities are considered regulated ACM (RACM). A memo issued by the Arkansas Department of Environmental Quality (ADEQ) on December 19, 2006 clarifies that Category I nonfriable ACM becomes RACM if it has become friable or it will be or has been subjected to sanding, grading, cutting, or abrading, whether by manual or mechanical means.

RACM must be removed prior to renovation or demolition activities which will disturb the materials. In the state of Arkansas, asbestos activities are regulated by the ADEQ. The ADEQ requires that asbestos-related activities conducted in a public building be performed by personnel licensed by the ADEQ. The owner or operator must provide the ADEQ with written notification of planned removal activities at least 10 working days prior to the commencement of asbestos abatement activities. Asbestos abatement must be performed by ADEQ-licensed asbestos abatement contractors in accordance with a Project Design prepared by an ADEQ-licensed Asbestos Consultant. Air monitoring must be conducted during the abatement activities; a third-party air

monitor is recommended. Management Plans developed for the in-place management of asbestos-containing materials must be developed by an ADEQ-licensed Management Planner.

The Occupational Safety and Health Administration (OSHA) Asbestos standard for construction (29 CFR 1926.1101) regulates workplace exposure to asbestos. The OSHA standard requires that employee exposure to airborne asbestos fibers be maintained below the Permissible Exposure Limit (PEL) of 0.1 fibers per cubic centimeter (f/cc) of air as an 8-hour Time Weighted Average (TWA). The OSHA standard classifies construction and maintenance activities which could disturb ACM and specifies work practices and precautions which employers must follow when engaging in each class of regulated work.

5.2 Lead Paint Regulatory Overview

OSHA regulations govern exposure of workers to lead, regardless of the concentration of lead identified. The OSHA regulations, which have been established for general and construction industries, cover any type of workplace activity that could expose an employee to potential lead contamination (OSHA Standards 29 CFR 1926.62 and 1910.1025).

Any contractor and/or workers conducting any renovation, repair or demolition activities should be notified of these findings and the contractor should be tasked with determining whether lead-safe work practices are to be employed and/or whether personnel should be provided personal protective equipment (PPE).

All occupational exposure to lead occurring in the course of construction work, including maintenance activities, painting, alteration and repairs is subject to the OSHA Lead Exposure in Construction standard (29 CFR 1926.62).

Construction work covered by 29 CFR 1926.62 includes any repair or renovation activities or other activities that disturb in-place lead-containing materials but does not include routine cleaning and repainting where there is insignificant damage, wear, or corrosion of existing lead-containing coatings or substrates. Employers must assure that no employee will be exposed to lead at concentrations greater than 50 micrograms per cubic meter averaged over an 8-hour period without adequate protection. Utilizing lead-safe work practices is recommended to reduce employee exposure during activities that disturb or generate lead dust.

The Resource Conservation and Recovery Act (RCRA) gives the USEPA authority to regulate the waste status of demolition or renovation debris, including lead-containing materials. The USEPA has stated that components removed with intact lead-based paint (LBP) that is not delaminating from the substrate may be disposed as general demolition debris. If the LBP is stripped from components, or if it is delaminating from the substrate, the waste may be subject to hazardous waste rules [i.e., TCLP]. Lead containing wastes are considered hazardous waste under RCRA if TCLP results exceed 5 milligrams per liter (mg/L). USEPA exempts from most RCRA requirements

those generators whose combined hazardous waste generation is less than 100 kilograms (kg) per month.

The above overview is not intended to be inclusive of all potentially pertinent regulatory information. The relevant USEPA and OSHA standards should be consulted prior to undertaking activities involving the demolition, renovation, or maintenance of surfaces coated with lead-containing paints.

6.0 FINDINGS AND RECOMMENDATIONS

6.1 Asbestos Sample Results

Asbestos was not identified in the samples collected and analyzed for this project.

A summary of the suspect ACM materials sampled are presented in Appendix A. Laboratory analytical reports are included in Appendix B.

It should be noted that suspect materials, other than those identified during the March 14 and April 11, 2023, inspection may exist within the building or below existing roofing material. Should suspect materials other than those which were identified during this inspection be uncovered prior to or during the abatement and/or demolition process, those materials should be assumed asbestos-containing until sampling and analysis can confirm or deny their asbestos content.

6.2 Lead Sample Results

The following materials were determined to **contain concentrations of lead** above the limit of detection for the analytical method performed and classified as lead containing under the OSHA Lead Standard for Construction:

- Beige on wood windows
- Brown on wood wall panel
- Teal on metal roof vents
- Grey on metal sky light

The lead paint sample summary is provided in Appendix C; the laboratory analytical report is provided in Appendix D.

Any Contractor and/or workers conducting any renovation, repair or demolition activities should be notified of these findings and the contractor should be tasked with determining whether lead-safe work practices are to be employed and/or whether personnel should be provided personal protective equipment (PPE).

