Smithsonian Institution

Office of Engineering Design & Construction

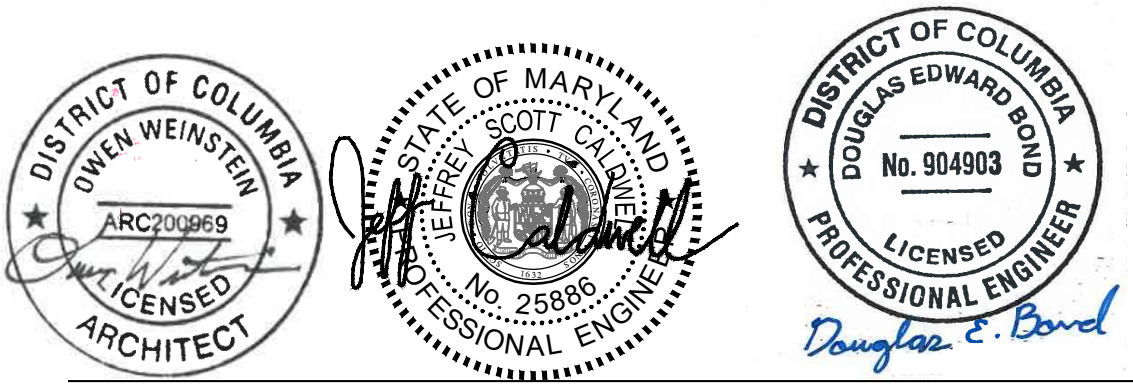
SPECIFICATIONS

PROJECT NO.: **2003106**

PROJECT TITLE: **Gunboat Philadelphia – Exhibition Demolition and Temporary Preservation Space**

FACILITY: **National Museum of American History**

DATE: **July 12, 2024**
Final CD Submission



This project is approved as being in conformance with applicable provisions of the Smithsonian Directive (SD) 410.

600 Maryland Avenue, S.W.
Suite 5001
Washington, D.C. 20560
Voice: 202.633.6230 Fax: 202.633.6233

USPS Mail: OEDC Capital Gallery
MRC 511
P.O. Box 37012
Washington, D.C. 20013-7012

Michael J. Carrancho, P.E., Associate Director Date

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DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01000

SUPPLEMENTARY CONDITIONS FOR CONSTRUCTION

PROJECT SUMMARY AND INFORMATION

1. PROJECT INFORMATION

1.1. OFEO Project No. 2003106
Gunboat Philadelphia – Exhibition Demolition and Temporary Preservation Space
National Museum of American History
1300 Constitution Avenue NW
Washington, DC 20560

1.2. Smithsonian Institution Contacts:

Contracting Officer (CO)
Smithsonian Institution
Office of Contracting
2011 Crystal Drive, Suite 350
Arlington, VA 22202-3709

Contracting Officer's Technical Representative (COTR)
Smithsonian Institution
Attn: Jamil Burnett
Office of Planning, Design & Construction
600 Maryland Avenue, SW, Suite 5001
Washington, DC 20024
(202) 633-0100

2. SUMMARY OF WORK

2.1. The Contractor shall furnish all supervision, labor, materials, and equipment needed to demolish existing exhibit, building structures, and gift shop; and provide a new Preservation Space at the Smithsonian Institution's National Museum of American History located at 1300 Constitution Avenue, NW, Washington, DC, 20560, as set forth on the Drawings for OFEO Project No. 2003106, and in these specifications, both dated 14 July, 2024.

2.2. The Work includes, but is not limited to:

- Providing protection for the Gunboat Philadelphia
- Demolishing selected building elements
- Asbestos Abatement required by HVAC Demo

- Building new preservation space with specialized HVAC requirements and fire-rated window wall.

2.3. Critical Elements of the Work: The successful Contractor shall be fully qualified to install critical elements of the Work., Offerors shall submit a statement of qualifications to address the following critical elements of the Work:

- Artifact Protection
- Fire rated window wall assembly
- Specialized Mechanical system
- Asbestos Abatement
- Exhibit lighting

The Contractor shall perform the following sequence of operations:

1. Cover the gunboat with plastic sheeting (by NMAH)
2. Install temporary wall protection in front of gallery walls
3. Temporary closure of small room in presidency gallery to address egress issues through construction space (by NMAH)
4. Remove carpet directly around/under the gunboat (by NMAH)
5. Build Gunboat protection
6. Demolition activities
    a. Asbestos Abatement should be fully completed before non-hazardous demotion.
7. Build rated partition enclosing new conservation space
8. Interior elements
9. Install flooring/Masonite up to gunboat box edge (GC should lay down a section North/South and about 12’ out from the east wall before the move. That way the timber under the boat will have some place to go during the move.)
10. Remove temporary construction wall (if not removed earlier)
11. Deep cleaning of gallery (see Div. 1000 Section 65)
12. Remove gunboat protection
13. Rotate gunboat (by NMAH)
14. Finish install of new flooring
15. Closeout activities

2.4. Delegated Design Elements of the Work: Furnish full engineering services on the following elements of the Work:

- Cold-Formed Metal Framing
- Other elements as specified in Technical Sections

3. CONTRACT TIME FOR COMPLETION

3.1. Work under this contract shall begin by the Contractor within ten (10) calendar days after the Notice to Proceed and shall be completed within the total contract time of 130

calendar days. All work, including project closeout activities, shall be completed in every respect within the contract time.

3.2. The start date and completion date shall be as stated in the Notice to Proceed issued by the Contracting Officer.

4. SCHEDULE OF OPTIONS FOR PROPOSAL

4.1. The following is a brief statement of the Work identified for proposal options. The complete description of the Work is identified elsewhere in the drawings and specifications.

BASE PROPOSAL:
Demolition of existing exhibit while providing protection of artifacts, and building new temporary conservation exhibit space with supporting HVAC and other systems.

5. SCHEDULE OF UNIT PRICES – NOT USED

6. OFFEROR EXAMINATION OF SITE

6.1. Every effort has been made to indicate all work necessary to complete the project as identified. All offerors shall carefully examine the premises during the offer period and satisfy themselves as to the extent, nature and location of the work, general and local conditions, particularly those bearing on transportation, disposal, handling and storage of materials, availability of labor, water, electric power, access routes, uncertainties of the weather, type of equipment and facilities needed for the successful execution of the Work.

6.2. Before the offer opening date, offerors may view the project site on an appointment basis. Any comments, information or discussion during the site visit shall not modify the Contract Documents. Offerors shall make an appointment to view the site by contacting:

Jamil Burnett, COTR
Telephone No. (202) 633-0100
BurnettJ@SI.edu
Smithsonian Institution
Office of Planning, Design & Construction (OPDC)
600 Maryland Ave, SW Suite 5001 MRC 511
Washington, DC 20024

6.3. Pre-Proposal Conference and Site Visit. Before the proposal opening date, a scheduled pre-proposal conference and site visit will be announced by the Contracting Officer. The purpose of the scheduled meeting is to provide an opportunity for all offerors to review the project site. Any comments, information or discussion during the site visit shall not modify the Contract Documents.

6.4. Limited areas of this project are in a public area and requires no special arrangements to visit the site between the hours of 10:00AM and 5:30PM.

7. **AVAILABILITY OF DOCUMENTS:**

7.1 The solicitation documents are available in electronic form, at no cost to the Offeror, from the Contracting Officer. The Offeror is responsible for making their own hard copies of the solicitation documents.

SPECIAL PROJECT REQUIREMENTS

8. UNITS OF MEASURE

8.1. All fabrication and installation shall be performed in accordance with the units of measure given in the Contract Documents.

8.2. All Contractor and subcontractor personnel working on the site shall possess and use metric measuring equipment for all work shown in metric units. Conversion of dimensions shown on contract drawings to English units for use of non-metric measuring equipment is prohibited.

9. NON-PUBLIC, TENANT AND SECURED SPACES

9.1. Certain tenant spaces, non-public spaces, utility and equipment rooms and other areas related to or used for purposes of storage, conservation, research, curation of museum collection and artifacts or for scientific research may have restricted access.

9.2. The Contractor shall identify to the COTR as soon as possible, but no less than two (2) working days in advance, any occupied areas that the Contractor must access that are located outside the limits of the project site. The Contractor shall identify in writing:

9.2.1. Restricted areas to be accessed.

9.2.2. Specific reason for needing access.

9.2.3. Nature of the work to be performed.

9.2.4. Date(s) and hours needed to complete construction work activity.

10. MUSEUM ARTIFACTS AND SCIENTIFIC RESEARCH MATERIALS

10.1. The handling of museum artifacts or scientific research experiments by the Contractor is strictly prohibited without written consent of the Smithsonian. The existing museum artifacts and research related materials may be moved only by authorized Smithsonian Museum curatorial personnel. An offender of this clause may be subject to arrest or removal from the premises and project by Smithsonian security officers.

10.2. If temporary relocation of artifacts or research experiments is necessary, the Contractor shall give notice to the COTR at least five (5) working days in advance of the time relocation is needed.

10.3. Humidity/Temperature Controlled Spaces: The Contractor shall take care to minimize fluctuations in air conditions and quality, particularly in areas containing artifacts and storage collections and laboratories and scientific research experiments. Humidity and temperature-controlled areas require consistency of utility operation.

11. PROTECTION OF HISTORIC PROPERTIES

11.1. The project site is located in a designated National Historic Landmark property and requires special attention to the quality of materials selected for installation and workmanship efforts to satisfactorily preserve and restore historic elements and finishes of an historic landmark structure.

11.1.1. The Gunboat Philadelphia is listed on the National Register of Historic Places as an individual artifact and requires special protection prior to commencement of all other project work.

11.2. Submit evidence of technical competence in restoration work for National Historic Landmark structures, including subcontractor resumes, references and photographs or previous similar work.

11.3. Without exception, all original building fabric of the National Museum of American History is designated historic.

12. COMMITMENT TO SUSTAINABILITY

12.1. The Smithsonian Institution is a trust instrumentality of the United States (recognized as a tax-exempt organization under Section 501(c)(3) of the Internal Revenue Code) and although not an Executive Branch of the U.S. Government, is committed to planning, designing, constructing, maintaining and operating its owned and leased buildings and facilities consistent with Federal environmental and energy management requirements, as listed in the Smithsonian OFEO Codes, Standards and Guidelines document, dated February 15, 2012, to the maximum extent practical.

12.2. Refer to the Construction and Demolition Waste Tracking Chart at the end of this section 010000 for disposal of materials.

13. COMMISSIONING

13.1 The Smithsonian requires Enhanced Commissioning (as defined by the LEED NC and CI rating systems) of all eligible design and construction projects, even if the project is not eligible to pursue LEED certification.

13.2 Refer Division 01 sections on General Commissioning Requirements following this section 010000.

CONTRACTOR USE OF PREMISES

14. HOURS OF WORK, WORKDAYS AND GOVERNMENT HOLIDAYS

14.1. Work shall be performed, under this contract, during the normal workdays of Monday through Friday, except Smithsonian holidays as specified herein and the normal work hours of 6:00 AM to 3:30 PM

14.2. For each occasion the Contractor intends to work on Saturdays, Sundays or Smithsonian holidays or during hours other than those indicated above, the Contractor shall obtain written permission from the COTR, at least three (3) working days in advance.

14.3. The Contractor shall reimburse the Smithsonian Institution for security and inspection services provided by the Smithsonian when the Contractor chooses to work outside the normal workdays and hours, as identified herein. However, the Contractor will not be charged for SI overtime security and inspection services, if in the opinion of the COTR, the work cannot be done during the normal workdays and hours due to requirements of the Smithsonian.

14.4. Smithsonian Holidays: For holidays that fall on Saturday, the Smithsonian Holiday is observed on the previous Friday. For holidays that fall on Sunday, the Smithsonian holiday is observed on the following Monday. The Smithsonian Holidays are listed below.

New Year's Day	January 1
Martin Luther King Jr.'s Birthday	January, third Monday
Presidents' Day	February, third Monday
Memorial Day	May, last Monday
Independence Day	July 4
Juneteenth	July 19
Labor Day	September, first Monday
Columbus Day	October, second Monday
Veterans' Day	November 11
Thanksgiving Day	November, fourth Thursday
Christmas Day	December 25
President's Inauguration Day	January 20, 2025

15. CONDITIONS AFFECTING CONTRACTOR'S WORK

15.1. Existing Occupied Spaces: The premises will be occupied during the performance of the Work. The Contractor shall schedule work activities to minimize interruption of occupants and occupied spaces. Efforts will be made to temporarily move employees and contents out of specific areas under construction, as needed, during the times requested by

the Contractor. However, the needs of the Smithsonian Institution take precedence and free access for the Contractor cannot always be guaranteed. The Contractor may work in the Gunboat exhibition space and A More Perfect Union (AMPU) Storage, and other exhibition and utility spaces only in the presence of authorized Smithsonian staff or guard personnel. Areas that will remain occupied include the Landmark Space, American Presidents Exhibition, and all other Museum spaces.

15.2. Relocation of Existing Occupants: Contractor's requests for the Smithsonian to temporarily relocate existing occupants or for Contractor's access to secured areas shall be made to the COTR as far in advance as possible, but no less than three working days in advance of the need for relocation.

15.3. Space for Contractor Use: The space available for Contractor's use is limited to areas indicated on the Contract Drawings as the project site. Space allocation and availability are subject to change, at the discretion of the Smithsonian, to meet the needs of all parties requiring access and space within the building and the surrounding areas.

16. CONTRACTOR DELIVERIES, HAULING AND ACCESS

16.1. The Contractor's materials and equipment shall be delivered, received and handled by the Contractor's personnel.

16.2. Access to the building for on- and off-loading of all material, structures and equipment will be at the Loading Dock at the Basement Level.

16.3. The Contractor may use the freight elevator 1000E8 located in the East Wing for movement of material, structures and equipment within acceptable loading limits. Use of freight elevator will be permitted prior to 9:30 AM with prior approval by COTR.

16.4. The transportation of hazardous materials or hazardous waste into or out of the building shall be limited to the following routes and freight elevators: East Wing freight elevator, Basement corridor, and Loading dock. All hazardous materials shall be transported through the building in secondary containment and properly secured to transport carts to prevent breakage or spills.

16.4 Should suspected hazardous materials be encountered, notify the COTR immediately and await further instructions.

17. DRESS AND DEPORTMENT

17.1. Contractors' personnel shall be fully and appropriately clothed at all times and shall conduct themselves in a manner appropriate to a public place. The COTR may require removal of any individual from the premises and project for unacceptable dress, demeanor or disruptive conduct, if the Contractor superintendent fails to correct conditions in violation of this paragraph.

18. CONTRACTOR PARKING

18.1. No parking spaces will be provided by Smithsonian Institution.

19. EATING, DRINKING, SMOKING AND ILLEGAL SUBSTANCE ABUSE

19.1. Eating and drinking in Smithsonian buildings or leased space will be allowed only in designated areas. Offenders may be subject to removal from the premises and project should the Contractor's Superintendent fail to correct conditions, which, in the opinion of the COTR, violate this clause.

19.2. The consumption of alcoholic beverages by the Contractor's personnel is prohibited in all Smithsonian buildings or leased space.

19.3. Smoking or carrying lighted tobacco products is prohibited in all Smithsonian buildings or leased space, in exhibition and public spaces, in areas where hazardous materials are stored or handled and in areas undergoing construction, renovation or repair. Acceptable areas for smoking are outside of the building at least 25 feet from any opening, operable window or air intake vent and as designated by the Smithsonian Building Manager.

19.4. The possession, sale and/or use of narcotics or other illegal substances or firearms by Contractor employees are strictly prohibited in all Smithsonian facilities and leased space. Contractor employees are strictly prohibited from working on the project under the influence of alcohol and/or illegal substances. Contractor employees in violation of any of the above prohibitions will be removed from the project.

PROJECT COORDINATION

20. COORDINATION OF TRADES

20.1. The Contractor shall coordinate work of different trades so that interference between mechanical, electrical, architectural and structural work, including existing services, shall be avoided.

20.2. Refer to Division 011913 Commissioning for requirements of commission.

20.3 Where work by separate entities requires off-site fabrication of products and accurate interfacing of materials to produce the required results, the Contractor shall prepare coordination drawings to indicate how work shown on separate shop drawings will be interfaced, intermeshed and sequenced for installation. Coordination drawings shall be submitted in accordance with the requirements of the "Submissions" section.

20.3.1. Work installed prior to approval of coordination drawings shall be at the Contractor's risk. Subsequent relocations required to avoid interferences shall be made without additional expense to the Smithsonian. If an interference develops,

the COTR will decide which work shall be relocated, regardless of which was installed first.

20.4. Installation of equipment and systems shall allow the maximum practical space for operation, repair, removal and testing, within the limits indicated on the Contract Documents. Pipes, conduit, ducts and other system components shall be installed as close as possible to ceiling slabs, walls and columns to minimize space used while accommodating function and maintenance.

21. QUALITY CONTROL

21.1. The Contractor shall provide for quality control, inspections, testing and re-testing as necessary for all work, including that of Subcontractors, to assure compliance with the Contract Documents.

21.2. Contractor Quality Control (CQC) System: The Contractor shall provide a quality control organization and system to perform quality control, inspections, testing and re-testing as necessary for any item of work, including that of Subcontractors, to assure compliance with the contract documents.

21.3. CQC Representative Designation and Authority: The Contractor shall provide a CQC Representative, supplemented as necessary by additional personnel, who shall be on the jobsite at all times during progress, with complete authority to take any action necessary to ensure compliance with the contract documents. The CQC Representative shall be appointed by a letter addressed to him/her and signed by an officer of the firm and shall not be the same individual as, or be subordinate to, the job superintendent or project manager.

21.4. CQC Plan Requirements: The Contractor shall submit for review/approval CQC Plan within thirty (30) calendar days after Contract Award to the COTR for approval. The Plan shall detail the procedures, instruction and reports to be used to assure compliance with the contract documents. As a minimum, the Plan shall include the following:

21.4.1. Designation of the CQC Representative: Identify the person and list duties, responsibilities and authority. The superintendent may act as CQC Representative.

21.4.2. Organization Chart: Show CQC staff and its relationship with other staff members and Subcontractors.

21.4.3. Personnel Matrix: For each specification section, identify who is the authorized submittal reviewer, who will inspect the work, what testing laboratory or person will perform on-site testing, who will perform factory inspections and testing and who will certify the documentation.

21.4.4. Responsibility and Authority: State the responsibility and authority for each individual in the CQC system.

21.4.5. Personnel Qualifications: Provide resumes and descriptions of prior experience on similar work.

21.4.6. Inspection Procedures and Schedule: Identify the inspection and testing procedures and scheduled dates as reflected on the CPM project schedule, organized by technical specification section.

21.4.7. Submittal Review Procedures and Schedule: Provide submittal log in accordance with the Submissions section. For each specification section, identify the name(s) of person(s) authorized to review and sign submittals for compliance.

21.4.8. CQC Documentation: Identify the procedures for documenting quality control operations, inspection and testing. Provide samples of each type of required documentation - all forms, logs, reports, etc. Include a testing log listing all tests and inspections required by the contract documents and stating the action to be taken by the Contractor and/or the Smithsonian.

21.5. Not used

21.6. CQC Inspection Requirements: As a minimum, the inspection procedures shall include the following:

21.6.1. Preparatory Inspection: Preparatory inspection shall be performed before beginning work and before beginning each segment of work. Preparatory inspection shall include a review of the contract requirements, complete review of shop drawings and other submittals for conformance with contract documents, confirmation that all required testing will be provided, physical examination of all materials and equipment for conformance with approved shop drawings and submittals and verification that all required preliminary work has been completed.

21.6.2. Initial Inspection: Initial inspection shall be performed as soon as a representative segment of the particular item of work has been accomplished. Initial inspection shall include checking of all dimensions, careful inspection of workmanship, performance of required testing, performance of corrective actions as necessary and approval or rejection of the initial segment of the work.

21.6.3. Follow-up Inspections: Follow-up inspections shall be performed daily or more frequently, as necessary, and shall include continued testing and examinations to assure continued compliance with the contract requirements.

21.6.4. Special Inspection and Documentation: In addition to the above inspection requirements, certain Special Inspection and Documentation requirements may be contained within the technical specification sections. Each Special Inspection shall be performed and documented as required and documentation shall be submitted as soon as possible after performance unless otherwise indicated.

21.6.5. Factory Inspection by the Contractor: The Contractor shall arrange and perform all factory inspections specifically required in the technical specification sections.

21.6.6. Non-Compliance Check-Off List: The CQC Representative shall maintain a check-off list of work that does not comply with the contract, stating specifically what is non-complying, the date the faulty work was originally discovered and the date the work was corrected. The CQC Representative shall not allow the Contractor to add to or build upon non-complying work unless, in the opinion of the COTR, correction can be made without disturbing the continuing work. The CQC Representative shall submit a copy of the check-off list to the COTR on a monthly basis. Items corrected on the day they are discovered do not need to be included on the submitted list.

21.6.7. Completion and Inspection of Work: The CQC Representative shall sign the written request for Substantial Completion Inspection (discussed in the Project Closeout Requirements section).

21.7. Testing Requirements: Except as specifically stated otherwise, the Contractor shall be responsible for all field sampling and in-place testing required by the contract documents.

21.7.1. Independent Testing Laboratory: The Contractor shall provide an independent, commercial testing laboratory to perform all sampling and testing services required, unless otherwise specified. The testing services shall be on- or off-site as required. Submit complete documentation of all tests performed in connection with the construction contract.

21.7.2. Smithsonian Acceptance of Laboratories: Except for factory tests, all field sampling and testing normally performed by commercial laboratories shall be performed by an independent commercial laboratory employed by the Contractor and accepted by the COTR. The Contractor shall submit the following information to the COTR for approval:

21.7.2.1. Name, registration number and engineering discipline of the Registered Professional Engineer in charge of the laboratory.

21.7.2.2. Affidavit of compliance and certification that the laboratory performs work in accordance with requirements as stated in the contract documents.

21.7.2.3. A list of testing equipment proposed for each test procedure including latest calibration data.

21.7.2.4. A copy of the latest Laboratory Inspection Report by an independent agency with laboratory certification that deficiencies (if any) have been corrected.

21.7.2.5. Names and qualifications of persons actually performing testing and sampling. Changes in personnel shall be approved by the COTR prior to performance of work under this contract.

21.7.3. Factory Tests: Unless otherwise specified, the Contractor shall arrange for factory tests when they are required under the Contract. Certified copies of test reports showing that the materials to be incorporated into the work conform to the contract documents will be acceptable, provided they are performed by the manufacturer or by agencies or laboratories acceptable to the COTR.

21.7.4. Test Results: Test results shall cite the contract requirements, the test or analytical procedures used, the actual results and include a statement that the item tested or analyzed conforms or fails to conform to specification requirements. The cover sheet for each report shall be conspicuously stamped in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, as the case may be. All test reports shall be signed by a testing laboratory representative authorized to sign certified test reports. The Contractor shall arrange for immediate and direct delivery of the signed reports, certifications and other documentation to the COTR.

21.8. Documentation: The CQC shall prepare or assist with the preparation of the following documents:

21.8.1. Daily Reports: The Contractor's Daily Report, as discussed in the section Contractor Correspondence and Daily Reports, shall be signed by the CQC Representative as well as the Superintendent. The CQC Representative's signature certifies that, to the best of his or her knowledge, the report is complete and correct and that all materials, equipment and work described on the report are in compliance with the contract plans and specifications, except as noted otherwise.

21.8.2. Special Inspection and Documentation: Reports of Special Inspections shall be signed by both the CQC Representative and the CQC Specialized Supplemental Person who witnessed the test or inspection certifying compliance with the specific contract requirement.

21.8.3. As-Builts: The CQC Representative shall ensure that all requirements for as-built record drawings and specifications are met. The CQC Representative or Specialized Supplemental Personnel assigned to inspect that particular portion of work shall initial each as-built drawing or technical specification section to certify its accuracy prior to submission in accordance with the Project Close-Out Requirements section.