Asbestos and Lead Paint Inspection

Fordyce Bathhouse - Roof ■ Hot Springs, Arkansas

September 22, 2023 ■ Project No. 35237083



It should be understood, however, that OSHA regulations govern exposure of workers to lead, regardless of the concentration of lead identified. The OSHA regulations, which have been established for general and construction industries, cover any type of workplace activity that could expose an employee to potential lead contamination (OSHA Standards 29 CFR 1926.62 and 1910.1025).

7.0 GENERAL COMMENTS

The results, findings, conclusions and recommendations expressed in this report are containing on conditions observed during our inspection of the subject buildings. The information contained in this report is relevant to the date on which this inspection was performed and should not be relied upon to represent conditions at a later date. This report has been prepared on behalf of and exclusively for use by the Strata for specific application to their project as discussed. This report is not a bidding document. Contractors or consultants reviewing this report must draw their own conclusions regarding further investigation or remediation deemed necessary.

APPENDIX A
ASBESTOS INSPECTION SAMPLE SUMMARY

APPENDIX A
ASBESTOS INSPECTION SAMPLE SUMMARY
Fordyce Bathhouse
369 Central Avenue
Hot Springs, Arkansas
Terracon Project No. 35237083

HA	SAMPLE NO.	DESCRIPTION	SAMPLE LOCATION	NESHAP CATEGORY	ASBESTOS CONTENT
1	1	Caulk (grey)	Sky light, north	NA	ND
1	2	Caulk (grey)	Sky light, central	NA	ND
1	3	Caulk (grey)	Sky light south	NA	ND
2	1	Roof core	Main roof, west		
2	2	Roof core	Main roof, south central		
2	3	Roof core	Main roof, east	NA	ND
3	1	Caulk (white)	Guardrail, northeast	NA	ND
3	2	Caulk (white)	Guardrail, southwest	NA	ND
3	3	Caulk (white)	Guardrail, southwest	NA	ND
4	1	Coating (silver) on caulk (white)	Norwest	NA	ND
4	2	Coating (silver) on caulk (white)	Southwest	NA	ND
4	3	Coating (silver) on caulk (white)	Southwest	NA	ND
5	1	Mortar and grout (gray)	Central courtyard roof	NA	ND
5	2	Mortar and grout (gray)	Central courtyard roof	NA	ND
5	3	Mortar and grout (gray)	Central courtyard roof	NA	ND
6	1	Roof core	Central courtyard roof	NA	ND
6	2	Roof core	Central courtyard roof	NA	ND
6	3	Roof core	Central courtyard roof	NA	ND

APPENDIX B
ASBESTOS LABORATORY ANALYTICAL REPORTS



PLM Summary Report

NVLAP Lab Code 102056-0

TDSHS License No. 300084

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

Client :	Terracon - Bryant	Lab Job No. :	23B-03240
Project :	Fordyce Roof	Report Date :	03/23/2023
Project # :	35237083	Sample Date :	03/14/2023
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

Page 1 of 2

On 3/20/2023, fifteen (15) bulk material samples were submitted by a representative of Terracon - Bryant for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
1-1	Caulk (Gray), Skylight, North	None Detected - Caulking
1-2	Caulk (Gray), Skylight, Central	None Detected - Caulking
1-3	Caulk (Gray), Skylight, South	None Detected - Caulking
2-1	Roof Core, Main Roof, West	None Detected - Roofing Material None Detected - Roofing Membrane None Detected - Felt Facing None Detected - Pink Foam Insulation None Detected - White Foam Insulation
2-2	Roof Core, Main Roof, South Central	None Detected - Roofing Material None Detected - Roofing Membrane None Detected - Felt Facing None Detected - White Foam Insulation
2-3	Roof Core, Main Roof, East	None Detected - Roofing Material None Detected - Roofing Membrane None Detected - Felt Facing None Detected - Pink Foam Insulation None Detected - White Foam Insulation
3-1	Caulk (White), Guardrail Northwest	None Detected - White Caulking
3-2	Caulk (White), Guardrail Northeast	None Detected - White Caulking
3-3	Caulk (White), Guardrail Southeast	None Detected - White Caulking
4-1	Coat (Silver) on Caulk (White), Northwest	None Detected - Silver Paint None Detected - Caulking
4-2	Coat (Silver) on Caulk (White), Southwest	None Detected - Silver Paint None Detected - Caulking
4-3	Coat (Silver) on Caulk (White), Southwest	None Detected - Silver Paint None Detected - Caulking
5-1	Mortar and Grout (Gray), Lower Roof	None Detected - Brick None Detected - Grout None Detected - Mortar



PLM Summary Report

NVLAP Lab Code 102056-0

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

TDSHS License No. 300084

Client :	Terracon - Bryant	Lab Job No. :	23B-03240
Project :	Fordyce Roof	Report Date :	03/23/2023
Project # :	35237083	Sample Date :	03/14/2023
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

Page 2 of 2

On 3/20/2023, fifteen (15) bulk material samples were submitted by a representative of Terracon - Bryant for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
5-2	Mortar and Grout (Gray), Lower Roof	None Detected - Brick None Detected - Grout None Detected - Mortar
5-3	Mortar and Grout (Gray), Lower Roof	None Detected - Brick None Detected - Grout None Detected - Mortar

These samples were analyzed by layers. Quantification, unless otherwise noted, is performed by calibrated visual estimate. The test report shall not be reproduced except in full without written approval of the laboratory. The results relate only to the items tested. These test results do not imply endorsement by NVLAP or any agency of the U.S. Government. Accredited by the National Voluntary Laboratory Accreditation Program for Bulk Asbestos Fiber Analysis under Lab Code 102056-0.



Analyst(s): Hannah Wall

Lab Manager : Heather Lopez

Lab Director : Bruce Crabb

Approved Signatory : *Heather Lopez*

Approved Signatory : *Bruce Crabb*

Thank you for choosing Moody Labs

Moody Labs
 2051 Valley View Lane
 Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report
 Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
 TDSHS License No. 300084

Client : Terracon - Bryant
 Project : Fordyce Roof
 Project # : 35237083

Lab Job No. : 23B-03240
 Report Date : 03/23/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
1-1	Caulking (Gray)	100%	Binders / Fillers	100%	03/23	HW
1-2	Caulking (Gray)	100%	Binders / Fillers	100%	03/23	HW
1-3	Caulking (Gray)	100%	Binders / Fillers	100%	03/23	HW
2-1	Roofing Material (Black)	60%	Glass Wool Fibers	10%	03/23	HW
			Cellulose Fibers	25%		
			Aggregate	20%		
			Tar Binders	45%		
	Roofing Membrane (Gray / White)	20%	Synthetic Fiber Mesh	15%		
			Vinyl Binders	85%		
	Felt Facing (Gray)	10%	Cellulose Fibers	100%		
Pink Foam Insulation (Pink)	5%	Synthetic Foam	100%			
	White Foam Insulation (White)	5%	Synthetic Foam	100%		
2-2	Roofing Material (Black)	10%	Glass Wool Fibers	10%	03/23	HW
			Cellulose Fibers	25%		
			Aggregate	20%		
			Tar Binders	45%		
	Roofing Membrane (Gray / White)	45%	Synthetic Fiber Mesh	15%		
			Vinyl Binders	85%		
	Felt Facing (Gray)	35%	Cellulose Fibers	100%		
White Foam Insulation (White)	10%	Synthetic Foam	100%			
2-3	Roofing Material (Black)	30%	Glass Wool Fibers	10%	03/23	HW
			Cellulose Fibers	25%		
			Aggregate	20%		
			Tar Binders	45%		
	Roofing Membrane (Gray / White)	20%	Synthetic Fiber Mesh	15%		
			Vinyl Binders	85%		
	Felt Facing (Gray)	30%	Cellulose Fibers	100%		
Pink Foam Insulation (Pink)	10%	Synthetic Foam	100%			
	White Foam Insulation (White)	10%	Synthetic Foam	100%		

Moody Labs
 2051 Valley View Lane
 Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report
 Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
 TDSHS License No. 300084

Client : Terracon - Bryant
 Project : Fordyce Roof
 Project # : 35237083

Lab Job No. : 23B-03240
 Report Date : 03/23/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
3-1	White Caulking (White)	90%	Binders / Fillers	100%	03/23	HW
	Black Caulking (Black)	10%	Binders / Fillers	100%		
3-2	White Caulking (White)	50%	Binders / Fillers	100%	03/23	HW
	Black Caulking (Black)	50%	Binders / Fillers	100%		
3-3	White Caulking (White)	50%	Binders / Fillers	100%	03/23	HW
	Black Caulking (Black)	50%	Binders / Fillers	100%		
4-1	Silver Paint (Silver)	2%	Pigment / Binders	100%	03/23	HW
	Caulking (Beige)	98%	Calcite	50%		
			Binders / Fillers	50%		
4-2	Silver Paint (Silver)	5%	Pigment / Binders	100%	03/23	HW
	Caulking (Beige)	95%	Calcite	50%		
			Binders / Fillers	50%		
4-3	Silver Paint (Silver)	1%	Pigment / Binders	100%	03/23	HW
	Caulking (White)	99%	Calcite	50%		
			Binders / Fillers	50%		
5-1	Brick (Orange)	85%	Sintered Clays	100%	03/23	HW
	Grout (Gray)	5%	Aggregate	65%		
			Cement Binders	35%		
	Mortar (White)	10%	Aggregate	65%		
Calcite / Binders			35%			
5-2	Brick (Orange)	88%	Sintered Clays	100%	03/23	HW
	Grout (Gray)	2%	Aggregate	65%		
			Cement Binders	35%		
	Mortar (White)	10%	Aggregate	65%		
Calcite / Binders			35%			