22. PERMITS, LICENSES& FEES

22.1. The Contractor shall obtain and pay for all applicable permits and licenses required by regulating agencies, including but not limited to: permits for pedestrian and road markings, construction fences, sidewalk cuts, utility company connections, elevator certificates, waste containers, etc.

22.2. The Contractor shall pay all duties, fees, taxes and other charges and give all notices necessary and incidental to the due and lawful execution of the work.

22.3. The Contractor shall keep the Smithsonian indemnified against all penalties and liability for breach of provisions of any national, provincial, district or city statute, ordinance or law and the regulations and by-laws of any local or other duly constituted authority, which may be applicable to the Work and with such rules and regulations of public bodies and companies.

22.4. Accessibility for Physically-Disabled Persons: The Contractor's shall provide temporary constructions at the site as necessary to maintain access for physically disabled persons. All provisions for temporary access shall be subject to the approval of the COTR.

23. UTILITY SERVICE INTERRUPTIONS AND NEW CONNECTIONS

23.1. Any planned interruption in utility service must be approved by and coordinated through the COTR. The Contractor shall submit a written request as far in advance of scheduled interruption as possible, but no less than two (2) full working days in advance. The Contractor shall make the necessary temporary provisions to supply continuous electrical power, HVAC space conditioning and security as required during periods when service is interrupted.

23.2. The Contractor's work efforts to restore service shall be continuous until the interrupted utility is back in service.

23.3. Electrical power interruptions for National Museum of American must be requested and coordinated with the COTR.

23.4. A fire watch shall be provided for the time periods when fire suppression and detection systems are out of service.

24. SMITHSONIAN-FURNISHED ITEMS INSTALLED BY THE CONTRACTOR – NOT USED

25. SALVAGE

25.1. The Smithsonian Institution assumes no responsibility for salvage value or any loss or damage to materials or structures on the site for which the Contractor may have reflected a salvage value in his or her proposal.

25.2. Except as specifically stated in the contract documents, construction materials, equipment or other items that are to be removed and neither re-used under this contract nor reserved as property of the Smithsonian Institution shall become the property of the Contractor and shall be removed from the premises by the Contractor.

25.3. The following items shall remain the property of the Smithsonian and the Contractor shall deliver the items to the locations specified or as otherwise directed by the COTR, at no additional cost to the Smithsonian.

ITEM	DELIVERY LOCATION
Wood Bench	As directed by COTR
Wood and Glass Cabinets	As directed by COTR

26. CUTTING, PATCHING AND MATCHING EXISTING WORK

26.1. Existing work shall be cut, drilled, altered, removed or temporarily removed and replaced as necessary for performance of work under the contract. Work that is replaced shall match similar existing work. Structural members shall not be cut or altered, except where noted on drawings, without authorization of the COTR. Work to remain in place, which is damaged or defaced during this contract shall be restored to match the conditions existing at the time of award of the contract, at no additional cost to the Smithsonian.

26.2. Conditions exposed by removal of existing work that do not match new finishes or align with new work shall be called to the COTR's immediate attention. Necessary corrective work directed by the COTR will be subject to adjustment provisions as stated in the General Conditions of the contract.

PROTECTION OF THE SITE DURING CONSTRUCTION

27. PROTECTION OF THE SITE

27.1. The Contractor shall provide adequate protection for all parts of the building, including interior and exterior surfaces, its occupants and contents and grounds wherever work under this contract is performed.

27.2. Plan for Protection of the Site: The Contractor shall submit a plan for protection of the site to the COTR for approval. As a minimum, the Plan shall describe:

27.2.1. Proposed method, location and construction of temporary enclosures.

27.2.2. Routes of access and egress, including those for people with disabilities.

27.2.3. Location and maintenance of emergency exits.

27.2.4. Methods of protection of existing surfaces and occupants.

27.2.5. Means of connection of temporary enclosures/surfaces to existing historic materials.

27.3. During construction, temporary enclosures shall be constructed to prevent unauthorized access or egress. Dust and fume barriers shall be constructed, as needed or as determined by the COTR, to seal and isolate the work area from the remainder of the interior areas while the work is in progress. Wood used for protection of the site shall be pressure-impregnated, fire-retardant. All plastic sheeting shall be fire retardant 6-mil polyethylene. Submit product data to the COTR for review and approval.

27.4. The Contractor shall submit information describing the proposed construction of temporary enclosures and methods of installation to the COTR for approval. Any connections to existing structures must be accomplished in such a way as to minimize disturbance of existing surfaces.

28. PROTECTION OF FLORA,FAUNA AND CENTRAL COMPUTER CONTROLLER IRRIGATION SYSTEM – NOT USED

29. DEBRIS CONTROL AND DAILY CLEANUP

29.1. The Contractor shall regularly clean up the work areas and shall, at all times, maintain the project in as neat and orderly a manner as is consistent with normal operations. Debris resulting from construction operations shall be removed from the site daily by the Contractor. The Contractor shall keep all access, haul routes and site areas free of dirt, debris and other materials resulting from construction activities.

29.2. Under no circumstances shall any rubbish or waste be dropped or thrown from one level of scaffolding to another or within or outside the building. Rubbish may be lowered by way of chutes, taken down on hoists or lowered in receptacles.

29.3. Trash receptacles: The Contractor shall provide enclosed trash receptacle(s) in quantity and size necessary to meet project needs, located as approved by the COTR. Trash receptacles shall not be placed outside of temporary partitions, or in any location where it may impede visitor and staff egress or the use damage building fabric or exhibitions.

29.4. Refer to the Construction and Demolition Waste Tracking Chart following this section 010000.

30. DUST AND AIR QUALITY CONTROL

30.1. The Contractor will execute the Work by methods that minimize dust, vapors and gases raised by construction operations. The Contractor will utilize engineering controls and work practices to prevent airborne dust, vapors, gases and objectionable odors from dispersing into the atmosphere and from being drawn into existing air-intake louvers,

ductwork and adjacent elevator shafts. A work plan of methods and means for this section shall be submitted to the COTR for review and approval.

30.2. Dust barriers shall be erected, where necessary, to protect adjacent areas from dust infiltration as required by the COTR. Dust barriers shall be rigid and visually opaque and shall seal the work area by affixing to the structure on all sides (i.e., ceiling, walls and floor). Wood used for dust barriers shall be pressure-impregnated, fire-retardant treated lumber. All plastic sheeting shall be fire-retardant 6-mil polyethylene. Submit product data for review and approval to the COTR.

30.3. Means of connection of dust barriers to existing structures shall not damage the building fabric. Details of barriers shall be submitted for approval to the COTR.

30.4. No open fires or burning of trash are permitted.

31. NOISE CONTROL

31.1. The Contractor shall comply with the regulations of the District of Columbia and OSHA Standards 1926.52 and 1910.95 and all other regulations relative to safety noise control.

31.2. Activities that generate excessive noise or vibration and interrupt museum functions or create public disturbances may be required to be performed during off-hours at the discretion of the COTR.

31.2.1 Noise and Vibration Environmental Plan: Submit a Site-specific Noise and Vibration plan within 15 working days after the Notice to Proceed for review and response and prior to commencement of any construction activities that may create excessive noise and/or vibration at the Project site. Plan shall be prepared bu a cerified industrial hygienist acceptable to the COTR and contain the following:

1. A noise environmental plan describing Contractor's planned protection against excessive noise level throughout the construction site and adjacent SI spaces.
2. A vibration environmental plan describing Contractor's planned protection against excessive vibrations during seleceted construction activities. Plan shall include: Proposed areas of event, type of construction activity, expected vibration levels at source, and potential impact on artwork and building structure. Provide shop drawings detailing methods of protection and vibration environmental isolation.
3. Proposed product data of an approved method to provide remote monitoring of a noise and vibration monitor system which notifies the COTR and the Contractor immediately of excessive noise and vibration levels at locations determined by the COTR and maintained by the Contractor.

31.2.2 Construction Restricitions

1. Noise and Vibration: Restrict construction-related activities involving excessive noise, vibration, and similar disruptions during the SI's occupied hours and special events. In the event that noise and vibration limits are exceeded, the Contractor is to cease the activity, investigate the cause of the alert and/or excess experienced, and rectify the cause before proceeding with the work. Activities include, but are not limited to, the following:
    a. Demolition and cutting, including chipping, drilling or cutting concrete (hand or power).
    b. Demolition and cutting of construction materials, including wood and metal.
    c. The use of powered tools that exceed the following specified criteria.
    d. Delivery of bulk and oversized construction materials to the construction site.

2. Excessive noise is any generated noise over 70 dB that may be measured by a sound level meter complying with ANSI and International Electrotechnical Commission (IEC) Type II Sound Level Meter Standards at slow response when measured in public or SI staff environments adjoining the Project site
    a. Interior spaces: As allowable per OSHA before 10:00 am and after 5:00 pm weekdays/Saturdays or 6:00 pm on Sundays.
    b. Interior Spaces: 70dB between 10:00 a.m. and 5:00 p.m. weekdays/Saturdays and 11:00 a.m. and 6:00 p.m. on Sundays.
    c. The use of noise producing equipment shall not expose the public or SI staff at any time to noise in excess of prescribed standards as set forth by OSHA.
    d. Contractor shall schedule excessively loud or disruptive activities to be performed after hours, unless pre-approved by COTR, so as not to disrupt operations of the Museum.

3. Excessive vibration is any sensation of vibration in adjoining public or staff environments to the Project site. Excessive vibration is defined as any generated vibration which exceeds a peak particle velocity of 0.10 inch/second (2.5 mm/second).

4. Contractor shall provide a third party monitoring and testing agency to actively review noise and vibration levels. The SI may also conduct its own monitoring of noise and vibration levels.

a. Monitoring of noise and vibration levels shall be provided by up to three field-installed noise and vibration monitors that are placed at COTR approved locations. Each monitor shall provide remote monitoring alarm protocol for alert levels and reporting that includes real-time wireless notification of triggered events to multiple offices as determined by the COTR. Each monitor shall have a battery back-up system to ensure that monthly readings are not lost during possible power disruptions to the monitors. The Contractor shall submit monthly hardcopy reports of daily readings along with a brief summary report of each monitor's overall recorded events.

31.3. The Contractor shall provide sound attenuation to maintain acoustic level below 75 dBA at a distance of 15 m or below 75 dBA in occupied staff areas if less than 15 m away from noise source. Activities that generate objectionable noise or vibration in occupied staff areas may be required to be performed during off-hours at the discretion of the COTR.

32. VERMIN, PEST AND RODENT CONTROL – NOT USED

33. DRILLING, WELDING AND TORCH CUTTING

33.1. Daily Permits: When welding, torch cutting or other heating operations are to occur inside existing structures, the Contractor shall obtain a daily HOT WORK PERMIT from the Building Manager's Office. Permit must be obtained no more than 24 hours in advance, including for days following holidays, Mondays and off-hours (night) work. Reference attached Hot Work Permit form and General Instructions for required permit process. The PAI (Permit Authorizing Individual) will be available in the Building Management Office and/or throughout the Facility. Building Management Office hours are from 8am to 4pm. The permit must be posted at the job site prior to beginning the scheduled work. During the course of the Work, all existing smoke and heat detectors and sprinklers heads must remain operable. Coverings may be applied to protect them from spray coatings or other hazardous conditions only during the actual operations. Coverings must be removed immediately after the operations have concluded, but at the end of each working day at a minimum. When work produces dust or other airborne contaminants, e.g., spray painting, that could impair existing fire suppression or detection system(s) or when the system itself is otherwise impaired (drained down, etc.), the Contractor shall obtain a daily FIRE SYSTEM IMPAIRMENT PERMIT. Fire System Impairment Permit must be obtained a minimum of 48 hours in advance. Reference attached Fire System Impairment Permit form and General Instructions.

33.2. Fire Watch: No welding or torch cutting shall be performed unless adequate fire protection is provided. The Contractor shall maintain a fire watch for the duration of welding, cutting and heating operations and for at least 30 minutes after the 'hot' work has stopped. A fire extinguisher (minimum 10 pounds, dry-chemical type, typical) shall be on hand when drilling, welding or cutting.

33.3. Use of Impact Hammers: The use of impact hammers or other equipment causing vibration, noise and dust may be harmful to collections and/or building occupants. The Contractor shall request approval from the COTR at least five (5) working days before beginning this type of work to ensure adequate time for notification of building occupants and protection of objects and collections.

33.4 Ventilation: The Contractor shall provide adequate ventilation to prevent air contamination or the accumulation of toxic materials. Take necessary measures to prevent welding fumes from passive transfer to adjacent areas and from entering mechanical ventilation systems, including sealing all adjacent ducts and equipment openings with plastic. Where transfer is deemed likely or verified by the COTR, utilize local exhaust ventilation with HEPA filtration to control welding fumes. The Contractor shall submit means and methods for controlling air contamination to the COTR for review and approval.

TEMPORARY CONSTRUCTION FACILITIES

34. CONTRACTOR FIELD OFFICES, TRAILERS AND SHEDS

34.1. The Contractor shall establish a temporary office at the project site. The Contractor shall provide information about proposed locations of any temporary office, sheds, trailers and staging and storage areas and designation of size, color and materials to the COTR for approval at least five (5) working days prior to mobilization.

34.2. The Contractor may provide his own locking device on the door to the temporary office, trailer or shed. The Contractor shall be solely responsible for the safekeeping and security of the construction facilities, materials and equipment.

34.3. Upon completion of the Work, the temporary offices, trailers and sheds shall be removed and the area returned to its original pre-contract condition.

35. STAGING, STORAGE AND WORK AREAS

35.1. The Contractor shall provide adequate storage and protection of materials and equipment delivered to the site to prevent theft, weather damage, mold infiltration, moisture damage and other physical damage.

35.2. Plan for Staging, Storage& Work Areas: The Contractor shall submit a drawing (scale 1:50) of areas proposed for construction operations for approval by the COTR at least five (5) working days prior to mobilization or at the Preconstruction Meeting, whichever is first. The drawing shall show buildings, utilities, temporary toilet facilities, temporary utility extensions, temporary interior walls and barriers to limit unauthorized intrusion and to control noise and dust, pedestrian walkways, vehicular access, temporary fencing, trailers, sheds, storage areas and the Contract's desired route for access and egress to the premises and to the project site.

35.3. All wood used for temporary, interior construction shall be pressure-impregnated with a "Dricon" treatment or an equal treatment approved by the Smithsonian Institution.

All pieces must bear the UL "FR-S" stamp. Intumescent (fire-retardant) paint shall not be used. All plastic sheeting shall be fire retardant 6-mil polyethylene. Submit product data to the COTR for review and approval.

36. SANITARY FACILITIES

36.1. Contractors' personnel will be permitted to use designated restrooms located on the premises. If, in the opinion of the COTR, the Contractors' personnel fail to maintain acceptable dress and conduct appropriate to a public place, permission to use the public restrooms may be rescinded.

37. TEMPORARY UTILITY SERVICES AND EXTENSIONS – NOT USED

38. SCAFFOLDING AND PLATFORMS

38.1. The Contractor shall erect temporary scaffolding in accordance with OSHA 29 CFR 1926.451 and ANSI A10.8. The Contractor shall provide landing platforms with stairways or ladders for proper access and egress to all work areas.

38.2. For all frame scaffolding greater than 4 m in height, the Contractor shall submit working drawings to the COTR a minimum of ten (10) working days in advance of scaffolding erection. Working drawings submitted by the Contractor shall be certified by a registered Professional Engineer.

38.3. During non-working hours, the Contractor shall close and lock the scaffolding with a physical barrier to prevent access by unauthorized persons.

39. PROJECT SIGNS

39.1. All signs, including signs shall be submitted at least five (5) working days prior to erection for approval by the COTR. The Contractor shall maintain and relocate the signs, as necessary, during the progress of the Work. The Contractor shall remove all signs at the completion of the Work.

39.2. Construction Site Information and Direction: Informational signs required to indicate the location of the Contractor's office and directional signs for safety, vehicular control, pedestrian right-of-ways, detours to facilities, etc. shall be furnished and installed by the Contractor as requested and approved by the COTR.

39.3. Egress signs: When egress routes are blocked due to work, provide signage directing staff and visitors to alternate routes. Submit signage to COTR for review and approved by OSHEM and building staff.

MEETINGS

40. PRECONSTRUCTION MEETING

40.1. A Preconstruction Meeting will be scheduled with the Contractor before any work is started at the site. As soon as possible after the Date of Award, the COTR will contact the Contractor to arrange a time, date and place for the conference. Items to be discussed at the Preconstruction Meeting include, but are not limited to:

40.1.1. Contract Time: Notice to Proceed date and Completion date;

40.1.2. Scheduling and Submittals;

40.1.3. Mobilization and Staging;

40.1.4. Access to the Premises, Haul Routes, Loading Dock;

40.1.5. Contractor Deliveries;

40.1.6. Security Requirements/List of Contractor's Personnel;

40.1.7. Emergency Procedures and Phone Numbers;

40.1.8. Protection of Site and Historic Preservation;

40.1.9. Fire Protection and Safety Requirements;

40.1.10. Utility Interruptions, Rough-in Inspections, Testing;

40.1.11. Applications for Payment;

40.1.12. Pre-Condition Survey of the Site;

40.1.13. Accessibility Requirements;

40.1.14. Sustainability Requirements;

40.1.15. Building Systems Commissioning;

40.1.16. Quality Control.

40.2. The Contractor's key staff and representatives of all Subcontractors or Suppliers shall attend the Preconstruction Meeting.

40.3. Coordination Plan: The Contractor shall use the Preconstruction Meeting to develop a Coordination Plan for interaction with other parties working in or using the facility. The plan shall be submitted no less than five (5) working days after the Preconstruction Meeting and shall address interactions with other contractors, tenants, the public and any others making use of the site and surrounding areas. As a minimum it shall include:

40.3.1. Locations of overlap in use of the site by the Contractor and others, including work areas, delivery points, access/egress areas.

40.3.2. Specific items of work by others required to support critical milestones in the Contractor's schedule.

40.3.3. Coordination with the work of the designated Commissioning Provider.

40.3.4. Completion or delivery of work by others that may impact the Contractor's schedule.

40.3.5. Portions of the work that create special hazards or disturbances.

40.3.6. Portions of the work that affect utilities, fire-protection or detection systems or security systems.

40.3.7. Events requiring access to areas outside of the project site or secured spaces.

40.3.8. Protection to be provided by the Contractor for work completed by others either before or during this project.

41. PRE-CONDITION SURVEY OF THE SITE

41.1. After the Preconstruction Meeting and before the start of work on the site, the project site (i.e., building, its contents, grounds and equipment) shall be inspected by the Contractor, major Subcontractors, COTR and other Smithsonian Institution personnel as may be required for the purpose of verification of the existing conditions. Any damages or defective equipment will be noted at this time and this survey will serve as the basis for the establishment of the pre-contract conditions. The identification of pre-contract conditions will be jointly established by the Contractor and Smithsonian Institution.

41.2. Written and photographic documentation: The Contractor shall prepare a typewritten and photographic report in PDF format to identify damages or defects of materials, equipment and the site. The Contractor shall submit report electronically to the Contracting Officer and the COTR.

42. PROJECT MEETINGS

42.1. Progress Meetings: The COTR will lead regular progress meetings with an interdisciplinary integrated management team consisting of representatives of the Contractor, Smithsonian, Architect/Engineer, Commissioning Provider, major Subcontractors and other critical Subcontractors and suppliers. The purposes of these meetings are to expedite the work, coordinate and schedule the Work and coordinate the work with Smithsonian activities. Progress meetings shall be held weekly unless otherwise directed by the COTR. The time and place of the meetings will be established at the Preconstruction Meeting. The Contractor shall ensure that all required Subcontractors and suppliers attend the Progress Meetings and the COTR will ensure that all necessary SI personnel attend.

42.2. Special-Topic Meetings: At the discretion of the COTR, additional meetings may be scheduled to address issues of quality control, sustainability requirements, coordination between contractors on the premises, coordination with other agencies, scheduling of the

work, application for payments, etc. The Contractor's staff and Subcontractors or Suppliers shall attend.

42.3. Meeting Minutes: The Contractor shall promptly prepare minutes of each meeting and transmit, to the COTR, within five (5) working days.

SUBMISSIONS

43. SUBMITTAL DEFINITIONS

43.1. Submittals are defined to include shop drawings, product data, samples and additional data required for submission to the COTR for review and approval prior to incorporation into the work.

43.1.1. Shop Drawings: Detailed drawings, schedules, diagrams and illustrations prepared specifically for this project by the Contractor or any subcontractor, manufacturer, supplier or distributor to illustrate fabrication and/or installation of a portion of the Work.

43.1.2. Schedule: A detailed tabulation of components, items or parts to be furnished for use on this project.

43.1.3. Statement: An affirmation prepared by the Contractor, the installer or manufacturer of a material, product or system, to satisfy a requirement defined in a technical section.

43.1.4. Factory Test Report: A written report of the findings of a test performed by the Contractor on an actual portion of the Work or prototype prepared for this project before it is shipped to the site.

43.1.5. Field Test Report: A written report of the findings of a test performed by the Contractor on a portion of the Work during or after installation.

43.1.6. Certificate of Compliance: A written statement, signed by an authorized official of the manufacturer of a product or system or supplier of a material attesting that the product, system or material meets the requirements of the contract documents. The certificate of compliance must be dated after the award of this Contract and must name the project and cite the specification section, paragraph and requirements, which it is intended to address.

43.1.7. Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature and catalog information illustrating a material, product or system to be installed on this project, including all data related to LEED requirements, such as recycled and regional content information, Volatile Organic Compound (VOC) product schedules, Forest Stewardship Council (FSC) chain-of-custody documentation and other documentation as requested by the COTR.

43.1.8. Color Charts: Pre-printed brochures showing the color range of a material.

43.1.9. Test Reports: Reports verifying that a material, assembly, system, process or laboratory meets requirements established in the Contract Documents. Reports shall indicate compliance by naming and describing the test method and test results. Testing must have occurred within three (3) years of the date of award of this contract.

43.1.10. Samples: Physical examples of materials, equipment, assemblies or workmanship establishing standards for evaluating finished Work.

43.1.11. Color/Texture Selection Sample: Samples of an available range of textures and/or colors of a material formed of the actual finish material over a substrate identical to that which will be used in the field.

43.1.12. Mock-up: An assembly or sample panel constructed in accordance with specifications to show construction details, finished appearance and/or performance.

43.1.13. Material Safety Data Sheets: Instructions, warnings and recommended and required handling and use procedures for individual hazardous materials published by the product manufacturer.

43.1.14. Delegated Design: Design and engineering responsibilities for specialty Structural elements, signed and sealed by a Professional Engineer registered in the District of Columbia. Include detailed drawings, schedules, diagrams, calculations, and illustrations prepared specifically for this project, and include all relevant information for a complete design in a single set of coordination documents.

44. SUBMITTALS AND REVIEWS

44.1. Contractor Responsibility for Submittals: The Contractor shall provide all required submittals, by technical specification section, in accordance with the contract documents. All submittals, with the exception of mockups or samples, are to be submitted electronically in PDF format, using e-mail, the Smithsonian's I-Manage portal, or a contractor-sponsored FTP site, as directed by the COTR, the Contractor shall clearly indicate, on the submittal, that it has been reviewed by the Contractor and found to meet the project requirements. Any items submitted as substitutions shall be clearly identified as such on the submittal and the transmittal document. If shop drawings show variations from the contract documents because of standard shop practices or for other reasons, the Contractor shall provide a separate, written description of variations along with the submittal. The Contractor shall:

44.1.1. Review each submittal for conformance with requirements of the contract documents and coordination with related work.

44.1.2. Determine and verify all field measurements, required material quantities, method of assembly or erection, installation requirements and proper connection to adjoining materials installed by others.

44.1.3. Assure that all submittals use the appropriate units of measure. All drawings and technical data shall be in SI (metric) units for projects designed in SI units. Preprinted literature in other units shall be accompanied by documentation to show conformance to project requirements.