Moody Labs

2051 Valley View Lane

Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report
Supplement to PLM Summary Report

NVLAP Lab Code 102056-0

TDSHS License No. 300084

Client : Terracon - Bryant

Project : Fordyce Roof

Project # : 35237083

Lab Job No. : 23B-03240

Report Date : 03/23/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
5-3	Brick (Orange)	88%	Sintered Clays	100%	03/23	HW
	Grout (Gray)	2%	Aggregate	65%		
			Cement Binders	35%		
	Mortar (White)	10%	Aggregate	65%		
			Calcite / Binders	35%		



Chain of Custody

Lab Job # 23B-03240PLM15
Lab Job #
Lab Job #

AFTER HOURS / WEEKEND WORK: YES NO
Please call in advance for after hours / immediate pricing & availability

Page of

ASBESTOS PLM

MOLD

Bulk Immediate 1 day 2 day 3 day 5-7 day
Analyze All Positive Stop

Direct Exam Immed 1 day 2 day 5 day
Standard Air Immed 1 day 2 day 5 day
Expanded Air Immed 1 day 2 day 5 day
TPC w/ Yeast & Mold (TYMC)** 5 day
Culture** 10-14 days
Analyze Blanks Yes No

PCM Air (7400)

Immediate 1 day 2 day 3 day 5 day
Analyze Blanks Yes No

TOTAL DUST(0500/0600)

1 day 2 day

ASBESTOS TEM

Air AHERA Method Late Night* 6 hr 12 hr 24 hr
Air 7402 (Modified) 1 day 2 day 3 day
Bulk 1 day 2 day 3 day 5 day
Water/Wipe/Micro Vac 1 day 2 day 3 day
Analyze Blanks Yes No

BACTERIA**

Total Plate Count (TAMC) 2 day
Coliform & E. coli (P/A) 1 day
Coliform & E. coli (Q) 1 day
Enterococci (P/A) 1 day

Please note Bateria / Mold Culture turnarounds are approximate and subject to analytical requirements**

OTHER:

Billing Company / City: Terracon / Bryant # of Samples: 15 Sample Date: 3-14-23
Project: Fordyce Roof Project #: 35237083
Contact Information: Name: Sody Adams Phone #:
E-mail Results to: Sody.Adams@Terracon.com Mobile #:
Invoice Address: 25804 I-30 S, Bryant, AR 72022 P.O. #:

Please review paperwork and samples before submitting to lab. Unsealed / Improperly packaged / damaged / expired samples or excessive administrative requests may incur additional fees*

Notes:

Table with 4 columns: Sample #, Sample Description, Vol. / Area (if applicable), Location / Notes. Contains handwritten entries for samples 1-1 through 5-3.

Released By: Received By: Date / Time: 3/17/23 10:00 Date / Time: 3/20/23 9:25A



PLM Summary Report

NVLAP Lab Code 102056-0

2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

TDSHS License No. 300084

Client :	Terracon - Bryant	Lab Job No. :	23B-04268
Project :	Fordyee Roof	Report Date :	04/18/2023
Project # :	35237083	Sample Date :	04/11/2023
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

Page 1 of 1

On 4/12/2023, three (3) bulk material samples were submitted by Jody Adams of Terracon - Bryant for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
6-1	Roof Core, Central Courtyard Roof	None Detected - Foam None Detected - Fiber Mesh None Detected - Caulking None Detected - Cotton Wrap None Detected - Plastic None Detected - Aggregate
6-2	Roof Core, Central Courtyard Roof	None Detected - Foam None Detected - Fiber Mesh None Detected - Caulking None Detected - Cotton Wrap None Detected - Plastic None Detected - Aggregate
6-3	Roof Core, Central Courtyard Roof	None Detected - Foam None Detected - Fiber Mesh None Detected - Caulking None Detected - Cotton Wrap None Detected - Plastic None Detected - Aggregate

These samples were analyzed by layers. Quantification, unless otherwise noted, is performed by calibrated visual estimate. The test report shall not be reproduced except in full without written approval of the laboratory. The results relate only to the items tested. These test results do not imply endorsement by NVLAP or any agency of the U.S. Government. Accredited by the National Voluntary Laboratory Accreditation Program for Bulk Asbestos Fiber Analysis under Lab Code 102056-0.