44.1.4. Transmit all required submittals for a technical specification section at the same time unless prior written waiver of this requirement has been provided by the COTR.

44.1.5. Transmit submittals to the COTR in a logical and orderly sequence in accordance with the Submittal Schedule to prevent project delays or adversely impact work by the Smithsonian Institution or other contractors.

44.1.6. Correct and resubmit submittals according to response from Smithsonian Office Oof Planning, Design & Construction.

44.1.7. Commence work on items requiring submittals only after all related submittals are reviewed and approved by the Smithsonian. All Work shall conform to approved submittals.

44.2. Submittal Schedule and Control Log: The Contractor shall submit, to the COTR, a schedule of work-related submittals using the Smithsonian OFEO Submittal Log form within fourteen (14)calendar days after the effective date of the Notice to Proceed. (Submittal Log form is available on computer disk upon request.) Submittals shall be listed in the order they are scheduled to be submitted and the following information shall be given:

44.2.1. Project Name, Project Number, Contractor Name, Contract Number;

44.2.2. Technical Specification Section for each submittal;

44.2.3. Unique Submittal Number;

44.2.4. Description of item to be submitted, as listed in the specifications;

44.2.5. Date item must be submitted to the Smithsonian in order to support the project schedule;

44.2.6. Subcontractor providing submittal (in "Comments" column).

44.3. Quantities for Submittals: Unless otherwise noted in the technical specification, the Contractor shall deliver to the COTR:

44.3.1. Shop Drawings: Submit electronic copy of shop drawings in PDF format. Submittal will be forwarded electronically to the AE for review. After submittal

review, submittal will be returned to the Contractor electronically, in PDF format. Submit in DWG format, if requested.

44.3.2. Product Data, Test Reports, Color Charts, etc.: The Contractor will make submittals in electronic format, preferably PDF.

44.3.3. Color/Texture Samples: Submit two (2) samples, minimum size 600 mm by 600 mm, unless otherwise specified. After submittal review, one (1) sample may be retained by the Smithsonian.

44.3.4. Mock-up and Sample Installations: Unless otherwise specified, minimum size shall be as noted to complete a panel section or normal break in the work.

44.3.5. Written Text Documents, Plans and Reports: Submit electronic copy of written text documents, plans and reports in PDF format. Submittal will be forwarded electronically to the AE for review. After submittal review, submittal will be returned to the Contractor electronically, in PDF format.

44.4. Submittal Reviews by the Smithsonian: Reviewed submittals will be marked "Approved," "Approved as Noted," "Resubmit" or "Disapproved." Submittal approval by the Smithsonian shall not relieve the Contractor of responsibility for submittal errors, omissions or deviations from the contract documents. Approval of submissions does not constitute acceptance of substitutions except as covered under sub-paragraph entitled "Contract Requests for Substitutions."

44.5. Submittal Review Period: The Contractor shall transmit, to the COTR, all submittals sufficiently in advance of the time necessary for fabrication and installation to allow for review by the Smithsonian and return to the Contractor, including any time needed for correction and resubmission by the Contractor. The expected time required by the Smithsonian for review of initial submission is 14 calendar days. No extension of the Contract Time will be granted for the Contractor's failure to allow sufficient time for review and processing, including resubmission of items, which initially rejected due to improper submission or non-compliance with the Contract Documents.

44.6. Contractor Requests for Substitutions: Contractor requests for items identified by manufacturer, brand name, make, catalog number, etc. in the contract documents shall be submitted to the Contracting Officer for approval prior to contract award, in accordance with the General Conditions. After award of the contract, contractor requests for substitutions may be considered and accepted by the Smithsonian at the discretion of the Contracting Officer.

45. CRITERIA FOR PRODUCT SELECTION

45.1. To the greatest extent possible, subject to the restrictions of the Buy American Act, provide products, materials or equipment of a singular generic kind from a single source.

Where more than one choice of a product or material is available for Contractor's selection, select an option, which is compatible with other products and materials already selected.

45.2. Provide products complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation for intended use and effect.

45.3. Products, which, by nature of their application, are likely to be needed at a later date for maintenance and repair or replacement work, shall be current models for which replacement parts are available.

45.4. Product selection shall be done in accordance with the following requirements:

45.4.1. Standards, Codes and Regulations: Select from among products that are in compliance with the project requirements, as well as with construction standards, all applicable codes and regulations and LEED requirements.

45.4.2. Performance Requirements: Provide products that comply with specific performances indicated and are recommended by the manufacturer (in published product literature or by individual certification) for the application indicated.

45.4.3. Prescriptive Requirements: Provide products that have been produced in accordance with prescriptive requirements, using specified ingredients and components and complying with specified requirements for mixing, fabricating, curing, finishing, testing and other operations in the manufacturing process.

45.4.4. Visual Matching: Where matching with an established sample for color, pattern and/or texture, the COTR shall determine whether a proposed product matches the sample.

45.4.5. Avoidance of banned materials: The Contractor will commit to not using the following toxic and hazardous materials:

45.4.5.1. Products containing asbestos, urea formaldehyde, polychlorinated biphenyls (PCBs) and/or chlorinated fluorocarbons;

45.4.5.2. Products containing lead content, including older or flux containing more than 0.2 percent lead; domestic water pipe or pipe fittings containing more than 8 percent lead; and paint containing more than 0.06 percent lead.

46. PROGRESS PHOTOGRAPHS

46.1. Provide photographs of the project site and construction activities throughout the progress of the Work, acceptable to the Smithsonian Institution.

46.2. At least 15 color progress photographs shall be taken monthly. The actual number and location of views shall be directed by the COTR. Photographs shall be taken at the start and finish of various elements of construction designated by the COTR.

46.3. Within ten (10) working days of taking photographs, submit to the COTR, via email or other electronic means, JPEG files for all photographs taken.

46.4. Submit all original images, select labeled images and typed index to COTR by electronic transfer via email.

46.5. Digital images, negatives, contact sheets and photographs, including the copyright thereto, are the sole property of the Smithsonian Institution and shall be submitted to the COTR before Final Payment processing. The Contractor shall not use Smithsonian property except as authorized in writing by the Contracting Officer.

47. CONTRACTOR CORRESPONDENCE AND DAILY REPORTS

47.1. The Contractor shall correspond with the COTR for all matters related to this construction project, unless otherwise directed. All correspondence shall be signed and dated by the Contractor and shall reference the project, project number and contract number.

47.2. The Contractor shall maintain daily reports using the Smithsonian Institution Contractor's Daily Report form. Reports shall be numbered consecutively and all sections shall be completed or noted as "not applicable." Reports shall contain detailed remarks each day, including but not limited to progress on the job, problems discovered and discussions with Smithsonian staff. Reports shall be submitted to the COTR each day for the previous workday.

47.3. All correspondence with the Smithsonian Institution shall be in the English language.

SAFETY, HEALTH AND FIRE PROTECTION

48. JOBSITE SAFETY

48.1. Safety Coordinator: The Contractor shall designate a person responsible for safety at the project site for the duration of the project.

48.2. Jobsite Safety Plan: The Contractor shall submit a Jobsite Safety Plan within *30 calendar days of the Contract Award and at least *10 calendar days prior to mobilization to the site for approval by the COTR. As a minimum, the plan shall detail the procedures, designated persons, instructions and reports to be used to assure jobsite safety for all contractors, subcontractors, Smithsonian personnel, the public and others on the site.

48.3. Occupational Safety and Health: This contract is subject to Title 29 of the Code of Federal Regulations, Part 1910 "Occupational Safety and Health Standards" and Part 1926

"Safety and Health Regulations for Construction" pursuant to the Occupational Safety and Health Act (OSHA) of 1970 administered by the US Department of Labor, Occupational Safety and Health Administration.

48.4. Emergency Assistance: The Contractor shall post, at the site, telephone numbers for reporting emergencies, including the Smithsonian Office of Protection Services (OPS), ambulance, police, fire department, gas utility, electric utility, water/sewer utility, poison prevention aid and hazardous-waste handling. This information shall be posted in a conspicuous location within the project area prior to the start of any work at the site.

48.5. Safety Signs: The Contractor shall post legible accident prevention signs in construction areas in accordance with OSHA standards. Safety signs shall conform to ANSI 235.1 and 235.2 Vehicular traffic control devices, barricades and signals shall conform to ANSI D6.1.

48.6. Report of Accident or Illness: In the event of any accident or illness for which medical assistance is required, any criminal action or any fire, the Contractor shall notify the appropriate authority (Ambulance, Police, Fire Dept.), Smithsonian Security and the COTR.

48.7. Emergency Evacuation: The Contractor shall post evacuation routes and facility emergency/self-protection plans at the site, train all employees in emergency procedures and document such training. In the event of a fire, the Contractor shall immediately activate the alarm at the nearest fire alarm pull station and notify building security. Upon the activation of the audible alarm, the building will be evacuated. No personnel shall reenter the facility until security personnel signal that the building is safe.

48.8. Contractor Personnel to be Contacted: The Contractor shall submit a written list of emergency telephone numbers and names of persons to contact for the General Contractor superintendent and for each major sub-contractor working on the project site. The initial list shall be submitted to the COTR at the Preconstruction Meeting. The list shall be updated and resubmitted to the COTR as needed.

49. TOXIC AND HAZARDOUS SUBSTANCES

49.1. Submit a “Safety Data Sheet” in compliance with OSHA’s updated Hazard Communication Standard (HCS) 1910.1200, for all hazardous chemicals used, which includes the following 16 sections:

49.1.1. Product Identification;

49.1.2. Hazardous Identification;

49.1.3. Composition/Information on Ingredients;

49.1.4. First-Aid Measures;

49.1.5. Fire-Fighting Measures;

49.1.6. Accidental Release;

49.1.7. Handling and Storage;

49.1.8. Exposure Controls/Personal Protection;

49.1.9. Physical and Chemical Properties;

49.1.10. Stability and Reactivity;

49.1.11. Toxicological Information;

49.1.12 Ecological Information;

49.1.13 Disposal Considerations;

49.1.14 Transport Information;

49.1.15 Regulatory Information;

49.1.16 Other Information (e.g., preparation date, last revision).

49.2. The Contractor shall monitor the use of all toxic and hazardous substances to ensure that exposure to their workers from airborne concentration of, or physical contact with, these substances does not exceed applicable regulatory worker health and safety exposure limits.

49.3. The Contractor shall monitor the use of all toxic and hazardous substances to ensure that exposure to Smithsonian Institution employees and visitors from airborne concentrations of, or physical contact with, these substances is maintained as low as reasonably achievable. Under no circumstances shall exposure exceed the established Short-Term Exposure Limit or 50% of the established Threshold Limit Values or Permissible Exposure Limits (whichever is less) as specified in either:

49.3.1. "Threshold Limit Values and Biological Exposure Indices" of the American Conference of Governmental Industrial Hygienists, latest revision.

49.3.2. Title 29 CFR Part 1910, Subpart Z - "Toxic and Hazardous Substances" of the Occupational Safety and Health Standards, latest revision.

49.4. The Contractor shall provide methods, means and facilities to prevent contamination of soil, water and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations. The removal of contaminated waste shall be in compliance with applicable laws and regulations.

49.5. To achieve compliance with the requirements of this section, administration or engineering controls shall first be implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or other protective measures shall be used to keep exposure of all persons within the prescribed limits. Descriptions of equipment or technical measures to be used for this purpose must be submitted to the

COTR for approval. The Contractor's requirements for compliance with all applicable Local, Federal and State regulations remain in force.

49.6. The SI may reject any product that poses a high risk of fire or health hazard to staff, visitors or the building, based on flammability criteria (e.g., low flashpoint) or established toxicity data (e.g., designation as a human carcinogen).

49.7. The Contractor shall submit, to the COTR, a list of the hazardous materials to be stored on site and the manner in which they will be stored. All containers and storage cabinets shall be approved by the COTR and labeled as to hazard and content.

49.8. The SI has made every effort to identify and to notify the Contractor of hazardous materials that may be encountered during the work. However, if suspected asbestos-containing material, lead-based paint or other suspected hazardous materials are encountered during demolition or other phases of the work, the work involving the suspected material shall cease and the Contractor shall notify the COTR immediately.

50. PERSONAL PROTECTIVE EQUIPMENT

50.1. Personal protective equipment for eyes, face, ears, nose, head, extremities and/or full body shall be provided, used and properly maintained by the Contractor whenever necessitated by reasons of hazards encountered in a manner capable of causing illness, injury or impairment in the function of any part of the body.

50.2. Persons required to use personal protective equipment shall be thoroughly trained. Training programs shall, as a minimum, meet OSHA and EPA requirements where applicable. The Contractor shall submit proof and criteria for employee training as requested.

51. BARRICADES, BARRIERS AND WALKWAYS

51.1. The Contractor shall provide safety barricades in accordance with the District of Columbia Building Code and applicable OSHA regulations. The Contractor shall also provide barricades, subject to approval by the COTR, to deter passage of persons and/or vehicles into construction areas as specified or necessary.

51.2. The Contractor shall install temporary barriers, in a manner satisfactory to the COTR, to contain and secure the site from unauthorized entry and to minimize the adverse effects of noise, dust and vapors generated by construction activities on surrounding areas. Barriers must be built of non-combustible materials, built from floor to ceiling, and sealed at ceiling. Submit all product data to the COTR for review and approval.

51.3. If the work interferes with public or employee access to the facility or parts of the facility, as determined by the COTR, the Contractor shall provide personnel barriers and signage to create easily identifiable, accessible (to people with handicaps) walkways around the work. Signs shall be posted at decision points to prevent unnecessary travel along changed routes and to dead ends. The barriers shall be erected and dismantled in phases so

that a clear route is always available. The COTR and Contractor personnel shall have access through the barriers to the work areas. The Contractor may use hardware on the barrier doors to prevent entry by unauthorized persons.

51.3.1. Interior barriers shall be of standard drywall partition construction, painted and terminated at the underside the existing ceilings. All requirements for fire protection shall be maintained.

51.4. Unless specifically indicated otherwise, barricades, barriers and associated signs shall be removed upon completion of the Work. The Contractor shall coordinate the dismantling and removal with the COTR.

51.5 Contractor to furnish and install full-size wall graphic for temporary construction partition, design provided by COTR. Graphic to be printed on matte laminated high-performance vinyl; size to be determined. Install during off-hours.

52. EXISTING FIRE PROTECTION SYSTEMS

52.1. During the course of the Work, all existing smoke and heat detectors and sprinkler heads are to remain operable to the maximum extent possible. Where specific work will or may adversely affect these devices, coverings shall be applied to protect them from dust, paint overspray or other hazardous conditions for the duration of each task. Written permission shall be obtained in advance of work from the COTR. A qualified person shall remain on site during operations while heads are covered. Coverings must be removed immediately after the operations have concluded for that day. Damaged detectors and sprinkler heads shall be replaced immediately by the Contractor at no additional cost to the Smithsonian Institution. The Contractor shall use accepted procedures to test replaced detectors and sprinklers after installation to the satisfaction of the COTR.

52.2 If a fire protection or life safety system must be impaired for modifications or adjustments during the project, the Contractor shall obtain a daily “Fire System Impairment Permit.” Each permit must be obtained at least two (2) working days in advance from the Building Managers Office and be posted at the jobsite prior to beginning the scheduled work.

SECURITY REQUIREMENTS

53. GENERAL SECURITY REQUIREMENTS

53.1. The Contractor and his employees must comply with security requirements imposed by the Smithsonian Institution, including any necessary security clearances. Failure to inspect the site or obtain knowledge of security regulations shall not relieve the Contractor from security requirements or from performance of any part of the work.

53.2. Prior to the start of work on the site, the Contractor shall submit, to the COTR for approval, a list of the names, social security numbers and addresses of all employees and subcontractor employees. The list shall identify the Prime Contractor and each

subcontractor and trade. It shall be updated, as necessary, to accurately identify all workers who will be working on the site during the project.

53.3. The name and telephone number of the Contractor's Superintendent and authorized alternate individual who can be reached on a 24-hour basis shall be provided to the COTR at the Preconstruction Meeting.

54. IDENTIFICATION BADGES

54.1. Controlled Access: Contractor employees shall sign in and out with the security officer on a daily basis for the duration of the Contract Time. Access to the building will be granted only to Contractor employees who sign the Building Entry and Departure Register at designated entrances and who wear a Contractor Day Pass in plain view for inspection. Only temporary Day Passes will be issued.

54.2. ID Processing: Contractor personnel will be issued day passes for use while on the premises.

54.2.1. Day passes will be provided by the Smithsonian at no cost to the Contractor. Smithsonian reserves the right to not issue day passes to those Contractor employees who fail to meet security requirements.

54.2.2. The Contractor shall submit, to the COTR, a written request for approval of each employee who will be working on site and was not on the original list. Each application must be submitted at least five (5) working days before the employee is scheduled to begin on the project.

54.3. ID Pickup: Contractor’s personnel reporting for work shall be required to sign the building entry and departure register and to exchange a driver's license or some other photo identification for the Contractor Identification Badge or Day Pass. The personal identification exchanged for the badge or pass will only be returned to its owner when the credential is returned.

54.4. Accountability for ID: Contractors who are issued a day pass are strictly accountable for it and for following established access control procedures. Misuse of the credential, noncompliance with access control procedures or failure to return the day pass upon leaving the premises shall be reported to the COTR.

54.5. Lost ID: If a Contractor or subcontractor employee loses a day pass, the Contractor shall report the loss immediately to the COTR. The Contractor shall submit to the COTR, within two (2) calendar days, a written report detailing how, where and when the credential was lost. A request to the COTR for authorization of a replacement credential, if necessary, shall accompany this report. The Contractor shall bear the cost for replacement of the lost pass.

54.6. Ownership of ID: The Contractor Day Pass shall remain the property of the Smithsonian and it shall not be taken off the premises. The pass will be issued to the person it identifies when he reports to the work site for duty and it must be returned to the security guard station whenever the person it identifies leaves the premises.

55. ACCESS AND PROPERTY CONTROL AT THE MUSEUM SUPPORT CENTER – NOT USED

56. SECURITY OF TEMPORARY OPENINGS

56.1. Any temporary opening in the building perimeter or between non-public and public interior spaces must be closed and secured with means acceptable to the COTR at the end of each workday. A clear and safe path shall be maintained at all times to allow museum visitors entrance into the museums. The Contractor shall secure his facilities and equipment during non-working times at his own expense. Authorized Smithsonian personnel shall have access to the work site.

57. EXISTING BUILDING ALARM SYSTEMS

57.1. The Contractor shall notify the COTR prior to disturbing any alarm wiring, device, system, etc. The Contractor shall coordinate planned disturbances at least two (2) working days in advance of the scheduled work. Any alarm wiring, device or system that is broken or disturbed for any reason must be reported to the Building Manager, COTR and the Building Security Control Room within three(3) minutes of the occurrence.

57.2. If any system or component is damaged by Contractor employees, the Smithsonian Institution Office of Protection Services will determine the procedures for repairing the damage to existing building alarm systems and who will perform the repair work. The cost to repair the system and any related overtime costs for Smithsonian personnel shall be borne by the Contractor.

58. SECURITY GUARD DUTY CHARGES

58.1. If the Contractor is required to accelerate the work in order to complete the project within the specified Contract Time or if other conditions arise as a result of the Contractor's management of the work, which require that construction be accomplished during other than the normal workdays and hours defined for this project, the Contractor will be required to assume the cost of any additional inspection and guard services at overtime rates.

58.2. The current overtime hourly rate charged for each Smithsonian guard is $45.00. This rate is subject to change during the Contract Time without notice.

SCHEDULES AND PAYMENTS

59. SCHEDULE OF VALUES

59.1. The Contractor shall submit, to the COTR, a schedule of estimated values of all parts of the work. The breakdown of costs on the Schedule of Values shall follow the divisions used in the project specifications and shall reflect major items and groups of items shown on the Contractor's project schedule. All values shall be in US dollars.

59.2. Wages: The contractor shall verify wages and comply with regulated wage scales, i.e., Davis-Bacon, Service Contract Act, etc.

60. SCHEDULING & PAYMENTS / BAR CHART

60.1. Project Schedule: The Contractor shall submit to the COTR for approval a Gantt bar chart project schedule within fourteen (14)calendar days after the date of contract award. Submit Project Schedule in both PDF format and original scheduling software format. No work shall start at the site until the project schedule has been approved by the COTR. The approved bar chart will represent a baseline schedule on which the monthly construction progress will be indicated and submitted to the COTR. The baseline project schedule shall comply with the following:

60.1.1. Weekly breakdown of work activities shall be provided, including interaction between building trades, subdivided by items of work and areas of the project. Items of work shall be grouped and subdivided according to the divisions of the Construction Specifications Institute (CSI) format.

60.1.2. The start date and completion date shall be consistent with the Contract Time established by the Contracting Officer. Any intermediate deadline dates needed to meet specific requirements for Smithsonian use of portions of the work shall be shown.

60.1.3. Project condition survey activities shall be scheduled not later than the 14th calendar day of the contract time and prior to the start of any site work.

60.1.4. Project closeout activities shall be scheduled for completion in accordance with the requirements for the Contract Time for Completion.

60.1.5. Order dates and projected delivery dates shall be shown for equipment, special devices, hardware, products or other items requiring long lead-time.

60.1.6. Required delivery dates for items to be furnished by Smithsonian and installed by the Contractor shall be shown, as well as items to be furnished and installed by Smithsonian, which will affect the Contractor's work.

60.1.7. Review periods for all submittals and time required for all necessary inspection and/or testing shall be shown.

60.1.8. Dates shall be given for ordering, delivery, installation and testing of major equipment and special materials and equipment.

60.1.9. The Contractor shall specifically identify work activities and dates associated with construction options.

60.2. Revisions to Baseline Schedules: The Contractor shall submit, to the COTR for approval, all revisions to the approved baseline project schedule. The Contractor shall submit a proposed revision to the schedule as necessary along with proposals for construction changes, clearly indicating modifications to the schedule based on the proposal. The Contractor shall also submit, for review and approval, any proposed changes to the schedule due to inability to accomplish the work as planned, for any reason. Approved changes to the schedule shall be incorporated into the Project Schedule and it shall be resubmitted as necessary or as requested by the COTR.

60.3. Progress Behind Schedule: If it becomes apparent to the COTR that the overall progress of the project is behind the approved project schedule, then the COTR will notify the Contractor in writing. The Contractor shall submit to the COTR for approval a Recovery Schedule and Plan to describe how the Work will be accelerated to meet the Contract Time requirements in accordance with the General Conditions contract clause entitled "Commencement, Prosecution and Completion of the Work." The Recovery Schedule shall be superimposed on the approved baseline project schedule to demonstrate that proposed recovery activities will accomplish completion of the work by the approved completion date.

60.4. Reporting Progress and Applying for Payment: Each month, the Contractor shall apply for payment and submit a report of the actual construction progress as follows:

60.4.1. By the 25th of each month, the Contractor and the COTR shall have inspected the work to determine percentages complete for each item, projected through the end of the month. The parties shall attempt to reach agreement on each item, but if they cannot reach an agreement the COTR will determine percent complete.

60.4.2. By the last day of the month, the Contractor shall submit an Application for Payment based on the determined percentages complete for each item. The application shall be submitted in triplicate on the Smithsonian standard Application for Payment form. Each copy of the Application for Payment shall be accompanied by the following:

1. A Progress Schedule identifying the cumulative progress superimposed on the latest revision of the approved Project Schedule. The net progress for the month and applicable dates shall be clearly indicated.
2. A complete set of copies of certified weekly-payroll data for the period.
3. Progress photographs.

4. Daily reports up to date through end of billing period.
5. Construction and Demolition Waste Tracking Report.

60.5. Response to Application:

60.5.1. Payment shall be made only for progress agreed upon by the COTR, performed on original Contract Work or approved modifications, in accordance with the current, approved Project Schedule. Failure to submit the Application in accordance with the specifications will prevent the processing of payments.