Analyst(s): Jared Martin

Lab Manager : Heather Lopez

Lab Director : Bruce Crabb

Approved Signatory : *Heather Lopez*

Approved Signatory : *Bruce Crabb*

Thank you for choosing Moody Labs

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Moody Labs
 2051 Valley View Lane
 Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report
 Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
 TDSHS License No. 300084

Client : Terracon - Bryant
 Project : Fordyee Roof
 Project # : 35237083

Lab Job No. : 23B-04268
 Report Date : 04/18/2023

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
6-1	Foam (Gray)	25%	Synthetic Foam	100%	04/17	JM
	Fiber Mesh (Black)	15%	Synthetic Fiber Mesh	100%		
	Caulking (Black)	5%	Calcite	50%		
			Binders / Fillers	50%		
	Cotton Wrap (Off-White)	3%	Cotton Fibers	100%		
	Plastic (Black)	27%	Plastic	100%		
	Aggregate (Tan)	25%	Aggregate	100%		
Note: Layer Relation Unclear						
6-2	Foam (Gray)	25%	Synthetic Foam	100%	04/17	JM
	Fiber Mesh (Black)	15%	Synthetic Fiber Mesh	100%		
	Caulking (Black)	5%	Calcite	50%		
			Binders / Fillers	50%		
	Cotton Wrap (Off-White)	3%	Cotton Fibers	100%		
	Plastic (Black)	27%	Plastic	100%		
	Aggregate (Tan)	25%	Aggregate	100%		
Note: Layer Relation Unclear						
6-3	Foam (Gray)	25%	Synthetic Foam	100%	04/17	JM
	Fiber Mesh (Black)	15%	Synthetic Fiber Mesh	100%		
	Caulking (Black)	5%	Calcite	50%		
			Binders / Fillers	50%		
	Cotton Wrap (Off-White)	3%	Cotton Fibers	100%		
	Plastic (Black)	27%	Plastic	100%		
	Aggregate (Tan)	25%	Aggregate	100%		
Note: Layer Relation Unclear						



Chain of Custody

Lab Job # 23B-154268
Lab Job # 3 PLM
Lab Job #

AFTER HOURS / WEEKEND WORK: YES NO
Please call in advance for after hours / immediate pricing & availability

ASBESTOS PLM

Bulk Immediate 1 day 2 day 3 day 5 day
Analyze All Positive Stop

MOLD

Direct Exam Immed 1 day 2 day 5 day
Standard Air Immed 1 day 2 day 5 day
Expanded Air Immed 1 day 2 day 5 day
Culture** 10-14 days
TPC w/ Yeast & Mold (TYMC)** 5 day
Analyze Blanks Yes No

PCM Air (7400)

Immediate 1 day 2 day 3 day 5 day
Analyze Blanks Yes No

TOTAL DUST(0500/0600)

1 day 2 day

ASBESTOS TEM

Air AHERA Method Late Night* 6 hr 12 hr 24 hr
Air 7402 (Modified) 1 day 2 day 3 day
Bulk 1 day 2 day 3 day 5 day
Water/Wipe/Micro Vac 1 day 2 day 3 day
Analyze Blanks Yes No

BACTERIA**

Total Plate Count (TAMC) 2 day
Coliform & E. coli (P/A) 1 day
Staphylococcus aureus 1 day

Please note Bateria / Mold Culture turnarounds are approximate and subject to analytical requirements

OTHER:

Billing Company / City: Terracon / Little Rock # of Samples: 3 Sample Date: 4/11/23
Project: Fordyce Roof Project #: 35237083
Contact Information: Name: Jody Adams Phone #: 479-970-0290
E-mail Results to: jody.adams@terracon.com Mobile #:
Invoice Address: 25809 I 30 S Bryant AR 72022 P.O. #:

Please review paperwork and samples before submitting to lab. Unsealed / improperly packaged / damaged / expired samples or excessive administrative requests may incur additional fees

Notes:

Table with 4 columns: Sample #, Sample Description, Vol. / Area (if applicable), Location / Notes. Contains 3 rows of roof core samples from Central Courtyard Roof.

Released By: Joshua Ray Date/Time: 4/11/23 1500 Received By: Jody Adams Date/Time: 4/11/23 9:35A

APPENDIX C
LEAD PAINT SAMPLE SUMMARY

APPENDIX C
LEAD-CONTAINING PAINT SAMPLE SUMMARY
Fordyce Bathhouse
369 Central Avenue
Hot Springs, Arkansas
Terracon Project No. 35237083

Sample No.	Paint Color	Paint Substrate	Material Location	Analytical Result (% wt)
F-L-1	Beige	Wood	Window frames	0.017
F-L-2	Brown	Wood wall panel	Exterior of elevator equipment room	0.0061
F-L-3	Teal	Metal	Roof vents	0.021
F-L-4	Grey	Metal	Sky light	0.21

Bold = Lead containing paint

APPENDIX D
LEAD PAINT ANALYTICAL LABORATORY DATA

CERTIFICATE OF ANALYSIS

Client: Terracon
25809 I-30 South
Bryant AR 72022

Report Date: 3/24/2023
Report No.: 680157 - Lead Paint
Project: Fordyce
Project No.: 35237083

Client: TER908

LEAD PAINT SAMPLE ANALYSIS SUMMARY


Lab No.: 7587894 **Description:** Beige On Wood **Result (% by Weight):** 0.017
Client No.: F-L-1 **Location:** **Result (ppm):** 170
Comments: ***


Lab No.: 7587895 **Description:** Brown On Wood **Result (% by Weight):** 0.0061
Client No.: F-L-2 **Location:** **Result (ppm):** 61
Comments:

Lab No.: 7587896 **Description:** Teal On Metal **Result (% by Weight):** 0.021
Client No.: F-L-3 **Location:** **Result (ppm):** 210
Comments:

Lab No.: 7587897 **Description:** Grey On Metal **Result (% by Weight):** 0.21
Client No.: F-L-4 **Location:** **Result (ppm):** 2100
Comments: *

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 3/20/2023
Date Analyzed: 03/24/2023
Signature: 
Analyst: Chad Shaffer

Approved By: 
Frank E. Ehrenfeld, III
Laboratory Director

CERTIFICATE OF ANALYSIS

Client: Terracon
25809 I-30 South
Bryant AR 72022

Client: TER908

Report Date: 3/24/2023
Report No.: 680157 - Lead Paint
Project: Fordyce
Project No.: 35237083

Appendix to Analytical Report:

Customer Contact: Jody Adams

Method: ASTM D3335-85a, US EPA SW846 3050B:7000B

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com

iATL Office Manager: wchampion@iatl.com

iATL Account Representative: Semih Kocahasan

Sample Login Notes: See Batch Sheet Attached

Sample Matrix: Paint

Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and in our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by ASTM D3335-85a by AAS

Certification:

- National Lead Laboratory Program (NLLAP): AIHA-LAP, LLC No. 100188

- NYSDOH-ELAP No. 11021

This report meets the standards set forth in the EPA's National Lead Laboratory Accreditation Program (NLLAP) through the Laboratory Quality System Requirements (LQSR) Revision 3.0 November 5, 2007. All Environmental Lead Proficiency Analytical Testing (ELPAT) is through the AIHA-PAT established program.

Regulatory limit is 0.5% lead by weight (EPA/HUD guidelines). Recommend multiple sampling for all samples less than regulatory limit for confirmation.

All results are based on the samples as received at the lab. iATL assumes that appropriate sampling methods have been used and that the data upon which these results are based have been accurately supplied by the client.

Method Detection Limit (MDL) per EPA Method 40CFR Part 136 Appendix B.

Reporting Limit (RL) based upon Lowest Standard Determined (LSD) in accordance with AIHA-ELLAP policies.

LSD=0.2 ppm MDL=0.006% by weight. RL= 0.010% by weight (based upon 100 mg sampled).

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a complete list with highlighted disclaimers pertinent to this project. For a full explanation of these and other disclaimers, please inquire at customerservice@iatl.com.

CERTIFICATE OF ANALYSIS

Client: Terracon
25809 I-30 South
Bryant AR 72022

Report Date: 3/24/2023
Report No.: 680157 - Lead Paint
Project: Fordyce
Project No.: 35237083

Client: TER908

- * Insufficient sample provided to perform QC reanalysis (<200 mg)
- ** Not enough sample provided to analyze (<50 mg)
- *** Matrix / substrate interference possible.

< less than sign, signifies none-detected below the empirical value based upon sub-sampled mass. This is often below the Reporting Limit (see above).

Chain of Custody

– Environmental Lead –

Contact Information	
Client Company: <u>Terracon</u>	Project Number: <u>35237083</u>
Office Address: <u>25809 I-30 S</u>	Project Name: <u>Fordyce</u>
City, State, Zip: <u>Bryant, AR 72022</u>	Primary Contact: _____
Fax Number: _____	Office Phone: _____
Email Address: <u>Sody.Adams@Terracon.com</u>	Cell Phone: <u>479-970-0290</u>

iATL is accredited by the National Lead Laboratory Accreditation Program (NLLAP) to perform analytical testing of environmental samples for lead (Pb). The accreditation is through AIHA-LAP, LLC and several other nationally recognized state programs.