60.5.2. Payments will be mailed to the Contractor's address as identified in the contract documents on record with the Contracting Officer. Any changes of address or requests for wire transfer of progress payments must be made in writing, signed by the Contractor's authorized person and submitted to the Contracting Officer.

60.6. Commissioning Schedule:

60.5.1. The contractor shall prepare a detailed fragnet of the overall project CPM schedule. This schedule shall be the basis for coordinating the trades in the construction and commissioning of the Mechanical, electrical and Plumbing systems.

60.5.2. The contractor shall prepare a separate mechanical, Electrical and Plumbing Installation and Start-Up Commissioning schedule. This schedule shall be coordinated with the CPM schedule required in the supplementary Conditions division 01000. It shall reflect milestone dates and shall be a fragnet of the overall CPM. This MEP Installation and Start-Up Commissioning Schedule shall reflect the coordinated activities of the work associated with all mechanical, Electrical and Plumbing trades, and shall include all activities and timeframes required to execute Commissioning process, including the Pre-functional Testing checklist as well as final Functional testing activities.

60.5.3. Pre-Functional Testing Checklist and final Functional testing activities are to be completed as requirement of Substantial Completion Certificate.

60.5.4. The purpose of the Start-up schedule shall be to properly coordinate all activities necessary to provide fully functional building systems prior to Final Completion, assure all parties that the timeframes allocated in the CPM are realistic and coordinated with subcontractors with respect to logic and duration.

60.5.5. At a minimum, the Start-Up schedule shall include the following activities:

a. Mechanical and electrical rough-in and final connections on a system-by system basis;
b. Pipe testing and flushing;
c. Duct pressure testing;
d. Automatic controls rough-in and final connections.
e. Automatic controls system commissioning;
f. Calibration control loop verification on a system-by system basis;

g. Manufacturer start-up of all equipment;
h. Preliminary testing and balancing;
i. Final testing and balancing.
j. Checklist and final Functional testing activities associated with commissioning process;

60.5.6. The Start-Up Schedule shall reflect completion of Pre-Functional Checklist activities prior to witnessing and/or demonstrating of these activities to the Owner or Commissioning Authority.

60.5.7. The Start-Up Schedule shall also reflect the milestone dates for Substantial completion and Final Completion.

60.5.8. The Start-Up schedule shall be maintained on a monthly basis and modified to reflect any variances between as-planned and actual construction sequence

61. SCHEDULING & PAYMENTS / CRITICAL PATH METHOD – NOT USED

62. ASSIGNMENT OF CLAIMS

62.1. Assignment of Claims are subject to the approval of the Contracting Officer. Any Assignment of Claim or subsequent re-assignment shall meet the requirements of the General Conditions contract clause entitled "FAR 52.232-23 Assignment of Claims."

62.2. All documents for assignments shall be written in the English language and shall be original ink signatures of the Contractor and assignee. All monies shall be identified in US dollars.

PROJECT CLOSEOUT REQUIREMENTS

63. PROJECT CLOSEOUT

63.1. Definition: Project closeout is a scheduled process for fulfillment of remaining contract requirements at the end of the project in preparation for final acceptance, final payment, normal termination of contract, beneficial occupancy and establishment of the warranty period(s).

64. SUBSTANTIAL COMPLETION

64.1. Definition: The date of Substantial Completion of a project or specified part of a project is the date, as confirmed by inspection by the COTR, when the construction is at least 95% complete and ready for beneficial occupancy, so that the Smithsonian can take possession of that area or part of the work. Portions of the work that are specified to be phased for completion, areas required for Smithsonian's use prior to completion of the total

project or items of work identified by the COTR as necessary for partial beneficial occupancy may be inspected for substantial completion separately from the rest of the Work.

64.1.1. The Smithsonian Institution reserves the right to occupy or install equipment in completed areas of the building prior to substantial completion provided that such occupancy does not interfere with the completion of the work. Such partial occupancy shall not constitute acceptance of any part of the work.

64.2. Request for Substantial Completion Inspection: The Contractor shall submit a written request to the COTR for an inspection to establish Substantial Completion status. This request shall specify areas or parts of the work to be considered and shall include a listing of all exceptions to the request, that is, items not considered to be substantially complete.

64.3. Submission of Operation and Maintenance Manuals: Prior to requesting Substantial Completion Inspection, submit to the COTR electronic copies of manuals for review and approval. Upon approval, submit to the COTR, three hardcopy (3) sets of manuals for all systems and equipment, as specified in the technical sections of this specification. The manuals shall be bound in letter-sized, three-ring, loose-leaf binders with durable plastic covers. They shall be organized into suitable volumes of manageable size using the divisions of the Specifications as a guide. Each manual shall have a table of contents and shall be assembled to conform to the table of contents with tab sheets locating each subject. The instructions shall be legible and easy to read. Where oversize drawings are necessary, they shall be folded to be not greater than letter-size. The words "Operation and Maintenance Manual," the name and location of the project, project number, contract number, date and the name of the general contractor, shall appear on the cover. Data shall be specific to the equipment that is installed and reflect all approved changes and substitutions. Data shall also reflect any required or recommended seasonal adjustments or inspections. Include electronic copy of manual, in PDF format, on CD/DVD. Manuals shall include, as a minimum, the following data:

64.3.1. Detailed description of each system and each of its components, including layout showing piping, valves, controls and other components and including diagrams and illustrations where applicable.

64.3.2. Wiring and control diagrams with data to explain detailed operation and control of each component.

64.3.3. Control sequence describing start-up, operation and shutdown.

64.3.4. Procedures for starting, operating and shutdown.

64.3.5. Installation instructions.

64.3.6. Maintenance and overhaul instructions.

64.3.7. Lubricating schedule, including type, grade, temperature range and frequency.

64.3.8. Emergency instructions and safety precautions.

64.3.9. On-site acceptance test results for equipment installed under this contract.

64.3.10. Approved product data, shop drawings and system as-builts.

64.3.11. Copies of approved certifications and laboratory test reports (where applicable).

64.3.12. Notarized copies of warranties (originals to be provided as required by "Warranties and Guarantees").

64.3.13. Written instructions for test procedures.

64.3.14. Performance curves and rating data.

64.3.15. Parts list, including source of supply, recommended spare parts and service organization convenient to Smithsonian.

64.3.16. Name, address and telephone number of each subcontractor who installed equipment and systems, local representative for each type of equipment and each system.

64.3.17. Other pertinent data applicable to the operation and maintenance of particular systems or equipment and/or other data as specified Divisions 2 through 16 of the Specifications.

64.4. Other Prerequisites for Substantial Completion Inspection: The Contractor shall also complete the following prior to requesting inspection for certification of substantial completion:

64.4.1. Testing and start-up of systems.

64.4.2. Installation of all signage, including accessibility related signs, equipment instructions, identification labels and permanent directional signs.

64.4.3. Submission of spare parts, tools and surplus materials as required in technical specifications. Submit to the COTR an MSDS for each surplus material that contains toxic or hazardous substances. Surplus materials that the SI determines not to retain shall be removed and properly disposed of by the Contractor according to all applicable regulations.

64.4.4. Scheduling of training sessions for Smithsonian personnel.

64.4.5. Removal of all waste, rubbish and temporary facilities and services. Means of access to all areas of the work to be inspected by the COTR shall be maintained.

64.4.6. Disposition of samples and mock-ups not incorporated into the work.

64.4.7. Arrangement for permanent utility connections and billing responsibility transfer to Smithsonian's Office of Facilities Operations (OFO).

64.4.8. Arrangement for transfer of security responsibility for the project site and changeover of locks by Smithsonian's Office of Protection Services(OPS).

64.4.9. Hazardous Waste Disposal: Submit copies to the COTR of the following hazardous waste records for hazardous waste generated on SI property and disposed of by contract personnel.

1. Hazardous Waste Manifests
2. Notification and Certification Forms
3. Material Profile Sheet or characterization
4. Container Content Sheets
5. Certificates of Disposal

64.5. Scheduling of the Substantial Completion Inspection: Within seven (7) calendar days after receipt of the Contractor's written request, the COTR will either schedule an inspection or advise the Contractor of work that must be completed or prerequisites that must be met prior to scheduling the Substantial Completion Inspection. In that case, another written request for Substantial Completion Inspection must be submitted when all requirements have been met.

64.6. The Substantial Completion Inspection: The Substantial Completion Inspection will be performed by representatives of the Smithsonian Institution led by the COTR. During the inspection, the COTR will prepare a punch list of deficiencies in the work. If the punch list becomes too extensive the COTR may cancel the inspection and require additional work to be performed for a repeat inspection.

64.6.1. For satisfactory inspection results, the COTR will issue the written punch list to the Contractor as soon as possible after the inspection. Items on the punch list must be completed prior to final acceptance of the total project work.

64.6.2. For unsatisfactory inspection results, the COTR will, within three (3) calendar days, give written notice to the Contractor that the Work or portion of the Work is not substantially complete in accordance with the contract documents and therefore does not meet Substantial Completion status. Requests for re-inspection

shall meet all requirements for the original request for Substantial Completion inspection.

64.6.3 Pre-Functional Testing (PFT) checklist and final Functional Performance Testing (FPT) activities are to be completed as requirement of Substantial Completion Certificate.

64.7. Punch List: Incomplete contract requirements identified during the Substantial Completion Inspection will form an initial basis for a punch list for final acceptance. All punch list items must be completed by the Contractor within the Contract Time. If additional days are needed to complete the punch list items beyond the Contract Time, then the Contractor shall submit, prior to the end of the Contract Time, a written request to the Contracting Officer stating:

64.7.1. Items requiring additional time;

64.7.2. Amount of time needed to complete each item;

64.7.3. Reasons why the items cannot be completed by the contract completion date.

65. FINAL COMPLETION AND ACCEPTANCE

65.1. Definition: The date of final completion of a project is the date, as confirmed by inspection by the COTR, when the Work is satisfactorily completed and accepted in accordance with the contract documents, as amended and/or modified.

65.2. Request for Final Completion Inspection: When all items on the punch list have been corrected to the satisfaction of the COTR and additional requirements as described below have been satisfied, the Contractor shall submit a written request for Final Completion Inspection.

65.3. Prerequisites for Final Completion: Prior to requesting the inspection for certification of Final Completion, the Contractor shall complete the following:

65.3.1. Submission of a copy of a prior punch-list stating that each item has been completed or otherwise resolved for acceptance.

65.3.2. Provision of Instructions to Smithsonian Personnel -where instructions to Smithsonian personnel are specified in other sections, furnish, without additional expense to the Smithsonian, the services of competent instructors, who will give full instruction in the care, adjustment and operation of the systems and equipment to designated Smithsonian employees.

1. Each instructor shall be familiar with all parts of the system on which he or she is to give instruction and shall be knowledgeable about the systems' operation and required maintenance. Factory trained instructors shall be employed wherever practical and available.

2. Unless otherwise required or approved, the instruction shall be given during the regular workweek after the equipment has been accepted and turned over to the Smithsonian for regular operation. Where significant changes or modifications in equipment are made under the terms of the contract, additional instruction shall be provided as may be necessary to acquaint the operating personnel of the changes or modifications. Unless otherwise stated, at least half of the time allocated for instruction shall be "hands-on," using the actual system installed.

3. Upon completion the Contractor shall obtain written acknowledgment from the COTR that the required instruction was completed.
4. All training shall be professionally videotaped and provided to the Smithsonian Institution.

65.3.3. Posting of operating instructions approved by the COTR for each system and each principal piece of equipment. Include wiring and control diagrams showing the complete layout of the entire system including equipment, piping, valves and control sequence framed under clear laminated plastic and posted where directed by the COTR. Printed or engraved operating instructions for each principal piece of equipment including start-up, proper adjustment, operating lubrication, shut-down safety precautions, procedure in the event of equipment failure and any other necessary items of instruction as recommended by the manufacturer of the unit shall be attached to or posted adjacent to the piece of equipment. Operating instructions exposed to the weather or wet or humid conditions shall be made of weather-resisting materials or shall be suitably framed and enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling. The Contractor shall coordinate the location of posted instructions with the COTR.

65.3.4. Provision of equipment demonstrations for each equipment item. The Contractor shall coordinate scheduling of all demonstrations through the COTR.

65.3.5. Submission of original warranties for all products, equipment and systems.

1. The Contractor shall assemble original warranty certificates or notarized copies of warranty certificates executed by the Contractor, Subcontractors, suppliers and manufacturers in a tab-indexed, three-ring loose-leaf binder with a durable plastic cover. Provide electronic copy, in PDF format, on CD. The table of contents shall identify the item covered, the location of the item, the date of Substantial Completion, expiration date of the warranty and the supplier, vendor and installing contractor. Duplicate notarized copies of warranties shall be provided as required by "Manuals for Operation, Maintenance and As-Built Product Data."

2. Each warranty certificate or bond shall identify the date(s) for:

(1) Substantial Completion status in accordance with project closeout requirements.

(2) Beginning and ending of the warranty period.

(3) The Contractor shall provide any coincidental product warranty, which is available on a product incorporated in the Work, but for which the warranty is not specifically required by the contract documents.

3. Warranty of Construction: The Contractor shall warrant that the work performed under this contract conforms to the contract requirements and is free of any defect in equipment, materials, design furnished or workmanship performed by the Contractor or any subcontractor or supplier at any tier. Unless otherwise stated in the technical sections of the Specifications, the warranty of the Work shall continue for a period of one (1) year from the date of Final Completion status. If the Smithsonian takes partial occupancy before Final Completion, then the warranty for that portion shall be in effect for a period of one (1) year beginning on the date of Substantial Completion for that portion of the Work.

65.3.6. Submission of construction progress photographs and negatives, property survey and similar final record information.

65.3.7. Arrangement for changeover locks through the COTR and Smithsonian Office of Protection Services as required for security for Smithsonian occupancy.

65.3.8. Submission of evidence of payment and transfer date of utility company accounts for those utilities previously billed to the Contractor during construction, as necessary.

65.3.9. Submission of evidence that all regulatory agency permits and code requirements have been completed and recorded, as necessary.

65.3.10. Submission of a signed, written statement that no damage has occurred to the site as documented by the pre-condition survey report.

65.3.11. The Contractor shall recycle, salvage or otherwise divert from landfills and incinerators, at least 50%, with a goal of at least 75%, by weight (tons), unless otherwise noted, of non-hazardous construction and demolition material. The contractor shall track recycling efforts and diversion rates using the Construction and Demolition Waste Tracking Sheet, attached. Before any work is started, the contractor shall submit a Construction Waste Management Plan, consisting of waste identification and a waste reduction work plan. Waste identification shall indicate

anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates. Waste reduction work plan shall 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. With each application for payment, the contractor shall submit the Construction and Demolition Waste Tracking Sheet, attached, with data compiled for the payment period, including receipts from hauler or destination. Before request for substantial completion, the contractor shall submit calculated end-of-Project percentage of waste diverted from landfills and incinerators (recycled, salvaged, or disposed) as a percentage of total waste generated by the Work. With request for final payment, the contractor shall submit actual percentage of waste diverted from landfills and incinerators (recycled, salvaged, or disposed) as a percentage of total waste generated by the Work.

65.3.12. Final clean up, before the protection is removed from the gunboat including:

1. Sweep and dust all surfaces, including above ductwork and other ceiling or grid mounted items and wash all finished surfaces to appear new and free of all stains, soil marks, dirt and other forms of defacement. Cover gunboat box with a second sheet of plastic over the top before undertaking high cleaning and washing.

2. Remove labels that are not required as permanent labels.

3. Clean transparent materials, including mirrors and window/door glass, to a polished condition, removing substances that are noticeable as vision-obscuring materials. Replace broken glass and damaged transparent materials.

4. Clean exposed exterior and interior hard-surfaced finishes to a dirt and dust-free condition, free of dust stains, films and similar noticeable substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.

5. Wipe surfaces of equipment clean. Remove excess lubrication and other substances.

6. Remove debris and surface dust from limited-access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.

7. Wet-mop concrete and clean other hard-surface floors according to manufacturers' recommendations.

8. Vacuum clean carpeted surfaces and similar soft surfaces.

65.3.13. Commissioning Resolution Log: All deficiencies itemized in the Commissioning Resolution Log must be addressed and signed off by the Mechanical.

65.4. Inspection of the Work for Final Completion: Upon receipt of the Contractor's written notice that the work has been completed, the COTR will inspect the work to confirm Final Completion status and acceptance of the work. As soon as possible after inspection, the COTR will either provide written acknowledgment of final acceptance or advise the Contractor of work not completed or obligations not fulfilled as required for final completion and acceptance.

65.5. Application for Final Payment:

64.5.1. Application for Final Payment shall be submitted only after Final Acceptance has been certified in writing to the Contractor by the COTR. Application shall include final labor data and progress schedule update.

64.5.2. Final Payment will be approved when Final Acceptance has been certified and the following conditions have been met:

a. Certification signed and submitted by the Contractor that all contract requirements, including contract modifications, have been met.

b. Final Release of Claims submitted.

c. Release of assignment of claims or consent of surety submitted, as necessary.

d. All security day passes returned to Smithsonian.

e. As-Built Record Drawings Submitted: During the progress of the work the Contractor shall maintain a complete and up-to-date set of record prints, open to inspection by the COTR at any time. These prints shall provide a complete and accurate as-built record of all changes to the Contract Drawings, including rerouting of runs, relocation of items or control points and all other modifications. The exact location of pipes, conduit or other features concealed under concrete, in chases or above ceilings shall be shown by perpendicular dimensions from at least two available landmarks. As-built drawings shall be neatly marked with colored pencils or ink, marked "As-Built" and signed and dated by the Contractor. Upon completion of the Work and before final payment, the Contractor shall submit the following to the COTR: photographically

produced as-built record drawings on 4-mil, double matte, mylar sheets, sized the same as the contract drawings; electronic copies of as-built record drawings in PDF and DWG formats.

f. As-Built Record Specifications Submitted: The Contractor shall submit one (1) hard copy and one digital (scanned)set of project specifications with annotations to identify any changes made during construction, referencing modification numbers, dates and originators of authorizing letters or memos and other sources of changes. The cover shall be marked "As-Built" and signed and dated by the Contractor.

g. Close-out Conditions Text and Photographic Documentation Submitted: The Contractor shall prepare a typewritten text and photographic report of observations made during the inspections for project closeout regarding conditions of new work and adjacent items that were examined for the pre-condition survey report. Any defects shall be identified and the Contractor's operations on the defect shall be described. Within ten (10) calendar days after the Final Inspection, the Contractor shall submit the text and photographic report in PDF format to the Contracting Officer and the COTR and retain a copy of each for the Contractor's files.

END OF SUPPLEMENTARY CONDITIONS FOR CONSTRUCTION

Construction and Demolition Waste Tracking Sheet:

To be submitted with each application for payment for the payment period, and at project completion with total waste data and total percentage of waste diverted from landfill for entire project period.

Project Name: _____
Start Date: _____
End Date: _____

Material Description	**Disposal date**	**Diverted from Landfill or incinerator? (Y/N)**	**Diversion method (Recycled, Salvaged, etc.)**	**Hauler or Destination (submit receipts)**	**Volume (in cubic feet)**	**Weight (in tons)**
Land Clearing Debris						
Gypsum Wallboard Scrap						
Cardboard						
Paper goods						

Beverage containers						
Assorted Plastic						
Wood Pallets						
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						

Material Description	Disposal date	Diverted from Landfill or incinerator? (Y/N)	Diversion method (Recycled, Salvaged, etc.)	Hauler or Destination (submit receipts)	Volume (in cubic feet)	Weight (in tons)
Non-Window Glass						
Glazing						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Piping Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						
Other:						
Other:						
Total Diverted						
Total Not Diverted						
Total All Waste = Total Diverted + Total Not Diverted						
% Diversion Rate* = Total Diverted/Total All Waste						

**Percentage Diversion Rate to be compiled after project completion. Minimum Diversion rate is 50%. Goal Diversion rate is 75%*

SECTION 01 91 13 – COMMISSIONING - GENERAL

1.1 DESCRIPTION

A. The Smithsonian will procure the services of independent Commissioning Consultant; other terms are Commissioning Provider, Commissioning Agent, and Commissioning Authority. The Commissioning Consultant is an independent and knowledgeable third party, contracted to verify that the systems work as described in the Owners Project Requirements (OPR). The Commissioning Consultant will inform the Construction Manager (CM) COTR and the Architect of the results of the commissioning and provide suggestions, as necessary, to correct deficiencies in observed performance or installation.

B. Commissioning is the process to verify to the Smithsonian that systems, equipment, mechanical, electrical, controls and special systems function together properly to meet performance requirements and design intent, and as described in the Contract Documents. The General Contractor shall be responsible for participation in the commissioning process as outlined below and in references and attachments throughout the Contract Documents. The General Contractor shall furnish labor and materials sufficient to meet all requirements of building commissioning under this contract.

C. Various sections in the Division 23 and 26 Specifications as well as specifications in other formats outline the specific commissioning responsibilities of each General Contractor and corresponding subcontractors for the division and obligate the General Contractor to coordinate and manage the commissioning responsibility of those subcontractors.

1.2 REQUIREMENTS INCLUDED

A. Duties of Contractor.

B. Duties of Commissioning Consultant.

C. Commissioning Field Notebook.

D. Acceptance Procedures.

E. Performance Period.

F. Training and Instruction.

1.3 RELATED SECTIONS

A. All Division 1 Sections and Smithsonian General Requirements

B. All Division 23 Sections

C. All Division 26 Sections

D. All Division 28 Sections

1.4 TERMS

A. Acceptable Performance: A component or system being able to meet specified design parameters under actual load including satisfactory documented completion of all functional performance tests, control system trending and resolution of outstanding issues.

B. Basis of Design: The Basis of Design is *a document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process. (ASHRAE Guideline 0-2013).* The Basis of Design provided by the design engineer addresses the decisions to meet the design intent as defined by the Smithsonian Institution. The Basis of Design describes the systems, components, conditions and methods to meet the design intent.

C. Commissioning Plan: The Smithsonian's Commissioning Consultant prepares The Commissioning Plan. *The Commissioning plan is a document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process (ASHRAE Guideline 0-2013)*. In addition, defines the scope and format of the commissioning process and the responsibilities of all involved parties. The commissioning team reviews the Commissioning Plan to inform the intent and scope of the commissioning process, to ensure inclusion in the construction project scope/schedule and to facilitate and expedite the commissioning process. The Commissioning Plan is to be distributed by the Commissioning Consultant during the first third of the construction timeframe.

D. Functional Performance Testing: Is a full range of checkouts and tests carried out to determine if all components, sub-systems, systems and interfaces between systems function in accordance with the Contract Documents and meets the design intent. In this context, "function" includes all modes and sequences of control operation, all interlocks and conditional control responses and all specified responses to abnormal emergency conditions. The Commissioning Consultant will prepare the functional performance tests.

E. Commissioning (Also Commissioning Process) is *a quality-focused process enhancing the delivery of a project. The process focusses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements. (ASHRAE Guideline 0-2013).* Process to demonstrate the Smithsonian that building equipment controls and systems function together properly to meet design intent and performance requirements shown in a composite manner in the Contract Documents.

F. Resolution Log: The purpose of this document is to provide a method for tracking and resolution of deficiencies discovered during the commissioning process. This list also includes the current disposition of issues and the date of final resolution as confirmed by the Commissioning Consultant. Deficiencies are issues where products, execution or performance does not satisfy the Specifications and/or the design intent. The Commissioning consultant creates and manages the Resolution Log.

G. Pre-functional Construction Checklists: Commissioning Consultant prepares Checklist for equipment of systems and assemblies. See paragraph 1. A. Checklist shall be for the systems or equipment involved in the commissioning process to verify installation and start-up of equipment is complete and verify that systems are ready for functional testing. These documents require

signature by the Contractor prior to continuing with the commissioning process, and are required as a pre-condition of beginning the Functional Performance Testing.