Matrix/Method:

- Paint by AAS: ASTM D3335-85a, 2009
- Wipe/Dust by AAS: SW 846: 3050B: 700B, 2010
- Air by AAS: NIOSH 7082, 1994
- Soil by AAS: EPA SW 846 (Soil)
- Water by AAS-GF: ASTM D3559-03D, US EPA 200.9
- Other Metals (Cd, Zn, Cr) by AAS
- Toxicity Characteristic Leaching Procedure (TCLP) by AAS: US EPA 1311
- Other _____

Special Instructions:

Turnaround Time

Preliminary Results Requested Date: _____ Verbal Email Fax

Specific date / time

10 Day 5 Day 3 Day 2 Day 1 Day* 12 Hour** 6 Hour** RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization): <u>[Signature]</u>	Date: <u>3-17-23</u> Time: <u>11:05 AM</u>
Received (Name / iATL): _____	Date: _____ Time: _____
Sample Login (Name / iATL): _____	Date: _____ Time: _____
Analysis(Name(s) / iATL): <u>C3/24/23</u>	Date: _____ Time: _____
QA/QC Review (Name / iATL): <u>[Signature]</u>	Date: _____ Time: _____
Archived / Released: _____ QA/QC InterLAB Use: _____	Date: _____ Time: _____

Sample Log

—Environmental Lead—

Client: Terracon Project: Fordyce

Sampling Date/Time: 3-14-23

Client Sample #	iATL #	Location/ Description	Flow Rate	Start End	Sampling time (min)	Area (ft2) Volume (L)	Results ()
F-L-1	7587894	beige on wood					
F-L-2	7587895	beige Brown on wood					
F-L-3	7587896	teal on metal					
F-L-4	7587897	gray on metal					

* = Insufficient Sample Provided to Perform QC Reanalysis (<200mg)
 ** = Insufficient Sample Provided to Analyze (<50mg) *** = Matrix / Substrate Interference Possible
 FB = Method Requires the submittal of blank(s). ML = Multi Layered Sample. May result in inconsistent results.
 These preliminary results are issued by iATL to expedite procedures by clients based upon the above data. iATL assumes that all of the sampling methods and data upon which these results are based, has been accurately supplied by the client. These results may not have been reviewed by the Laboratory Director. Final Certificate of Analysis will follow these preliminary results. The signed COA is to be considered the official results. All EPA, HUD, and NJDEP conditions apply.