H. Testing and balancing (TAB) process. A complete pencil copy of TAB reports, on a system-by-system basis, is required prior to the start of any final functional performance test.

1.5 DUTIES OF CONTRACTOR

A. Provide copies of all approved shop drawings, manufacturer's literature, maintenance information or other information as may be needed for systems and assemblies to the Commissioning Consultant.

B. Collect the information requested by Commissioning Consultant for development of a complete Commissioning Plan, Commissioning Field Notebook, and Functional Performance Tests and provide to the Commissioning Consultant. The General Contractor to review the Commissioning Plan, Commissioning Field Notebook, and Functional performance Test and confirm in writing to the CM COTR, Architect and Commissioning Consultant any known areas of conflict or areas requiring clarifications.

C. Collect all proposed equipment start-up and Pre-Functional Construction Checklists documentation and place into the Commissioning Field Notebook. The General Contractor will provide the Commissioning Consultant with the completed commissioning field notebook.

D. Provide the Contractor's schedule to the commissioning Consultant for review and comment. Plan for and incorporate commissioning activities into the construction schedule. Provide a sufficient detailed level of scheduling, activity, detail to properly coordinate and schedule the trades. Provide a detailed Commissioning Schedule Fragnet to the project schedule, updated monthly.

E. Provide Commissioning Consultant with submittals for all systems and assemblies for review and comments. Include submittals of controls system and wiring diagrams and narrative sequences of operation, in time for use in preparing the Functional Test Procedures. The Commissioning Consultant review comments of pertinent submittals is coordinated through the Construction Manager COTR.

F. Provide a fully operational system per Specifications, started, verified, debugged, calibrated, balanced, tested and under automatic control.

G. Provide qualified personnel to participate in the commissioning tests, including seasonal testing.

H. Cooperate with the Commissioning Consultant's personnel.

I. Provide access to site for the Commissioning Consultant for review, verification and testing activities.

J. Provide office space for Commissioning Consultant for preparation of daily reports. Dedicate space for Commissioning Field Notebook in dedicated area.

K. Provide organized storage space for project drawings, Specifications, equipment and materials submittals, shop drawings and operation and maintenance manuals in the job site trailers or job site office space.

L. Provide updates to all project documentation to reflect all supplemental instructions, addenda or other revisions to the project construction documents. Updates and architect's supplemental instructions must be posted to the master set of documentation for review and reference by all Contractors and for the Commissioning Consultant's use.

M. Provide adequate time and resources to perform functional testing of systems and assemblies in contract. These times and activities shall be reflected in the Commissioning Fragnet schedule, updated monthly.

N. Coordinate participation of the all pertinent subcontractors including mechanical, electrical, controls and Testing and Balancing TAB subcontractors in the commissioning process.

O. Participate in any efforts to finalize sequences of operations with Construction Manager COTR, Designers and Commissioning Consultant.

P. Verify that coordination, installation, quality control and final testing have been completed such that installed systems and equipment comply with construction documents.

Q. Review the Commissioning Plan, Project Reports and test results and submit comments to the Commissioning Authority.

R. In a timely manner, address issues identified during construction that may affect the commissioning process or final system performance.

S. Perform equipment start-up and testing of mechanical and electrical equipment and systems and document as required with start-up reports and completion of Pre-functional Construction Checklists. These checklists include installation documentation, start-up documentation, controls point-to-point documentation and calibration documentation, verification that controls sequence of operations meets design intent and TAB final documentation. Reports will be stored in the Contractor's field trailer, as a part of the Commissioning Field Notebook. Contractor will coordinate efforts to complete the pre-functional documentation.

T. Lead verification testing of fire/smoke dampers and direct the resolution of deficiencies. Each fire/smoke damper and its functions are tracked in a matrix spreadsheet. Owner's Authority Having Jurisdiction (OSHEM) shall witness and approve all life safety systems including fire / smoke damper operation.

U. Provide preliminary TAB report, indicating all actual field values recorded to the Commissioning Consultant through the Construction Manager COTR, prior to initiation of functional testing. These reports shall be incorporated in the commissioning field notebook. Provide these "pencil copy" TAB data on a system by system basis, as systems have been finally and completely balanced.

V. Pre-test all systems prior to scheduling the final Functional Performance Test for the record. Operate equipment and systems as required in preparation of final functional performance testing. This includes, but is not limited to; manipulating the appropriate controls systems to execute the Functional Test Procedures.

W. The Contractor shall issue a written Notice of Readiness *for each system*; include verification of system completion, TAB completion and controls. Provide the Commissioning Consultant a copy of the Notice of Readiness upon completion of all systems work, start-up and Pre-functional Construction Checklists requirements by trade contractors.

X. Participate in the fine-tuning or troubleshooting of system performance, if of these measures becomes necessary.

Y. The Contractor shall compensate the Government for retesting and/or troubleshooting time required by the Commissioning Consultant when the Contractor's systems do not meet specified performance and are not ready for commissioning. Back-charge Contractors as necessary to collect reimbursement for Commissioning Consultant compensation.

Z. Review operating and maintenance data for verification, organization, distribution and conformance to requirement of the Contract Documents.

AA. Submit complete operation and maintenance information and as-built drawings to the Commissioning Consultant for compliance review of the requirement of the Contract Documents. Incorporate changes and recommendations provided by the commissioning Consultant into the

BB. Provide all documentation of training for the systems specified.

CC. Provide all proprietary test equipment required to test all the systems and equipment in this project. The Contractor shall provide all necessary tools, lifts, ladders, access, PPE and other equipment required for the Commissioning Consultant to witness Functional Performance Testing.

DD. The Commissioning Field Notebook will be stored in the Contractors field trailer and will be managed by the Contractor. The Contractor shall confirm in writing to the Commissioning Consultant that systems are complete, functional and the appropriate subcontractors have completed the specified tasks and signed off all pre function documentation.

1.6 DUTIES OF COMMISSIONING CONSULTANT

A. Develop the draft Commissioning Plan during Pre-Design phase. Commissioning plan updated at each design phase and construction phase.

B. Review the Commissioning Field Notebook with appropriate documentation provided from Contractor. Provide supplemental documentation as necessary to ensure that all aspects of start-up and testing have been complete and documented prior to functional testing.

C. Develop Functional Test Procedures from Contract Documents and final equipment submittals including narrative sequences of operation, control diagrams and software code for execution with the assistance of Contractor staff as required.

D. Review the Contractor's submittals relative to the systems and assemblies. Provide comments on the submittals during the same timeframe as the architect / engineer's review. Architect / Engineer have final decision on incorporating comments by the Commissioning Consultant. CM COTR formally incorporates the response to the General Contractor.

E. Perform site observations to follow installation progress and to verify system installation quality and readiness for testing.

F. Observe the start-up activities and initial testing of selected equipment and systems as required and review Contractor's start-up documentation.

G. Observe or review documentation of validation activities including: Proper test and balance activities, electrical testing and functional tests for normal and off-normal operating sequences.

H. Review submittal of all required pre-functional and start-up documentation provided by the General Contractor for completeness and reasonableness. This includes installation documentation, start-up documentation, point-to-point checklists and preliminary TAB report, prior to initiation of functional testing.

I. Witness a random selection of TAB readings (10**%)** performed by the TAB contractor. Coordinate with Division 23 project specifications. This witnessing activity is during the execution of regular TAB activities.

J. TAB verification to be a separate activity, occurring prior to the final Functional Performance Testing activities.

K. Assist with scheduling, direct and witness complete functional testing as defined in the Commissioning Plan and Functional Test Procedures. All testing to be performed and verified by the General Contractor and documented by the Commissioning Consultant.

L. Witness and verify satisfactory completion of equipment and system tests and inter-systems functional performance tests.

M. Conduct commissioning meetings, and distribute minutes of those meetings to all attendees.

N. Provide site observation, functional tests or other project reports in a timely manner.

O. Document inconsistencies or deficiencies in system operations and system compliance. System deficiencies shall be forwarded to the CM COTR and documented in the Resolution Log.

P. Coordinate via the General Contractor participation of Government's personnel with equipment, component and systems performance verification and participation in required training.

Q. When commissioning has been successfully completed, recommend acceptance to the Smithsonian Institution, and provide suggestions for those systems not performing as expected.

R. Once all functional tests is successfully completed and all outstanding issues resolved, the Commissioning Consultant will provide the Smithsonian Institution with a Final Commissioning Report of all commissioning activities that occurred during the project.

S. Provide technically qualified personnel when scheduled.

T. The Commissioning Consultant will formally communicate with the Contractor via approved project channels. It is expected, however, that informal communication and coordination will be conducted directly with the subcontractors; records of all contacts will be sent to the Architect through the normal channels.

U. The Commissioning Consultant is not authorized to release, revoke, alter or expand requirements of Contract Documents, to approve or accept any portion of the work or to perform any duties of the Contractor.

1.7 COMMISSIONING PLAN

A. The Commissioning Plan is a tool through which the commissioning process is described and incorporates the Construction Manager COTR, Architect, Contractor and Commissioning Authority roles relative to the commissioning process. Commissioning team members are all contractors, subcontractors and design professionals whose participation is of benefit in the delivery of a fully functioning building to the Government. The plan shall describe the communication, authority and responsibility of commissioning team members. The Commissioning Plan will include the following:

1. The purpose of commissioning.
2. Detail the commissioning process.
3. Commissioning team members' responsibilities.
4. Describe Pre-functional Construction Checklist Procedures.
5. Provide a guideline for acceptance of each piece of equipment or system.
6. Systems to be commissioned.

1.8 COMMISSIONING FIELD NOTEBOOK

A. The Commissioning Field Notebook is assembled by the General Contractor and reviewed by the Commissioning Consultant to identify and track all pertinent commissioning documentation. The Contractor will maintain and manage completion of this Notebook. The Notebook provides a central location for the Commissioning Consultant to identify and organize all pertinent information and will include the following format:

1. Summary describing Notebook contents and use.
2. Commissioning Plan for contractor field reference.
3. Listing of all specification documentation requirements listed by specification section, with construction completion sign offs for appropriate parties. These types of documents include piping pressure testing, flushing reports, factory start-up reports and any field-testing relative to the project.
4. Copy of final approved submittal / shop drawings for each major piece of equipment involved in commissioning, as well as systems such as controls.
5. Tabs for each specification section with copies of completed, signed off pre-functional checklists and final Functional Performance Tests.
6. Commissioning project reports, resolution logs schedule information or any other documentation provided by the Commissioning Consultant.
7. Provide a .pdf copy of entire completed Commissioning Field Notebook to Commissioning Consultant at conclusion of project for use in developing final Commissioning Report, prepared by the Commissioning Consultant.

1.9 SYSTEMS TO BE COMMISSIONED

A. Systems and Equipment to Be Functionally Tested: The system features are to be functionally tested and other building features will be evaluated for installation quality during construction. The functional performance testing will include the following systems and equipment.

1. Mechanical Systems:

a. Air handling units
b. Humidifiers
c. Fans
d. Air terminal units
e. Building automation system

1.10 COMMISSIONING ACTIVITIES

A. The Commissioning Fragnet Schedule: This schedule defines the milestones and conditions that must be achieved before system testing and other commissioning activities can commence. The schedule also includes the expected duration of the various tasks so that the commissioning process can be incorporated into the overall construction schedule.

B. Commissioning Field Notebook: The General Contractor is required to created, developed and maintained the Commissioning Field Notebook. The General Contractor to identify and track all pertinent commissioning documentation required during the installation start-up and checkout phases in the Commissioning Field Notebook. The Commissioning Notebook will be kept by the General Contractor on site and will be made available to all subcontractors for their use. The Notebook provides a central location for the subcontractors and Commissioning Consultant to identify, copy, and organize all pertinent information.

C. Preparation for Testing: To prepare for the system performance testing, the Commissioning Consultant will examine the design and Construction Documents, develop with appropriate Contractors Pre-functional Construction Checklists of construction responsibilities that must be completed prior to testing and develop detailed Functional Test Procedures and data forms. Using the Pre-functional Construction Checklists, the Contractor must verify that the systems they install comply with the Construction Documents and are fully functional. Commissioning is not intended to be a testing or inspection function that replaces any of the Contractors' obligations for testing and proof of performance. Functional testing will only begin when checklists are completed by the appropriate subcontractors, initialed, signed and returned to the Commissioning Consultant, the TAB process is complete for both air and water balancing, and the controls are completed and all control loops properly tuned.

D. Functional Testing: Functional testing is performed by experienced and qualified technicians of the Contractor(s), responsible for installation as facilitated by the Commissioning Consultant and may be observed by other members of the commissioning team including the Owner. Functional testing will verify proper sequencing, operation and performance of installed equipment and systems under realistic operating conditions. The functional testing will follow with written Functional Test Procedures with test results documented for permanent record.

E. Documentation: In addition to the Pre-functional Construction Checklists and Functional Test Procedures, written documentation will be maintained for all other commissioning activities.

Project communication reports shall be issued by the Commissioning Authority to the Contractor and key members of the commissioning team to document apparent deficiencies identified during examination of design and construction documents, daily activities on-site, construction deficiencies and successful or unsuccessful functional test results. At the end of the commissioning process, all documentation will be assembled and summarized in the Final Commissioning Report.

F. Deficiency Resolution: When an Issues Log, Resolution Log or Field Report is issued to address an identified deficiency, the Contractor shall forward the reports to the appropriate parties to initiate corrective action in an expeditious manner. The designer is relied on for supplemental instructions or design modifications and issuance of final design details and the Contractors are relied on for implementation of that design. Change orders must be issued through proper contract channels.

1.11 FUNCTIONAL TEST PROCEDURES

A. The Functional Test Procedures include, but are not limited to, the following:

1. Verification of testing, adjusting and balancing performance.
2. Verification of all equipment's ability to perform to the design intent.
3. Verification of the performance of sub-systems consisting of combinations of equipment
4. Verification of the performance of the automatic controls in all seasonal modes.
5. Verification of the performance of the HVAC system as a whole.
6. Verification of the performance of all life safety devices and systems that interface with the HVAC systems. Commissioning of life safety systems by the Commissioning Authority shall be limited to the fire alarm interface with the HVAC systems.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Operating equipment and systems shall be tested in presence of Government's Commissioning Consultant and Project Officer (Construction Manager COTR) to demonstrate compliance with specified requirements.

1. Notify COTR, in writing, fourteen (14) days prior to tests, twenty-one (21) days prior if a utility shutdown is required, scheduled under requirements of this Section.
2. Testing shall be conducted under specified design operating conditions as recommended or approved by construction Manager COTR and Architect.

B. The Functional Performance Testing shall be completed by the Contractor as a requirement of Substantial Completion. The acceptance of Functional Performance Test by Construction Manager COTR is a requirement of Final Completion.

C. All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by interaction with other major systems.

D. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment through the installing contractor. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Consultant in the commissioning process.

E. Acceptance Documentation: A copy of the functional performance tests results shall be necessary acceptance documentation along with other specified requirements. Documentation must be signed and dated.

3.2 ACCEPTANCE PROCEDURES

A. Prior to functional performance testing of each system, the Commissioning Consultant shall observe and verify that the physical installation of components and systems being tested is substantially installed in accordance with the Contract Documents.

B. Contractor's Tests:

1. System shall be checked for proper installation, shall be adjusted and calibrated to verify that it is ready to function as specified.
2. All system elements shall be checked to verify that they have been installed properly and that all connections have been made correctly.
3. All discrete elements and sub-systems shall be adjusted and checked for proper operation.
4. Start-up and operational tests shall be complete, with all required Pre-functional Construction Checklists signed and submitted for review by Commissioning Consultant within five (5) days of each activity, prior to starting functional performance testing.

C. Smithsonian Institution witnessed Functional Tests:

1. Objective of these tests is to demonstrate that system is operating and complying with specified performance requirements.
2. Smithsonian Institution witnessed functional performance tests shall be performed on complete system. Each function shall be demonstrated to satisfaction of the Architect / Engineer through the CM COTR and Smithsonian Institution's Commissioning Consultant on paragraph-by-paragraph basis of Commissioning Consultant's written test procedure, developed to demonstrate conformance to requirements of the Specifications.
3. Functional performance tests shall be witnessed and endorsed by the Commissioning Consultant upon satisfactory completion.
4. Actual testing program shall be conducted in accordance with prior approved procedures and shall be documented as required herein.
5. Contractor shall notify Architect and Construction Manager COTR at least two (2) weeks prior to date of functional performance tests.

D. The functional performance testing process shall be accomplished for all equipment, sub-systems, systems and system interfaces. The order of functional performance testing shall be reflected in

the Commissioning Fragnet Schedule. All must be tested for acceptances and there shall be a separate checklist for each to ensure documentation specific to each is complete.

E. Each system shall be operated through all modes of system operation (e.g., seasonal, occupied, unoccupied, warm-up, cool-down, etc., as applicable) including every individual interlock and conditional control logic, all control sequences, both full-load and part-load conditions and simulation of all abnormal conditions for which there is a specified system or controls response. The warm-up and cool-down test shall be a performance test, as applicable.

F. Temporary upsets of systems, such as distribution fault, control loss, set-point change, equilibrium upset and component failure, shall be imposed at different operation loads to determine system stability and recovery time.

G. When the functional performance of all individual systems has been proven, the interface or coordinated responses between systems shall be checked. The systems involved may be within the overall HVAC work or they may involve other systems, such as emergency systems for life safety.

H. Corrective Measures: If acceptable performance cannot be achieved, the cause of the deficiency will be identified. If it is determined, that the deficiency was caused by the system or component not being installed per the manufacturer's recommendations or Contract Documents, the necessary corrective measures shall be carried out by the General Contractor. Every check or test for which acceptable performance was not achieved shall be repeated after the necessary corrective measures have been completed. This re-testing process should be repeated until acceptable performance is achieved. The Contractor will be allowed one retest after initial testing of the equipment. If the retest fails, the Contractor shall be financially responsible, at standard rates, to reimburse the Commissioning Consultant for the additional time taken to achieve acceptable performance.

3.3 TRAINING AND INSTRUCTION

A. Training and instruction of Government personnel is a part of the commissioning process and essential for the proper operation of the facility. The contractors and vendors providing the training will complete training plans and submit to the Commissioning Consultant for review and approval in conjunction with the COTR.

3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed, regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.

B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. Heating equipment will be tested during winter design conditions. Cooling equipment will be tested during summer design conditions, with a fully occupied building. Each Contractor and supplier will be responsible to participate in the initial and the alternate peak season test of the systems required demonstrating performance.

C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. Each Contactor and supplier will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

D. Commissioning team including contractor, subcontractors, commissioning personnel and COTR shall meet at site roughly ten months after Substantial Completion to review any system issues, and correct any operational concerns covered by warranty. Commissioning Consultant shall lead this site meeting, and shall summarize findings in a site report.

3.5 SCHEDULE

A. The schedule includes the probable expected sequence and duration for the various tasks, so that the commissioning process can be integrated with the general construction schedule and refined over the course of the project. Actual sequencing and durations shall be by the General Contractor and Sub-Contractors, coordinated with the Commissioning Consultant.

B. Note: Attention to these scheduling needs are important to prevent conflicts that have been problematic within the commissioning process:

Milestone	Duration	Successor	Predecessor
Commissioning Kick off Mtg.	1 day	All contractors on board including Controls and TAB	Before major MEP installation
Review equipment submittals	2 weeks	After receipt of submittals	Before ordering or installation
Develop Pre-functional Construction Checklists	2 weeks	After equipment submittal review and after receipt of O&M literature	Before MEP installation
Walk contractors through Pre-functional Construction Checklists	1 day	After development of Pre-Functional Checklist documentation	Before MEP installation
Write Functional Tests	3 to 5 weeks	After controls submittal review	3 weeks prior to functional testing
Submit Functional Tests for review by COTR and Contractors	1 week	After development of Functional Tests	Before Functional testing
Complete Pre-functional Construction Checklists (contractor task)	On Going	During installation, startup and test, adjust and balance	Before TAB Backcheck and functional testing
Site Observations (CxA)	on-going	After majority of MEP installation	Before TAB Backcheck and functional testing
Test, Adjust and Balance (contractor task)	See CPM schedule	After Start-up and Pre-functional Construction checks. All walls, windows, doors, ceilings must be installed.	Before TAB Backcheck
Test, Adjust and Balance Backcheck (10%)	1 week	After Start-up and receipt of completed Pre-functional Construction Checklists from contractors	Before functional testing
Functional Testing	2 months	After TAB Backcheck and receipt of completed Pre-functional Construction Checklist have been completed by contractors	Before Government occupancy
Issues Resolution	1 week	After Functional Testing	Before Government occupancy
Final Commissioning Documentation Submittal	2 weeks	After resolution of issues log	2 weeks after resolution of issues log

END OF SECTION 01 91 13

SECTION 022000 – PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Photographs of existing conditions

a. The following photographs show typical and special conditions.
b. Photographs are included to supplement the drawings in showing the nature and extent of existing conditions.
c. Recent changes to the ceiling of the Landmark 3E and front of the Gift shop are documented at the end of the photographs. GC must verify existing conditions prior to proceeding with work.

PART 2 - PRODUCTS (Not Applicable)
PART 3 - EXECUTION (Not Applicable)

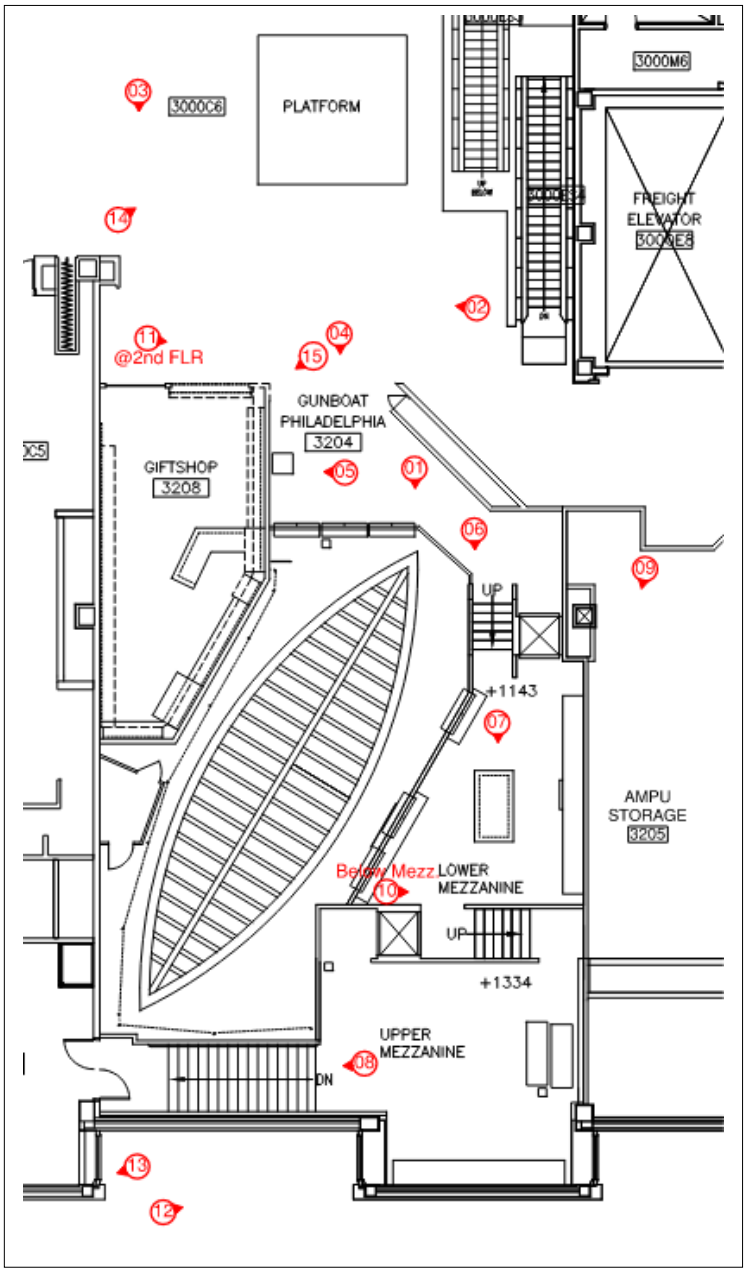

Photo Key Plan

Fig. 01: Gunboat Philadelphia. Cut back carpet to timber supports & provide protective box around gunboat.

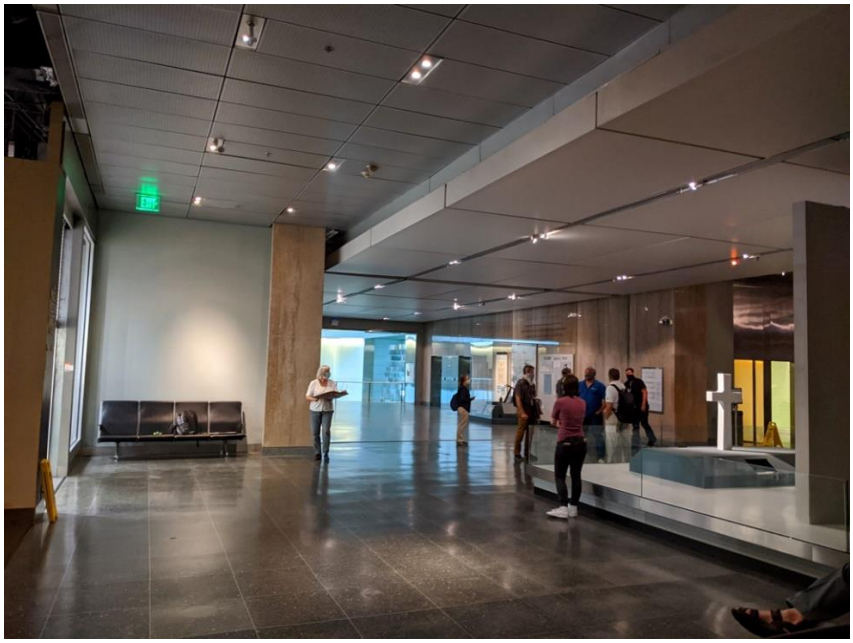

Figure 02: Looking west towards Landmark 3e past Exhibit and Gift shop on left. Note change in ceiling heights; platform at right. (Photo taken before ceiling recess was installed above platform.)

Figure 03: Looking from Landmark 3e towards Gift shop on right and Gunboat Philadelphia exhibit at left. Gift shop storefront and door now have a stud and gypsum board screen wall built in front.

Figure 04: Entrance to Gunboat Philadelphia Exhibit. Remove railing support prior to boxing Gunboat (railing has been removed.)

Figure 05: At entrance of Exhibit looking west towards Gift Shop

Figure 06: Steps to lower mezzanine; upper mezzanine beyond.


Figure 07: Lower mezzanine, SI will remove model of boat and its display case.

Figure 08: Stair from upper mezzanine to be demolished. Door to American Presidency is ETR but a delayed egress function will be added.

Figure 09: Inside AMPU Storage, looking towards security wall with expanded mesh.

Figure 10: Concealed space below Lower Mezzanine. Note expanded metal mesh on walls of Collections Storage.

Figure 11: Ceiling in public space outside of Lounge 2E. R&R ceiling between Lounge and Toilet Rooms to install piping (see Drawings.)

Figure 12: Window wall; replace 6th pane from planter with louver.

Figure 13: Window wall detail

Figure 14: Ceiling coffer and hanging bar has been added above the platform at Landmark 3E (3/17/22)

Figure 15: New screen wall in front of Gift Shop is painted gwb on steel studs. (3/17/22)

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Supplementary Conditions for Construction" for Smithsonian Institution project and execution requirements.
2. Division 23 Sections for salvaging terminal units and associated temperature sensors for reuse.
3. Division 26 & 28 sections for Fire alarm devices to be salvaged.
4. Division 28 Sections for:

    a. Security sensors to be reused or salvaged.
    b. Other operational equipment to be removed or salvaged.

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, carefully package and label, and deliver to Smithsonian Institution ready for reuse or store as directed by COTR.

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, the Gunboat Philadelphia and its related artifacts, exhibit artifacts and signage, and other items of interest or value to Smithsonian Institution that may be uncovered during demolition remain the property of Smithsonian Institution.

1. The COTR will remove all items from the exhibit except those the Contractor will protect in place.
2. The Contractor will protect in place the Gunboat Philadelphia and associated artifacts designated by COTR. Provide ventilated box shown on Drawings.
3. Notify COTR of any other historic items or objects uncovered or found in exhibit and wait for instructions for salvage or removal.

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 INFORMATIONAL 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. See Drawings for additional requirements

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 Smithsonian Institution's 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 freight elevator and stairs.
5. Coordination of Smithsonian's continuing occupancy of portions of existing building and of Smithsonian Institution'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 01000 "Supplementary Conditions for Construction." Submit before Work begins.

1. Provide documentation of the Gunboat Philadelphia prior to building protective box.

D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

A. The Smithsonian Institution will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Smithsonian Institution's operations will not be disrupted.

1. Building facilities remaining open to visitors and staff include adjacent exhibitions, elevators and escalators, corridors, and toilet rooms open.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Smithsonian Institution as far as practical.

1. Before selective demolition, NMAH Staff and COTR will remove the following items:

a. Artifacts in display cases.
b. Selected display cases, including boat model.
c. Floor and wall mounted signage and exhibitry.

C. Notify COTR of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify COTR. Hazardous materials will be removed by Smithsonian Institution under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. 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.

1.9 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Smithsonian Institution's operations.

1. Coordinate schedule with COTR to provide NMAH staff ample time to remove artifacts and objects they are keeping.

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 impacted 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 COTR. COTR does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged.

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. Do not proceed with work until the protection plan is reviewed and approved by the COTR, and the Smithsonian Institution has removed objects and artifacts.
2. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
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 010000 "Supplementary Conditions for Construction."

B. Temporary Protection of Artifacts: Provide protection to encase completely the Gunboat Philadelphia prior to commencing selective demolition. Refer to Drawings for protection details.

C. 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.

D. 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 work only after Smithsonian Institution has removed artifacts, objects, and exhibitory from the work area.
2. Provide temporary protection for Gunboat Philadelphia and for work area prior to proceeding with selective demolition.
3. 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.
4. 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.
5. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
6. When cutting through walls for floor/ceiling slabs, provide temporary protection on blind side and station workers on both sides to ensure safety and protection of people, artifacts, and objects.
7. 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.
8. Maintain fire watch during and for at least one hour after flame-cutting operations.

9. Maintain adequate ventilation when using cutting torches.
10. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
11. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
12. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
13. Dispose of demolished items and materials promptly. Comply with requirements in Section 010000 "Supplementary Conditions for Construction."

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. 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 Smithsonian Institution.
4. Transport items to Smithsonian Institution's storage area designated by COTR.
5. Protect items from damage during transport and storage.

D. 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.

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

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Provide opening in floor for piping shown on Plumbing drawings. Locate reinforcing in concrete prior to cutting, and consult COTR for exact location of opening. Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts

B. Carpet: Remove carpet in Gunboat Philadelphia exhibit area. Cut carpet back to boat supports prior to building protection. Removal of carpet under boat will be by others.

C. Oak Flooring: Carefully remove random width oak flooring in AMPU Storage. Coordinate area with dimensions new concrete equipment pad for new Air Handling Unit. Salvage oak flooring; demolish wood sleepers and exposed portion of abandoned Walker duct system.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction. and recycle or dispose of them according to Section 010000 "Supplementary Conditions for Construction."

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 building via East Freight Elevator to Loading Dock on Lower Level.
4. Comply with requirements specified in Section 010000 "Supplementary Conditions for Construction."

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.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Remove: Refer to Demolition Drawings.

B. Remove and Salvage: Salvage the following and turn over to COTR:

1. Random width oak flooring where removed for equipment pad.
2. Terminal units and associated temperature sensors.
3. Security sensors: vibration and motion types.

C. Remove and Reinstall: Where directed in Technical Sections.

D. Existing to Remain: Fire Compartment separation wall (west wall of Rm 3204), security wall (east wall of Rm 3204), and mezzanine structure (walls and floor/ceiling) within Conservation Space (Room 3204) housing Military Collections Storage (Room 3205C).

END OF SECTION 024119

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DIVISION 2

SECTION 028200 - ASBESTOS ABATEMENT

TABLE OF CONTENTS

DIVISION 2

SECTION 028200- ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 Introduction

1.1.1 Perform all planning, administration, execution, and cleaning necessary to safely remove asbestos-containing or contaminated materials.

1.1.2 Approval of or acceptance by the Contracting Officer's Technical Representative (COTR) of various construction activities or methods proposed by Contractor does not constitute an assumption of liability either by the COTR or Smithsonian Institution (SI) for adequacy or adverse consequences of said activities or methods.

1.2 Description of the Abatement Work

1.2.1 The asbestos abatement shall also include, but not be limited to the following:

(a) Notification to regulatory agencies

(b) Regulatory permits, licenses and approvals

(c) Worker health and safety program

(d) Air monitoring

(e) Construction of temporary containment barrier/decontamination enclosures

(f) Preparation for abatement operations

(g) Removal of existing asbestos-containing material

(h) Transport and disposal of asbestos-containing material

(i) Decontamination and cleaning

(j) Application of lockdown encapsulant**s**

(k) Removal of temporary containment barrier/decontamination enclosures

(l) Final job close-out

1.2.2 Summary Listing of Work Locations and Approximate Quantity: The Contractor shall review all contract documents and make a site visit to make his/her own

determination about quantity values prior to applying for the required federal, state, or local permits from agencies having authority or jurisdiction.

1. All HVAC mastics are assumed to contain ACM. All sections of the work that would remove or damage exisiting mastics require abatment.

1.2.3 Drawings and Other Information: Drawings of the project area(s) and the reference location(s) within the building may be provided upon request to assist in the Contractor's planning of the abatement work effort for protection of occupants and contents.

1.2.4 Other Work Not Included: Concurrently with this contract, the SI reserves the right to collect and analyze samples or retain an independent testing laboratory to provide supplemental sampling services. These services will in no way relieve the Contractor from compliance liability or from providing the testing required by these specifications or any other requirements of other agencies with jurisdiction authority.

NOTE: The SI has contracted independent air monitoring and testing services. The Contractor shall use a different firm for air monitoring and testing on this project.

1.3 Definitions

1.3.1 Abatement: Procedures to control or eliminate fiber release from asbestos-containing building materials, to include encapsulation, enclosure and removal.

1.3.2 Abatement Work Area (regulated area): An area established by the employer to demarcate areas where Class I, II, III and IV asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos, exceed or there is a reasonable possibility they may exceed the permissible exposure limit.

1.3.3 Airlock: A system of enclosures within the containment area consisting of two (2) doorways, curtained with polyethylene sheeting, at least 1 meter apart.

1.3.4 Air Filtration Units: A local exhaust unit, utilizing high-efficiency particulate air (HEPA) filtration and capable of maintaining a minimum negative pressure differential of 0.05 mm of water within the containment barrier with respect to that of the environment surrounding the containment barrier. The unit also cleans recirculated air or generates a constant air flow from adjacent areas into the abatement work area through the decontamination enclosure.

1.3.5 Air Monitoring**:** The process of measuring the fiber content of a specific volume of air during a stated period of time.

1.3.6 Air Pressure Monitoring: The process of measuring the air pressure differential between the containment barrier and the surrounding area using a micromanometer unit.

1.3.7 Amended Water: Water to which a surfactant (wetting agent) has been added to increase the ability of the liquid to penetrate asbestos containing materials (ACM).

1.3.8 ANSI**:** American National Standards Institute.

1.3.9 ASTM**:** American Society for Testing and Materials.

1.3.10 Asbestos: Asbestiform varieties of chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

1.3.11 Asbestos-Containing Material (ACM): Any material containing more than 1% asbestos by volume of any type or mixture of types.

1.3.12 Authorized Person: Any person authorized by the SI and required by work duties to be present in a regulated area.

1.3.13 Caulking: High-grade rubber base caulk for masonry and/or for other materials to be used or existing, as appropriate.

1.3.14. Class I Asbestos Work: Activities involving the removal of thermal systems insulation (TSI) and surfacing ACM and presumed asbestos containing materials (PACM).

1.3.15. Class II Asbestos Work: Activities involving the removal of ACM which is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

1.3.16. Class III Asbestos Work: Repair and maintenance operations, where ACM, including TSI and surfacing ACM and PACM, is likely to be disturbed.

1.3.17. Class IV Asbestos Work: Maintenance and custodial activities during which employees contact but do not disturb ACM or PACM and activities to clean up dust, waste and debris resulting from Class I, II and III activities.

1.3.18 Clean Room: An uncontaminated area or room which is part of the abatement worker/equipment decontamination enclosure, with provisions for storage of workers' or visitors' street clothing, protective equipment and uncontaminated materials and equipment. It may be used for changing clothes.

1.3.19 Competent Person: In addition to the definition in 29 CFR 1926.32 (f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32 (f)**.** In addition, the competent person shall have successfully completed training for Class I, Class II, Class III, and Class IV projects meeting the criteria set forth in the EPA Model Accreditation Plan (40 CFR 763) for project designer or supervisor, and operations and maintenance training.

1.3.20 Containment Barrier: A temporary enclosure constructed with fire-retardant plastic sheeting, suitable framing, tape (as defined in 1.3.52) and other adhesives within the abatement work area. This barrier serves to confine the asbestos abatement and decontamination work, and to contain the release of asbestos containing dust and debris through the action of pressure differential ventilation and air filtration systems. The only entrance is via the abatement worker/equipment decontamination enclosure.

1.3.21 COTR (Contracting Officer's Technical Representative)**:** An individual representing the SI as the technical advisor to the SI's Contracting Officer. This individual may be an employee of the SI or consultant.

1.3.22 Critical Barrier: Those portions of the containment barrier which represent the minimum structural components necessary to maintain the asbestos removal area in airtight isolation from the surrounding areas. Critical barriers shall be placed at floors, windows, ventilation louvers and other openings as necessary to achieve abatement work area isolation before putting up the double-layer plastic sheeting containment enclosure within which abatement work is performed. If a temporary plastic sheeting/stud wall

must be erected, it shall be treated as a critical barrier. The double-layer plastic sheeting containment enclosure shall then be erected on that wall. Wrappings on lights, control boxes, etc., do not constitute part of the critical barrier.

1.3.23 Curtained Doorway: A minimum 2-flap passageway to allow access or egress from one room to another while permitting minimal air movement between the rooms of the decontamination enclosure system. It is constructed by placing 2-3 overlapping sheets of plastic sheeting at least three feet wide over an existing or temporarily framed doorway. The sheets shall be weighted at the bottom so that they close quickly after being released.

1.3.24 Decontamination Enclosure: A series of connected rooms with curtained doorways between each room, for the decontamination of the abatement workers and equipment/materials. A decontamination enclosure contains a minimum of three (3) separate rooms (typically with airlocks located between the rooms) consisting of an equipment room, shower room, and clean room. The system is constructed of an air-tight, impermeable, temporary barrier. Framing for enclosure shall be metal or fire retardant pressure impregnated wood.

1.3.25 Disposal Bag: A properly labeled minimum 0.15 mm thick, leak-tight plastic bag used for transporting asbestos waste from the abatement work area to an EPA-approved disposal site for ACM waste.

1.3.26 Disturbance: Contact which releases fibers from ACM or presumed asbestos-containing material (PACM) or debris containing ACM or PACM. This term includes activities that disrupt the matrix of ACM or PACM, render ACM or PACM friable, or generate visible debris. Disturbance includes cutting away small amounts of ACM and PACM, no greater than the amount which can be contained in one standard sized glove bag (as defined in 1.3.29) or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or waste bag which shall not exceed 1.52 m in length and width.

1.3.27 Encapsulant: A material applied after the removal of ACM or to the ACM-edges of partially abated substrates which surrounds or embeds residual asbestos fibers in an adhesive matrix to prevent their release into the atmosphere. Encapsulation for purpose of final lockdown is not to be accomplished until after the project has passed final air clearance tests and the COTR has authorized removal of the containment.

1.3.28 Enclosure**:** Procedures necessary to completely enclose material containing asbestos behind airtight, impermeable, permanent barriers.

1.3.29 Equipment Room: A contaminated area or room which is part of the decontamination enclosure, with provisions for storage of contaminated clothing and equipment and cleaning supplies for decontamination of equipment. Airlocks are required at all entrances to the equipment room.

1.3.30 EPA**:** United States Environmental Protection Agency.

1.3.31 Excursion Limit: Airborne concentration of asbestos in excess of 1.0 fiber per cubic centimeter of air (1 f/cc), as averaged over a sampling period of thirty minutes.

1.3.32 Fiber: A particulate form of asbestos, 5 micrometers or longer, with a length-to-width ratio of at least 3 to 1.

1.3.33 Fixed Object: A unit of equipment or furniture in the abatement work area which cannot be removed from the abatement work area.

1.3.34 Glove Bag: A pouch, typically constructed of a minimum 0.15 mm thick, 1.5 m x 1.5 m (maximum), transparent polyethylene or polyvinylchloride plastic, with inward projecting sleeve gloves to abate ACM in a sealed micro-environment with designated inlets for amended water and sealant application, and a HEPA filtered vacuum unit attachment. The pouch has capacity for tool storage and to hold removed ACM.

1.3.35 GFCI (Ground Fault Circuit Interrupter): A type of ground fault protection in areas where personnel are at high risk of receiving electrical shocks (for example, in damp locations); makes use of a device designed to trip at a ground current in the milliampere range, i.e., very much below currents that are normally harmful.

1.3.36 HEPA Filter: A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97% of all mono-dispersed particles 0.3 micrometer in diameter or larger.

1.3.37 HEPA-Filtered Vacuum Cleaner: HEPA-filtered vacuuming equipment with a filter system capable of collecting and retaining asbestos fibers.

1.3.38 Holding Area**:** A chamber between the washroom and uncontaminated area in the equipment decontamination enclosure system.

1.3.39 Impermeable Waste-Disposal Containers: Suitable to receive and retain any asbestos-containing or contaminated material until disposal at an approved site. The containers shall be labeled in accordance with OSHA Regulation 29 CFR 1910.1001 and 29 CFR 1926.1101. Containers must be both water-tight and air-tight.

1.3.40 Lockdown: The process of applying encapsulant as a finishing coat to abated surfaces after project has successfully passed final air clearance tests and the COTR has authorized removal of containment.

1.3.41 Movable Object: A unit of equipment or furniture in the abatement work area which can be removed from the abatement work area.

1.3.42 MSHA: Mine Safety and Health Administration:

1.3.43 Negative Exposure Assessment (NEA): A demonstration by the contractor, which complies with the criteria in OSHA 29 CFR 1926.1101(f)(2)(iii), that employee exposures during an operation are expected to be consistently below the permissible exposure limits (PELs). Such assessment is to be used to justify level of respiratory protection to be used on the job.

1.3.44 NESHAP~~S~~**:** National Emissions Standard for Hazardous Air Pollutants.

1.3.45 N.E.C.**:** National Electrical Code.

1.3.46 NIOSH**:** National Institute for Occupational Safety and Health.

1.3.47 OSHA**:** Occupational Safety and Health Administration.

1.3.48 PACM**:** Presumed Asbestos-Containing Material, meaning thermal system insulation and surfacing material found in buildings constructed no later than 1980.

1.3.49 PEL**:** Permissible Exposure Limit. An occupational limit of exposure to a chemical substance or physical agent.

1.3.50 Personal Monitoring: Sampling of asbestos fiber concentrations within the breathing zone of an employee. Breathing zone is defined as a radius of 150 mm to 250 mm around the employee's head.

1.3.51 Personal Protective Equipment: Equipment which may consist of coveralls, shoes, gloves, helmet, goggles, and respirator used for protection against asbestos exposure.

1.3.52 Plastic Sheeting: Fire retardant Polyethylene sheet material of specified thickness used for protection of walls, floors, etc., and critical barriers in the abatement work area.

1.3.53 Protection Factor: The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer.

1.3.54 Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres and approved by NIOSH or MSHA for a specific category of use.

1.3.55 SI IH - Smithsonian Institution's Industrial Hygienist: An individual serving as the Smithsonian's industrial hygienist. This individual may be an employee or consultant.

1.3.56 Surfactant: A chemical wetting agent added to water to decrease surface tension and improve material penetration.

1.3.57 Tape: Glass fiber or other tape capable of sealing joints of adjacent sheets of plastic (0.15 mm polyethylene) and for attachment of plastic sheets to finished or unfinished surfaces of dissimilar materials under both dry and wet conditions, including use of amended water. Minimum tape width shall be 51 mm.

1.3.58 Warning Labels and Signs: As required by OSHA regulations 29 CFR 1910.1001 and 1926.58.

1.3.59 Waste Water Filters: Discharged liquids shall pass through a primary filter and the output shall be particles 20 microns or smaller. The secondary filter shall have output particles 5 microns or smaller.

1.3.60 Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with amended water.

1.4 Regulations and References

1.4.1 Regulations: Contractor shall comply with the most current edition of all federal, state, county, and city codes and ordinances as they apply to the location(s) in which the work is performed. Make available for review at the site one copy of all applicable federal, state, county and city regulations governing the abatement work, including but not limited to:

1.4.1.1 Occupational Safety and Health Administration (OSHA), U.S. Department of Labor

(a) 29 CFR 1910 (General Industry) and 29 CFR 1926 (Construction) Occupational Safety and Health Standards

(b) 29 CFR 1910.1001 and 29 CFR 1926.1101 Asbestos

(c) 29 CFR 1910.134 Respiratory Protection

(d) 29 CFR 1910.1200 Hazard Communication

1.4.1.2 U. S. Department of Transportation

(a) 49 CFR 171 Subchapter C, Hazardous Materials Regulations

(b) 49 CFR 172 Subchapter C, Shipping Container Specifications

1.4.1.3 U.S. Environmental Protection Agency

(a) 40 CFR 763, Toxic Substances Control Act; particularly Subpart E, Asbestos Containing Materials in Schools

(b) 40 CFR 61, Sub-parts A and M, National Emission Standard for Hazardous Air Pollutants (NESHAPS)

1.4.1.4 District of Columbia Law Title 20 DCMR Section 800. District of Columbia Department of Health.

1.4.1.5 New York City Department of Environmental Protection.

1.4.1.6 New York State Department of Health; New York State Department of Environmental Conservation; New York State Department of Labor.

1.4.1.7 Virginia Department of Labor and Industry; Virginia Department of Professional and Occupational Regulation; Virginia Department of Environmental Quality.

1.4.1.8 Maryland Department of the Environment; Maryland Occupational Safety and Health.

1.4.1.9 Arizona Department of Environmental Quality.

1.4.1.10 Hawaii Department of Health.

1.4.1.11 Florida Department of Environmental Protection.

1.4.1.12 Massachusetts Department of Environmental Protection.

1.4.1.13 American National Standards Institute (ANSI), 1430 Broadway, New York, New York 10018. Telephone (212)354-3300

(a) ANSI Publication Z88.2 Practices for Respiratory Protection

1.4.1.14 American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103. Telephone (215) 299-5400

(a) ASTM Standard P-189 Specification for Encapsulants for Friable Asbestos Containing Building Materials Proposal

1.4.1.15 Compressed Gas Association, Inc. New York. Pamphlet G-7 "Compressed Air for Human Respiration", Specification G-7.1 Commodity Specification for Air"

1.4.1.16 Canadian Standard Association (CSA), Rexdal, Ontario, Standard Z180.1, "Compressed Breathing Air".

1.5 Submittals

1.5.1 Reference Division 1, Section 01000 Supplementary Conditions for Construction, for additional requirements.

1.5.2 Contractor's Work Plan: The Contractor shall submit a Contractor's Work Plan for asbestos abatement work within 15 calendar days after contract award to the COTR for approval. Approval of the Plan is required prior to beginning abatement work. The Plan shall be on 220 mm x 280 mm paper in a binder indexed by the subjects listed below. Detail the procedures, instructions, and reports used to assure compliance with the contract documents.