APPENDIX E
FIELD DIAGRAM

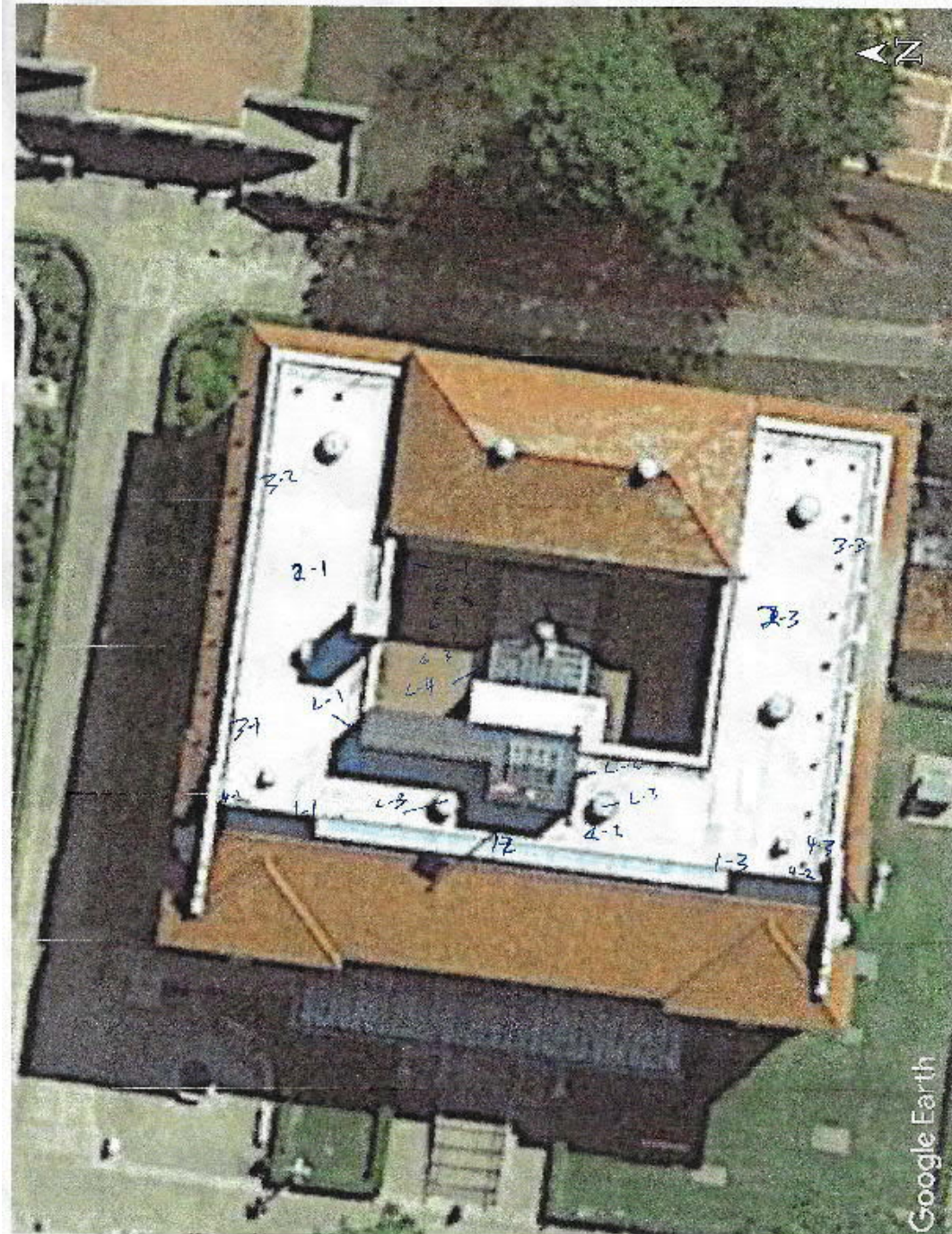


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY GOOGLE MAPS

Project Manager: JBA	Project No. 35237083	Terracon 25809 I 30 Bryant, AR 72022-9313	Sample Location Diagram	Figure 1
Drawn by: JBA	Scale: N.T.S		Fordyce Bath House 369 Central Avenue Hot Springs, AR	
Checked by: JBA	File Name:			
Approved by: JBA	Date:			

APPENDIX F
PHOTO LOG



Photo #1 Fordyce Bathhouse located at 369 Central Avenue in Hot Springs, Arkansas.



Photo #2 Overview of the roof.



Photo #3 Lower central courtyard roof



Photo #4 Terracotta shingles.

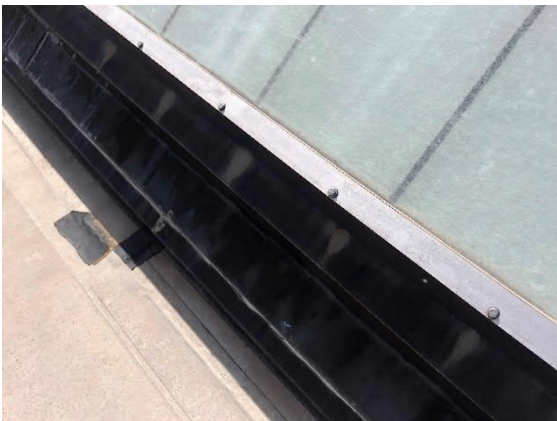


Photo #5 Upper sky light.



Photo #6 Example of roof core sample location.



Photo #7 Brown wood panel observed on the exterior of the elevator equipment room.



Photo #8 Lower courtyard roof.



Photo #9 Sky light in lower courtyard.



Photo #10 Overview of the upper roof.

APPENDIX G
CERTIFICATIONS

STATE OF ARKANSAS DEPARTMENT OF ENERGY AND ENVIRONMENT

Division of Environmental Quality

OFFICE OF AIR QUALITY, ASBESTOS PROGRAM

TERRACON CONSULTANTS, INC.

*having qualified as required by law in accordance with the rules adopted by the
Arkansas Pollution Control and Ecology Commission's Rule 21 pursuant to A.C.A. 20-27-1001, et seq.,
relative to performing asbestos related work within the State of Arkansas is licensed as an*

Asbestos Abatement Consultant

License Number: 000311

Issue Date: 2/2/2023
Expiration Date: 2/2/2024



Caleb J. Osborne
Division of Environmental Quality, Director
Chief Administrator, Environment
Arkansas Department of Energy & Environment

STATE OF ARKANSAS DEPARTMENT OF ENERGY AND ENVIRONMENT

Division of Environmental Quality

OFFICE OF AIR QUALITY, ASBESTOS PROGRAM

JODY B. ADAMS

having satisfied the requirements necessary to meet the provisions of AHERA/ASHARA under TSCA Title II and the Arkansas Pollution Control and Ecology Commission's Rule 21 pursuant to A.C.A. § 20-27-1001, et seq., within the State of Arkansas is hereby certified to perform activities related to asbestos containing material in the following discipline(s)

Discipline	Issue Date	Effective Date	Expiration Date
Inspector	10/13/2022	10/21/2022	10/31/2023
Project Designer	04/07/2022	05/04/2022	04/30/2023



Certification Number: **013888**

A handwritten signature in blue ink that reads 'Julie Linck'.

Julie Linck
Chief Administrator, Environment
Arkansas Department of Energy and Environment