1.5.2.1 Barchart Schedule: Provide barchart scheduling of the abatement work by daily and/or weekly increments for each abatement work area and individual decontamination enclosure system. The time line is to include all work, both on and off the job site, for the entire contract period.

1.5.2.2 Notices: The contractor shall notify federal, state, and local regulatory agencies in writing immediately upon contract award and a minimum of 10 days in advance of any asbestos related work. Notifications shall be made by the Contractor as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M)). Submit copies of notifications and documentation to the COTR. If a project consists of multi-phases, with distinct start and stop dates, these shall be declared on the EPA Notice or individual notices shall be filed for each phase.

1.5.2.3 Permits and Licenses: Maintain current licenses and obtain applicable permits as required by federal and applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the abatement work of this contract. Submit copies of all state and local licenses and permits necessary to carry out the abatement work of this contract.

(a) All asbestos containing waste is to be transported by an entity maintaining a current "Industrial waste hauler permit" specifically for asbestos-containing materials, as required for transporting of waste asbestos-containing materials to a disposal site.

(b) Notices of Violations: Submit copies of all Notices of Violations issued to the contractor and its sub-contractors within the last three (3) years by federal, state, and local regulatory agencies.

1.5.2.4 Sequence of Work: Narrative description of the proposed sequencing of asbestos work and breakdown of abatement work areas requiring separate or individual decontamination enclosures. Include how enclosure systems will be erected and dismantled. Include how re-useable equipment will be cleaned for re-use before relocation or removal from the site. Include how waste disposal containers will be cleaned and removed from the abatement work area.

1.5.2.5 Abatement Work Area Layout Sketch: Layout sketch of decontamination enclosure systems and abatement work area. Describe assembly of construction, materials to be used and location of notices to be posted on the job site. Indicate which areas will be sealed off (and by what means). Show locations of facilities and equipment such as showers, lockers, storage, etc. Show locations of all filtration devices to be used, their exhaust, and calculations to determine the number of these devices needed to provide the minimum 4 air changes per hour in the abatement work area. These requirements shall be coordinated with the COTR and facility representative

1.5.2.6 Isolation of Abatement Work Areas: Methods to isolate/restrict access to abatement work areas. Include how access will be controlled, how building HVAC ventilation systems will be isolated from abatement area. Include how security and fire systems will be maintained within the containment. Include plans for electrical lock-out and dedicated electrical systems. These requirements shall be coordinated with the COTR and facility representatives.

1.5.2.7 Transportation and Disposal: Details of hauling equipment, materials and contaminated debris from inside the building. Submit written identification of licensed hauler and landfill location.

1.5.2.8 Personnel Organization and Responsibilities: The Contractor shall provide a list of all project personnel, both on-site and in the offices, and a statement of their responsibilities and authority for work on this project.

1.5.2.9 Personal Protective Equipment: Details of personal protective equipment and use, storage and maintenance at job site.

1.5.2.10 Posted Notices and Warning Signs: Submit copies of notices to be posted at the job site, as required by EPA and OSHA regulation for asbestos abatement activities.

1.5.2.11 Materials and Equipment Product Data: Submit manufacturer's literature and written information for all materials and equipment, including NFPA test report of flame resistant materials, and material safety data sheets for all chemical-content supplies. Contractor shall not change materials or equipment without approval of a new submittal to the COTR.

1.5.2.12 Contractor Monitoring Services: Before start of asbestos work, submit to the COTR the name of the contractor's industrial hygiene consultant and analytical laboratory for air monitoring.

1.5.2.13 Superintendent/Competent Person: Before start of asbestos work, submit to the COTR the name of job site supervisor who must meet the following requirements as a minimum. Furnish documentation that the General Superintendent:

(a) has a minimum of five (5) years on-the-job experience as a supervisor of asbestos abatement projects

(b) is a competent per Section 1.3.15 of this document.

(c) is certified as an Asbestos Abatement Supervisor in accordance with 40 CFR Part 763.

(d) is fluent in the English language and all other primary languages spoken by the abatement work crew.

1.5.2.14 Workers' Specialized Training: Submit training course descriptions, locations, and dates. Submit to the COTR a written affidavit before start of asbestos removal as proof that all employees have had instruction on the hazards of asbestos exposure; and on all aspects of work procedures and personal protection and area protective measures as required and/or recommended by OSHA and EPA and other applicable guide documents. The affidavit shall include course name, designation, installation, place, date taken, and student names.

(a) Training shall be in accordance with 29 CFR 1926.1101.

(b) Course certification shall be in accordance with EPA as required by 40 CFR 763.

(c) Workers should have a minimum of one (1) year experience as an asbestos worker.

1.5.2.15 Respiratory Program: Submit a written respiratory program as defined in OSHA 1926.1101 and in these specifications. Submit type of NIOSH/MSHA certified respiratory equipment intended for each operation required by this project. Selection criteria must meet 29 CFR 1926.1101 (h) (2). When a Type "C" supplied positive pressure air respiratory system is required by the abatement work, submit drawing showing assembly of components into a complete supplied air respiratory system. Include diagram showing location of compressor, filter banks, backup air supply tanks, hose line connections in abatement work area(s), routing of air lines to abatement work area(s) from compressor.

1.5.2.16 Negative exposure assessment data submitted to justify respiratory selection must be less than 12 months old and closely resemble the current project following criteria set forth in 29 CFR 1926.1101 (f) (2) (iii).

1.5.2.17 Emergency Preparedness: Submit an emergency plan to COTR for approval by SI Office of Safety, Health and Environmental Management (OSHEM). The emergency plan shall address responses to fire, accident, power failure, pressure differential system failure, supplied air system failure, or any other event that may requiremodification or abridgement of decontamination or abatement work area isolation procedures. Show exit routes from the building, locations of the nearest manual pull stations, telephone number of Smithsonian security office, name of the designated employee responsible for fire protection, fire hazards inherent to the project and measures taken for prevention. All employees shall be familiar with the emergency plan and have initialed the plan after reading it, know how to activate the fire alarm, and trained in the use of portable fire extinguishers. One on-site employee shall be designated as responsible for fire protection. The plan shall be available at the job site in all primary languages of the abatement work crew. In addition, the following emergency information shall be posted at all entrances to the abatement work area:

(a) Exit route map
(b) Phone number of SI security office

1.6 Daily Reports

1.6.1 The Contractor shall correspond with the COTR for all matters related to this construction project, unless otherwise directed.

1.6.2 All correspondence with the SI shall be in the English language, signed and dated by the Contractor.

1.6.3 Reference General Conditions (Construction Contract Clauses) and Specifications Division 1 for Supplementary Conditions for Construction.

1.6.4 The Contractor shall maintain daily logs and reports of job-site activities and personnel exposure monitoring at the site and shall provide copies to the COTR for inspection upon request.

1.6.5 The Contractor shall maintain daily reports using the SI Contractor's Daily Report form. Reports shall be numbered consecutively and all sections shall be completed or noted as 'not applicable.' Each day's report shall contain detailed remarks including but not limited to progress on the job, problems discovered, and discussions with Smithsonian staff. Reports shall be submitted to the COTR each day for the previous work day.. Copies shall be maintained at the jobsite and made available to the COTR upon request.

1.6.6 Reporting Unusual Events: When an event of unusual and significant nature occurs at site (examples: failure of pressure differential system, rupture of temporary enclosures, equipment or power failure, high airborne fiber reading), prepare and submit a special report listing chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information.

1.6.7 Accident Reporting: Report all accidents to Smithsonian Security Office first, then to the COTR. Prepare reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury is sustained, property loss of substance is sustained, or where the event

posed a significant threat of loss or personal injury. Report shall be submitted to the COTR, who will forward copies to OSHEM and the facility Safety Coordinator.

1.6.8 Waste Manifest-Asbestos: At completion of hauling and disposal of each load, submit a copy of waste manifest, chain of custody form, and landfill receipt to the COTR. Waste manifest to be submitted shall be signed by the contractor, waste transporter, and the disposal facility. A copy of all manifests will be included in the post-job submittal.

1.6.9 Waste Manifest-Hazardous Waste: Any hazardous waste generated as a result of asbestos abatement activities will be disposed of by a Certified Hazardous Waste Disposal Contractor. A copy of the Hazardous Waste Manifest generated by this disposal is to be submitted to the COTR, who will forward a copy to the facility's SI Hazardous Waste Coordinator. A copy of all manifests will be included in the post-job submittal.

1.7 Product Handling

1.7.1 Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.

1.7.2 Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.

1.7.3 Remove from the premises all damaged or deteriorated materials. Dispose of materials that become contaminated with asbestos in accordance with applicable regulatory standards and these
specifications.

PART 2 - PRODUCTS

2.1 Materials

2.1.1 Caulking: High-grade rubber base caulk for masonry and/or for other materials.

2.1.2 Encapsulant: Product shall be rated as acceptable for use intended when field tested in accordance with ASTM Proposed Specification P-189 "Specification for Encapsulants for Friable Asbestos Containing Building Materials". Use only materials that have a flame spread index of 25 or less when dry, when tested in accordance with ASTM E-84.

2.1.3 Glove-Bag: 0.15 mm thick, 1500 mm x 1500 mm, transparent polyethylene or polyvinylchloride plastic with long sleeve gloves, designated inlets for HEPA vacuum attachment, and storage pouch.

2.1.4 Impermeable Waste-Disposal Containers: Suitable to receive and retain any asbestos-containing or contaminated material until disposal at an approved site. The containers shall be labeled in accordance with OSHA Regulation 29 CFR 1910.1001 and 29 CFR 1926.1101. Containers must be both water-tight and air-tight.

2.1.5 Plastic Sheeting: Product Standard PS 17-69 and OSHA Regulation 29 CFR 1926.1101; Polyethylene plastic sheeting material 0.15 mm thickness for covering floors and walls, providing air locks, and sealing doors and windows; supply in appropriate

widths to minimize seams. Must be flame-resistant material and must meet test criteria in NFPA 701. Reinforced sheeting is required for applications subject to wear and tear.

2.1.6 Surfactant (Wetting Agent): 50% polyoxyethylene ester and 50% polyoxyethylene ether, or approved equal, shall be mixed with water to provide a concentration of 2 ml surfactant to 1 liters of water, or manufacturer's recommended concentration.

2.1.7 Tape: Glass fiber or other tape capable of sealing joints of adjacent sheets of plastic sheeting and for attachment of plastic sheets to finished or unfinished surfaces of dissimilar materials under both dry and wet conditions, including use of amended water. Minimum tape width shall be 50 mm.

2.1.8 Warning Labels and Signs: As required by OSHA regulations 29 CFR 1910.1001 and 1926.58.

2.1.9 Waste Water Filters: Discharged liquids shall pass through a primary filter and the output shall be particles 20 microns or smaller. The secondary filter shall have output particles 5 microns or smaller.

2.2 Equipment

2.2.1 Air Filtration Units: Shall be factory-sealed and equipped with HEPA filters(final), pre-filters, instrumentation to monitor pressure differential, and safety and warning devices.

2.2.1.1 Provide units with electrical components approved by the National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL).

2.2.1.2 Access to the units for replacement of all air filters shall be from intake end. Provide units with pre-filters and intermediate filters installed either on or in the intake grid of the unit and held in place with special housings or clamps. The filter media shall be completely sealed on all edges with a structurally rigid frame with a continuous rubber gasket.

2.2.1.3 HEPA Filters: Provide units equipped with HEPA filters. Filters shall be individually tested and certified by the manufacturer.

2.2.1.4 Pre-filters: Provide a two-stage pre-filtration to extend the life of the primary HEPA filter. The first-stage pre-filter is a low-efficiency type effective for particles 100 micrometers and larger. The second-stage (or intermediate) filter has a medium efficiency effective for particles down to 5 micrometers.

2.2.1.5 Instrumentation: Provide units equipped with a magnehelic gauge or manometer to measure the pressure drop across filters and to indicate when filters have become loaded and need to be changed. A table indicating the usable air-handling capacity for various static pressure readings on the magnehelic gauge affixed near the gauge for reference, or the magnehelic reading indicating at what point the filters should be changed, noting cubic feet per minute (CFM) air delivery at that point. Provide an elapsed time meter to show the total accumulated hours of operation.

2.2.1.6 Safety and Warning Devices: Provide units with the following safety and warning devices:

(a) Warning lights to indicate normal operation, too high a pressure drop across the filters (i.e., filter overloading), and too low of a pressure drop (i.e., rupture in HEPA filter or obstructed discharge)

(b) GFCIs.

(c) Audible alarm if unit shuts down due to operation of safety systems.

(d) Electrical overload protection sized for the equipment. The motor, fan, fan housing, and cabinet are to be grounded.

2.2.2 Respirators and Respirator Systems

2.2.2.1 Product Data: Must possess NIOSH and MSHA approval for each component in an assembly and/or for entire assembly.

PART 3 - EXECUTION

3.1 Controlled Access to Site

3.1.1 Access to the abatement work area shall be restricted to contractor's workers and authorized visitors as defined in these specifications.

3.1.2 Authorized visitors shall have access to the work site at all times following notification to COTR. Contractor shall supply protective clothing and equipment for visitors as necessary, except for respirators which are to be provided by the visitor in accordance with Section 3.4 of this document.

3.1.3 Contractor shall prominently post signs at all potential entry points to the abatement work area which clearly state: "Restricted Area Under Construction-Admittance by Special Permission Only - Protective Clothing Required Beyond This Point". Immediately inside entry point and outside critical barriers post a warning sign meeting specifications of OSHA 29 CFR 1910 and 1926. Suggested format is a sign of minimum size 508 mm by 356 mm displaying the following legend:

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DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

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3.1.4 All workers and authorized visitors shall enter the abatement work area only through the abatement worker/equipment decontamination enclosure, in accordance with Section 3.3 of this document.

3.1.5 All workers and authorized visitors, before entering the abatement work area, shall read and be familiar with all posted regulations, personal protection requirements, and emergency procedures and exit routes.

3.1.6 Contractor shall maintain a daily job site personnel log listing names and social security numbers of individuals who entered the abatement work area, and the times of entering and leaving the area.

3.2 Worker and Visitor Protection

3.2.1 No eating, drinking, smoking, or chewing gum is permitted within the abatement work area. The COTR shall designate a "break area" where these activities, except for smoking, are permitted. Smoking is prohibited in SI facilities.

3.2.2 Workers and Visitors shall be fully protected with respirators and protective clothing during any work which may disturb asbestos-containing materials and result in fiber release. Full protection is not required during pre-abatement inspections of the containment, while work is not being conducted.

3.2.3 Protective Clothing and Equipment: Provide workers and visitors with sufficient sets of protective full body clothing, to include full body coveralls with hood, boots (for workers) and footwear coverings (for workers and visitors), and gloves. Provide eye protection and hard hats as required by applicable safety regulations. Contaminated non-disposal clothing and footwear shall be left in the equipment room until the end of the asbestos abatement work, at which time such items shall be disposed of as asbestos waste, or shall be thoroughly cleaned of all asbestos or asbestos-containing material. Contractor shall have at least six (6) sets of disposable protective full body clothing for COTR and authorized visitors for each work day. Provide storage facilities for visitors and workers for removed street clothing in the clean room.

3.2.3.1 Boots: Provide workers non-skid type work boots with protective shields as required by OSHA. Paint uppers of boots with red waterproof enamel paint as a permanent marking that the boots have been exposed to ACM abatement work areas. These boots are to be handled as asbestos-contaminated materials.

3.2.3.2 Hard Hats: Provide hard hats that meet ANSI Z89.1 for use where work is overhead, scaffolding is being used, or as otherwise required by OSHA. Label hats with same warning labels as required for ACM disposal bags.

3.2.3.3 Goggles: Provide goggles that meet ANSI Z87.1 as required by OSHA.

3.2.3.4 Gloves: Provide disposable work gloves for use in the abatement work area.

3.2.3.5 Coveralls with Hood: Provide disposable coveralls with hoods for use in the abatement work area.

3.2.3.6 Respirators: Provide workers with personally issued and marked respirator equipment approved by NIOSH/MSHA and, in accordance with these specifications, suitable for the asbestos exposure level in the abatement work area. Where respirators with disposable filters are employed, provide sufficient filters for replacement as necessary by the abatement worker, or as required by the applicable regulation. Authorized visitors must provide their own respirators, with fresh filters or cartridges as necessary, to enter the abatement work area. These are minimum requirements. Section 3.4 of this document is to be consulted for more detail.

3.3 Abatement Work Area Entry and Exit Procedures

3.3.1. Each time the abatement work area is entered remove all street clothes in the Clean Room of the Decontamination Enclosure and put on new disposable coveralls, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.

3.3.2 Each time the abatement work area is exited, the following procedures shall be followed:

3.3.2.1 Before leaving the regulated area, employees and authorized visitors shall remove all gross contamination and debris from their protective clothing.

3.3.2.2. Personnel exiting the regulated area shall remove their protective clothing and equipment (except respirators) in the equipment room and deposit the clothing in labeled impermeable bags or containers.

3.3.2.3 Personnel shall remove their respirators in the shower room, washing and rinsing them.

3.3.2.4 Personnel shall shower thoroughly before entering the clean room.

3.3.2.5 After showering, employees shall enter the clean room before changing into street clothes.

3.4 Respiratory Protection

3.4.1 Contractor is hereby advised that asbestos has been determined by the U.S. Government to be a CANCER-CAUSING AGENT. Provide workers with respirators [which, as a minimum, meet the requirements of OSHA 29 CFR 1926.1101] and protective clothing during all phases of the abatement work and until final air tests are accepted by COTR.

3.4.2 The Contractor shall select respirators from among those jointly approved as being acceptable for protection by the MSHA and the NIOSH under the provisions of 30 CFR Part 11.

3.4.3 The Contractor shall select and provide respirators, at no cost to the employee and shall ensure that the employee uses the respirator provided.

3.4.4 Instruct and train each worker involved in asbestos abatement or maintenance and repair of asbestos-containing materials in proper respiratory use and require that each worker always wear in the abatement work area a respirator, properly fitted on the face. The respirator shall be worn from the start of any operation which may cause airborne asbestos fibers until the abatement work area is completely decontaminated.

3.4.5 Allow an individual to use only those respirators for which training and fit-testing have been provided. Require that each time an air-purifying respirator is put on it be checked for fit with a positive and negative pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2.

3.4.6 For all jobs that involve the removal of thermal system insulation (TSI) or surfacing materials (OSHA definition of Class I work) the employer shall provide respirator protection in accordance with 29 CFR 1926.1101 (h) Table 1 - Respiratory Protection for Asbestos Fibers. This level of respiratory protection shall be maintained until the employer can produce a negative exposure assessment.

3.4.7 For all other abatement work, use respiratory protection appropriate for the fiber level encountered in the abatement work area or as required for other toxic or oxygen-deficient situations encountered. The level of respiratory protection which supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below the permissible exposure limit (PEL) is the minimum level of protection allowed. (Table 1, Respiratory Protection for Asbestos Fibers, 29 CFR 1926.1101*)* Do not use single-use, disposable, or quarter-face respirators.

3.4.8 Authorized visitors are responsible for providing their own respirator and replacement filters and cartridges, with the exception of Type C which shall be provided by Contractor, and for having been previously and properly trained fit-tested, for the respirator used.

3.4.9 For use with air-purifying respirators, provide, at a minimum, HEPA type filters certified by NIOSH and MSHA for protection against asbestos fibers. In addition, a chemical cartridge may be added, if required for protection against chemicals used on this job.

3.4.10 For use with powered air purifying respirators, supply a sufficient quantity of HEPA filters approved for asbestos, so workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement.

3.4.11 For supplied-air respirator systems, provide equipment capable of producing air used for breathing in Type "C" supplied air respiratory systems that meets or exceeds standards set for C.G.A. Type 1, Gaseous Air, Grade D. (See 1.5.2.15) System must be certified by NIOSH/MSHA as an approved Type "C" respirator assembly operating in pressure demand mode with a positive pressure face-piece including as a minimum the following:

- Auxiliary backup system
- Escape air supply
- Backup air supply
- Warning Alarm Device
- Compressor Shut Down
- Compressor Motor (electric)
- Compressor Location (outside building)
- Air Intake
- After-Cooler

3.5 Air Monitoring; Stop Action and Clearance Levels

3.5.1 This section describes work being performed by the SI. The SI will not be performing air monitoring to meet Contractor's OSHA requirements for personal sampling or any other purpose.. The Contractor is to conduct air monitoring required by OSHA for Contractor personnel.

3.5.2 Analytical Methods: The following methods will be used by the SI in analyzing filters used to collect air samples. Minimum sample volumes will be 1200 liters for clearance samples.

3.5.2.1 Phase Contrast Microscopy (PCM) - will be performed using the OSHA Reference Method, Appendix A to 29 CFR 1926.1101, or NIOSH Method 7400.

3.5.2.2 Transmission Electron Microscopy (TEM) - will be performed using the analysis method set forth in the AHERA regulation 40 CFR Part 763 Appendix A, or NIOSH Method 7402, whichever is deemed more appropriate by SI in each case.

3.5.3 Before Start of Work: The SI will secure abatement work area air samples to establish a base line fiber level in each homogeneous abatement work area before start of work. All samples will be taken at the same time to ensure identical environmental conditions.

3.5.4 Daily: From start of abatement work through project decontamination, the SI may be taking samples on a daily basis inside and outside each abatement work area.

3.5.5 All Clearance Air Samples will be taken using aggressive sampling techniques.

3.5.6 Stop Action: If any air sample taken outside of the abatement work area exceeds 0.01 f/cc by PCM, or 70 structures per mm^2 by TEM, depending on sampling method used, immediately and automatically stop all work except corrective action. PCM air samples will be re-analyzed by TEM to determine whether the high outside-of-work-area results were due to asbestos or non-asbestos fibers. The SI and the abatement contractor will determine the source of the high reading. The contractor will correct the condition, as appropriate.

3.5.7 Abatement Work Area Final Clearance Levels:

3.5.7.1 The SI standard for abatement work area final clearance in all occupied areas for removing the containment and re-occupancy is 70 structures per mm^2 by TEM using the analysis method set forth in the AHERA regulation 40 CFR Part 763 Appendix A.

3.5.7.2 The SI standard for abatement work area final clearance in un-occupied areas, or at the case-by-case discretion of the SI, is less than 0.01 fibers per cubic centimeter of air using PCM methods specified in NIOSH 7400.

3.5.7.3 Final air clearance requirements of specific state and local regulations that exceed the requirements of 3.5.7.1 and 3.5.7.2 will be utilized (e.g., in the District of Columbia, at least two PCM samples per 2,500 square feet of floor are required).

3.6 Initial Isolation of Abatement Work Area

3.6.1 Contractor shall completely separate the abatement work area from other portions of the building, and the outside, by sealing all openings (windows, doorways, elevator openings, corridor entrances, drains, ducts, grill, diffusers, skylights, etc.) with barriers of 0.15 mm polyethylene sheeting and tape, or by sealing cracks leading out of the

abatement work area. Contractor shall caulk the joints and seal holes in that portion of the walls, ceiling, and floor inside the abatement work area that could allow airborne asbestos fibers to be carried into adjoining spaces, or the exterior. Note in particular where pipes, conduit, and ductwork penetrate walls, ceilings and floor. Doorways and corridors which will not be used for passage during work must be sealed with 9.5 mm plywood, wood framing and plastic sheeting with tape.

3.6.2 All heating, ventilating, and air conditioning (HVAC) components that are in, supply or pass through the abatement work area shall be shut down. During asbestos removal and until job completion, elevators, exhaust fans, and HVAC vents and intakes will be key locked to not operate in the abatement work area.

Coordinate with the COTR and Building Representative which areas are to be shut down and for what duration. Seal all intake and exhaust vents, and seams in system components, with a double layer of 0.15 mm polyethylene sheeting.

3.6.3 If it becomes necessary to shut down electric power to the enclosed abatement work area, then the contractor shall provide temporary power and lighting and ensure safe installation of temporary power sources and equipment in accordance with NFPA 70 electric code requirements.

3.6.4 Arrange for the abatement work area to be locked during non-work hours. Install temporary doors with entrance type locksets that are key lockable from the outside and always unlocked and operable from the inside. Remove deadbolts and padlocks. Provide one key (to be held by SI security office on site) to the COTR.

3.7 Preparation of Abatement Work Area and Temporary Enclosures

3.7.1 No exhibit collection object shall be handled by the contractor without the approval of the COTR. Methods for surface decontamination and/or disposal of unsalvageable objects shall be determined with the input from the COTR, the object owner, the contractor and the SI IH.

3.7.2 Clean all contaminated furniture, equipment, and supplies with a HEPA-filtered vacuum cleaner or by wet wiping, as directed by the COTR, prior to being moved or covered.

3.7.3 Before removal, clean by HEPA-filtered cleaner and/or by wet wiping, all electrical and mechanical items, (such as lighting fixtures, clocks, diffusers, registers, etc.) and general construction items (such as cabinets casework, door and window trim, moldings, etc.) which cover the surface of the abatement work as required to prevent interference with the abatement work. Reinstall all such materials upon completion of the removal work with materials, finishes, and workmanship to match existing installations before start of work.

3.7.4 Remove all removable furniture, equipment, and supplies that have been deemed by the COTR to be uncontaminated, or completely cover with 2 layers of polyethylene sheeting, at least 0.15 mm in thickness, securely taped in place with duct tape. Such furniture, equipment, and supplies shall be considered outside the abatement work area unless covering plastic or seal is breached.

3.7.5 Clean all surfaces in abatement work area with a HEPA-filtered vacuum cleaner or by wet methods prior to installation of primary barrier.

3.7.6 All critical barriers, including ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, speakers, and other openings into the abatement work area shall be individually sealed with 0.15 mm plastic sheeting and tape. Elevator doors, fire extinguisher cabinets and all other penetration in the floor, walls, or ceiling shall be sealed in the abatement work area. If a temporary polyethylene/stud wall must be erected, that wall shall be treated as a critical barrier. The double layer polyethylene containment enclosure shall then be erected on that wall. Critical barriers shall be sealed prior to installation of primary barriers

3.7.7 Take care in sealing of lighting fixtures and control boxes to avoid melting or burning of sheeting. The inside of unsealed lighting fixtures, control boxes, and buss lines are to be cleaned by asbestos workers specially certified to work on high voltage lines.

3.7.8 Cover floor of abatement work area with 2 layers of clear polyethylene, at least 0.15 mm in thickness, turned up at the walls at least 600 mm. Both spray-glue and duct tape all seams in floor covering. Size to minimize seams. Locate seams in top layer 2.0 meters from, or at right angles to, seams in bottom layer. Install sheeting so that top layer can be removed independently of bottom layer. Do not locate seams at wall/floor interface.

3.7.9 If carpeting is to remain, cover carpeting with three layers of polyethylene sheeting at least 0.15 mm in thickness. Place one layer of corrugated cardboard sheets between the top and middle layers of polyethylene.

3.7.10 Cover plastic sheeting in areas where scaffolding is to be used with a single layer of 12.7 mm fire retardant plywood. Wrap edges and corners of each sheet with duct tape.

3.7.11 Cover all walls in abatement work area including critical barrier sheet plastic with primary barrier of 2 layers of 0.15 mm polyethylene sheeting, mechanically supported and sealed with duct tape or spray-glue in the same manner as critical barrier sheet plastic. Size to minimize seams. Seams shall be staggered and separated by at least 600 mm. Wall sheeting shall overlap floor sheeting by at least 406 mm beyond wall/floor joint. Tape all joints including the joining with the floor covering with duct tape or as otherwise indicated by the COTR.

3.7.12 Cover interior surfaces of any existing elevator with 2 layers of 0.15 mm plastic sheeting. Arrange entry to abatement work area so that elevator door is in a positively pressurized space outside the clean room of the decon unit.

3.7.13 When installing the critical and primary barriers, automatic sprinkler heads and fire detectors shall not be covered or altered to prevent or delay operation. Smoke detectors should be protected (but not completely masked) to avoid nuisance alarms during paint or demolition operations. The covers on the smoke detectors shall be removed directly after such operations and at the end of the abatement workday.

3.7.14 A secondary barrier of plastic as a drop cloth shall be used to protect the primary layer from debris and shall be rolled and disposed as contaminated waste at the end of each workday.

3.7.15 Provide emergency exiting from the enclosure as required by NFPA 101, Life Safety Code. Arrange exit door(s) so that it is secure from outside the abatement work area but permits exiting from the abatement work area. Mark outline of door on barriers

with luminescent paint at least 250 mm wide. Hang a razor knife on a string beside outline. Post a sign identifying "EMERGENCY EXIT", using letters at least 150 mm high, inside outline with luminescent paint. Arrows shall be taped on the polyethylene wall covering at eye level and at floor level to indicate location of exits. At entrance to decontamination chamber, post building floor plan and escape routes, plus locations of nearest exist and phone numbers of SI security. Emergency lighting shall be required, in accordance with the Life Safety Code.

3.7.16 A 4.5 kg ABC type portable fire extinguisher shall be located by each exit and clean room.

3.7.17 Install inspection windows in the containment barrier enclosure system walls. Each window shall have a minimum 600 mm x 600 mm viewing area fabricated from 6.0 mm acrylic or polycarbonate sheeting. Install window with top at 2.0 m above floor height in a manner that provides unobstructed vision from outside to inside of the abatement work area. A sufficient number of windows are to be installed to provide observation of all portions of the abatement work area that can be made visible from adjacent areas. Provide also for viewing to be blocked from the inside with opaque plastic flap.

3.7.18 Where the abatement work area is immediately adjacent to or within view of occupied areas, provide a visual barrier of opaque polyethylene sheeting at least 0.15 mm in thickness so that the abatement work procedures are not visible to building occupants. Where this visual barrier would block natural light, substitute frosted or woven rip-stop sheet plastic in locations approved by the COTR.

3.7.19 Provide GFCI protection for all electrical equipment.

3.7.20 Provide temporary lighting inside the decontamination enclosure facility.

3.8 Construction of Worker/Equipment Decontamination and Waste Load-Out Enclosures

3.8.1 Worker/equipment decontamination enclosures shall be provided at each location where workers shall enter or exit the abatement work area.

3.8.2 The Contractor shall construct a worker/equipment decontamination enclosure consisting of at least a clean room, a shower room, and an equipment room, each separated by 900 mm air locks. Narrower air locks may be built if approved by the COTR.

3.8.2.1 All rooms shall be constructed of or fully lined with 0.15 mm thick polyethylene sheeting and suitable framing to make them as air-tight as possible. Where joining separate sheets of polyethylene is necessary, the two sheets of polyethylene shall be over-lapped at least 150 mm and adhered with an unbroken line of tape in such a manner to prohibit air movement. Stagger joints. Tape shall then be used to further seal the joint on the other side of the containment barrier so that both loose edges of the overlap are completely sealed.

3.8.2.2 Doorways will consist of three 3 sheets of 0.15 mm polyethylene from ceiling to floor. The width of these polyethylene sheets shall be sufficient to prevent air movement through the doorways when closed.

These doorways shall be the only source of make-up air for the HEPA negative air filtration unit under normal circumstances, unless other sources are specifically approved by the COTR.

3.8.2.3 Provide GFCI protection for all electrical equipment.

3.8.2.4 Provide temporary lighting inside the decontamination enclosure facility.

3.8.3 The Clean Room shall have a curtained doorway leading to the outside of the abatement work area, and an airlock leading to the Shower Room. The clean room shall be of sufficient size to accommodate at least one worker, and a supply of clean disposable coveralls and storage facilities for street clothing, and uncontaminated equipment.

3.8.4 The Shower Room shall have two airlocks, one adjacent to the clean room and one adjacent to the equipment room. The Shower room shall provide hot and cold running water and soap and towels. It should have adequate space for a shower stall. Waste water from the shower shall be discharged through a water filtration unit efficient to 5 microns, then to a sanitary sewer. Shower room shall have opaque walls.

3.8.4.1 Shower Stall: Provide leak tight shower enclosure unit with integrated drain pan fabricated from fiberglass or other durable waterproof material. Equip with hose bibs for hot and cold water. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the abatement work area. Provide splash proof entrances. Provide back flow prevention device and vacuum breaker, where required. Connect drain to a reservoir, pump water from reservoir through filters to a drain. Mount filters inside shower stall in manner that allows for access for filters to be changed from inside the shower. Change filters daily or more often if necessary. Locate filters inside shower unit so that water lost during filter changes is caught by shower pan. Provide temporary extensions of existing (if available and authorized for Contractor use by COTR) hot and cold water and drainage, as necessary for a complete and operable shower.

3.8.4.2 Filtered Waste Water Drainage: Provide cascaded disposable HEPA filter units on drain lines from showers or any other fluid source carrying ACM. Connect so that discharged water passes primary filter and output of primary (particles 20 microns and smaller) filter passes through secondary (particles 5 microns and smaller) filter.

3.8.4.3 Sump Pump: Provide totally submersible waterproof sump pump with integral float switch. Provide unit sized to pump 2 times the flow capacity of all showers or hoses supplying water to the sump, through the filters specified herein when they are loaded to the extent that replacement is required. Provide unit capable of pumping debris, sand, plaster or other materials washed off during decontamination procedures without damage to mechanism of pump. Adjust float switch so that a minimum of 75 mm remains between top of liquid and top of sump pan.

3.8.5 The Equipment Room shall have two airlocks, one adjacent to the abatement work area and one adjacent to the shower room. The room shall be of sufficient size so as to accommodate at least one worker to change clothes, and temporarily house any equipment which the contractor wishes to store when not in use. The area shall have

facilities for decontaminating material and equipment, and a container lined with 0.15 mm polyethylene bag for collection of disposable coveralls and foot coverings.

3.8.6 Waste Load-Out Enclosure: Asbestos-contaminated waste that has been containerized shall be transported out of the abatement work area either through the personnel/equipment decontamination enclosure or through a separate waste load-out enclosure. If a separate enclosure is used, it shall be built with two airlocks, with curtained doorways: one to the abatement work area and one to an uncontaminated area outside the abatement work area.

3.9 Air Circulation Inside Containment Barrier

3.9.1 Formula for Quantity of Air-Filtration Units: The number of air filtration units needed to achieve the required air circulation rate shall be determined by the following formula:

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CALCULATE	Volume of abatement work area (CF)
MULTIPLY BY	Number of air changes per hour, four to ten.
MULTIPLY BY	1/60 (hr/minutes)
DIVIDE BY	Capacity of air filtration unit fully loaded with all filters (pressure differential activates warning light for loaded filters)
DIVIDE BY	80% expected efficiency
ADD	one additional unit as backup for machine failure or shutdown
EQUALS	minimum number of units required

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3.9.2 Supplemental Makeup Air Inlets: As necessary to achieve air flow throughout the abatement work area, locate auxiliary makeup air inlets as far away as possible from the air filtration units, preferably near the ceiling and away from barriers that separate the containment barriers and enclosures from surrounding areas. Cover inlet with plastic sheeting flaps to reseal automatically if the pressure differential system should shut down for any reason. Provide rigid framing around the opening. Spray the flap and around opening with spray adhesive so that if flap closes**,** the meeting surfaces are both covered with adhesive. Use adhesive that forms contact bond when dry. If used during clearance monitoring, tape or seal HEPA filters over inlets.

3.9.3 Penetrations through masonry and/or fire walls, required for improving air circulation, shall be protected with a fire damper.

3.9.4 Accomplish the pressure differential by exhausting a sufficient volume of HEPA filtered air from the abatement work area. Efforts to achieve pressure isolation shall first address:

3.9.4.1 Establishing required air circulation

3.9.4.2 Verifying seals are complete as practical

3.9.4.3 Establishing increased pressure in adjacent areas, if available

3.9.4.4 Exhausting sufficient volume of HEPA filtered air with additional air filtration units.

3.9.4.5 Decreasing the size of abatement work area to affect a smaller volume required for filtration

3.10 Placement of Air Filtration System Units

3.10.1 Equipment shall be located so as to optimize air movement throughout the abatement work area by positioning air filtration units as far away as practical from the access opening or other supplemental make-up air inlets.

3.10.2 The auxiliary air-filtration unit shall be located on site and available and ready to run at any time.

3.10.3 Air movement shall be established in such a way that air borne fibers will be carried away from workers' breathing zones.

3.10.4 Dead air pockets shall be minimized by proper ducting of make-up air if necessary, and by optimum location of the negative air filtration units.

3.10.5 The Contractor shall use smoke tubes to determine if dead air spots are present, and shall take corrective action as outlined above when they are found. Report such actions to the COTR immediately.

3.10.6 The air filtration units shall be placed so that access for changing the filters is inside the containment barrier. The unit is to run continuously during filter changing. A supply of filters shall be kept on site outside of containment area. If a unit must be turned off for servicing, an auxiliary unit must be in place and turned on.

3.10.7 Vent to the outside of the building, whenever practical, as determined by the COTR. Units may be vented inside the building only if outside venting is impractical. Units venting inside a building must be vented through an expansion chamber or diffuser system (self-contained water baffle) to reduce exhaust air velocity. A secondary HEPA unit may also be used after the expansion chamber/diffuser. Terminal exhaust ductwork must be placed as far away as possible from occupied areas. Special provisions for air monitoring shall be implemented by the SI air monitoring firm.

3.10.8 Mount units to exhaust directly or through disposable ductwork. Use ductwork and fittings of same diameter or larger than discharge connection on fan unit. Use spiral wire-reinforced flex duct in lengths not greater than 15 meters. If direction of discharge from fan unit is not aligned with duct use sheet metal elbow to change direction. Use six feet of spiral wire reinforced flex duct after direction change.

3.10.9 All HEPA units shall be tested in-place before removal begins. Test will be the responsibility of the contractor.

3.11 Pressure Differential Isolation

3.11.1 The abatement work area and the decontamination enclosure system shall be maintained at a negative pressure relative to adjacent areas. The relative pressure differential when measured across any physical or critical barrier must continuously equal or exceed a static pressure of 0.5 mm of water. Measurement shall be by manometer or magnahelic gage.

3.11.2 Minimum 4 air changes per hour. Continuous HEPA filtered exhaust unit is to be in operation until job is completed.

3.11.3 Make-up air shall be obtained only through the decontamination enclosure facilities, or as provided in Section 3.9.2 of these specifications.

3.11.4 Where asbestos-containing material covers an opening or joint, provide negative air pressure sufficient to draw air from the adjoining space into the containment barrier when the opening or joint is exposed after asbestos removal. Seal newly exposed openings and joints immediately to prevent contamination of adjoining spaces.

3.11.5 Supply sufficient pre-filters to allow frequent changes.

3.11.6 During and after the pre-abatement test, run the air filtration units continuously to maintain a constant pressure differential and air circulation until decontamination, cleaning, and encapsulation of the abatement work area is complete.

3.11.7 The HEPA-filtered units shall be left on continuously until after final clearance air measurement of 0.01 f/cc or the pre-removal background level, whichever is lower is achieved, and the COTR authorizes the shut-down of the units. Where feasible, the units shall be left on until the enclosure is completely removed.

3.11.8 HEPA units must be set up to cause an alarm-bell or buzzer to sound should the HEPA filter become clogged or the exhaust unit fails in operation after working hours. The alarm must be loud enough to alert a SI Security Officer of the equipment failure. The guard will phone a previously designated contractor employee whose 24-hour number shall have been recorded at the beginning of the project. The notified contractor will immediately dispatch a repair crew to the job site. A spare HEPA unit shall always be available to immediately restore negative air pressure.

3.11.9 If the pressure differential between inside and outside the containment barrier drops to 0.4 mm of water, the Contractor will immediately inspect the containment for sources of pressure leaks and report actions taken to the SI IH and COTR. The system warning alarm shall sound if pressure drops below 0.03 mm of water, and work shall stop.

3.12 Pre-Abatement Inspection, Testing, and Approval

3.12.1 Pre-Abatement Testing Requirements: Contractor must demonstrate with continuous data log that abatement work area can hold negative pressure of 0.5 mm of water for a minimum of 2 hours, prior to commencement of actual asbestos removal,

unless the system is exhausted through an isolated ventilation system. In this case, the test period shall be long enough to ensure that the lock-out ventilation controls are not over ridden and the HVAC system does not reactivate. As a minimum, the Contractor shall make all arrangements and demonstrate satisfactory equipment operation and set-up for compliance with these specifications.

3.12.1.1 Show proper condition of equipment seals including results of in-place HEPA-filter testing.

3.12.1.2 Show proper operation of safety and warning devices.

3.12.1.3 Show proper operation and calibration of instrumentation.

3.12.1.4 Show identification of equipment unit and fan capacity.

3.12.1.5 Use smoke tubes to demonstrate adequate air circulation, elimination of dead air pockets, and positive air motion through the decontamination enclosure system into the abatement work area.

3.12.1.6 Show the installation method for pre-filters and the HEPA primary filter in the air filtration unit. Show supply of filters available on site.

3.12.1.7 Demonstrate and record that a minimum 0.50 mm of water pressure differential has been achieved and can be maintained.

3.12.1.8 Demonstrate procedures for how workers will enter and exit the decontamination enclosure system.

3.12.1.9 Demonstrate procedures for handling emergencies and for the prevention of contamination of surrounding areas.

3.12.1.10 With COTR and Building Representative, identify disabled building ventilation systems and the positive means that will prevents accidental or premature restarting. Confirms means to have unit restarted at the conclusion of the abatement work. With COTR and Building Representative, verify that all equipment affected is secured at the main breaker.

3.12.1.11 Demonstrate how contaminated shower water is filtered and drained.

3.12.1.12 Use a pressure differential meter or manometer to demonstrate the required pressure differential at every barrier separating the abatement work area from the balance of the building, equipment, ductwork or outside.

3.12.1.13 Demonstrate that each air filtration unit is serviced by a dedicated minimum 115V-20A circuit with GFCI protection.

3.12.1.14 Demonstrate how asbestos will be removed and bagged for transport. Identify procedures for hauling through the building to the loading dock.

3.13 Maintenance of Containment Barrier and Enclosures

3.13.1 Ensure that the containment barrier, decontamination enclosure rooms, and other sealed doors, vents, etc., and plastic linings are effectively sealed and taped for the duration of the abatement work.

3.13.2 Repair damaged barriers and remedy defects immediately upon discovery. Visually inspect enclosure at the beginning of each work period.

3.13.3 Damaged or deteriorating materials shall not be used and shall be removed from the premises. Material that becomes exposed to and contaminated with asbestos shall be decontaminated or disposed of in accordance with the applicable regulations and special requirements.

3.13.4 Clean debris and residue from inside of the decontamination enclosure system on a daily basis. Damp wipe or hose down all surfaces after each shift change. Clean debris from shower pans on a daily basis.

3.13.5 Maintain floors in the clean room and airlocks as dry as possible to minimize slips and trips. Damp wipe all surfaces twice after each shift change with a disinfectant solution.

3.14 Removal of Asbestos-Containing Materials (ACM) - General

3.14.1 Prohibited Work Practices. The following methods shall not be used for work related to or disturbing asbestos, regardless of exposure level:

3.14.1.1 High-speed abrasive disc saws that are not equipped with point of cut ventilation or enclosures with HEPA-filtered exhaust air.

3.14.1.2 Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

3.14.1.3 Dry sweeping, shoveling or other dry cleanup of dust and debris containing ACM and PACM.

3.14.1.4 Employee rotation as a means of reducing employee exposure to asbestos.

3.14.2 Methods of Compliance. The following engineering controls and work practices shall be used, at a minimum, for all asbestos tasks:

3.14.2.1 HEPA-filtered vacuum cleaners.

3.14.2.2 Wet methods.

3.14.1.3 Prompt cleanup and disposal.

3.14.3 The following work shall be done only after the decontamination facilities have been constructed, the area has been isolated and can be maintained under negative air pressure as specified in the previous section, pre-abatement background sampling has been conducted, and arrangements have been made for disposing waste at an acceptable site.

3.14.4 Start abatement work at a location farthest from the fan units and proceed toward them. If an electric power failure occurs, immediately stop all abatement work and do not resume until power is restored and negative air filtration units are operating again. Immediately notify COTR of occurrence. Any torn or unsealed plastic sheeting shall be immediately repaired. Floor sheeting shall be replaced if damaged.

3.14.5 Wet Removal: Prior to stripping and/or tooling, the asbestos material shall be sprayed using an airless pump and wetting agents (amended water or removal encapsulant) to enhance penetration and reduce fiber dispersal into the air.

3.14.5.1 A fine spray of amended water shall be applied to reduce fiber release preceding the removal of the asbestos material. The material shall be sufficiently saturated to prevent emission of excessive airborne fibers.

3.14.5.2 Spray material repeatedly during the abatement work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's instructions. Perforate outer covering of any insulation which has been painted and/or jacketed in order to allow penetration of water, amended water or removal encapsulant. Where necessary, carefully strip away while simultaneously wetting the insulation to minimize dispersal of asbestos fibers into the air.

3.14.5.3 Remove materials in manageable quantities and control the descent to the staging or floor below. If over 6 meters, use drop chutes to contain material during descent.

3.14.6 Gross removal of dust and debris from contaminated material, material containers, and equipment shall be accomplished in the containment barrier before removal to the equipment decontamination room for wet sponging before leaving the abatement work site.

3.15 Requirements for Specific ACM and Methods - Fireproofing/Soundproofing on Scratch Coat or Wire Lath

3.15.1 Spray asbestos-containing fireproofing or architectural acoustic finish with a fine mist of amended water. Allow time for amended water to saturate materials to substrate.

3.15.2 Spray the asbestos-containing material repeatedly during the abatement work to maintain wet condition but do not use excessive amounts of water that results in ponding or entry into other areas of the building.

3.15.3 Do not over-saturate to cause excess dripping. Scrape materials from substrate. Remove residue remaining on scratch coat after scraping using stiff nylon bristled hand brush. Use high pressure washer only with written authorization from the COTR.

3.15.4 Remove the saturated asbestos-containing material in small sections. Do not allow material to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness.

3.15.5 Carefully lower removed and bagged asbestos-containing material to the floor without dropping or throwing, or transport to the floor via dust-tight chutes or containers, in accordance with the procedures set forth in 40 CFR 61.147.

3.15.6 Cut wire lath into 50 mm x 150 mm sections and cut hanger wires. Roll or fold up complete with asbestos-containing material and hand place in container. Do not drop on floor. After removal of lath and asbestos-containing material remove any overspray on decking and structure above using stiff nylon bristled brush. Use one of the following methods for containing waste.

(a) Wrap material in felt and place in fiberboard drum lined with two disposal bags. Use caution to insure that all edges of wire lath that could cut plastic are covered with felt.

(b) Place material directly in a steel drum. Use waste containers which are impervious to puncture, leakage, tearing, or ripping from wire lathe.

3.16 Requirements for Specific ACM and Methods - Vinyl Asbestos Tile (VAT) and Mastic

3.16.1 Full containment barriers, with pressure differential ventilation units, shall be used. Dispose as ACM.

3.16.2 Removal of asbestos-containing floor tile and mastic shall be performed in accordance with the procedure outlined below.

(a) Prepare abatement work area as previously specified for the abatement work.

(b) Spray areas of asbestos-containing material with amended water using spray equipment capable of providing a "mist" application to reduce the release of fibers. Wet the material sufficiently to maintain dust control. Spray the asbestos-containing material repeatedly during work process to maintain wet condition but do not use excessive amounts of water.

(c) Do not break the individual tiles to remove them. Gently pry up a corner of the tile with a broad blade putty knife and slip the knife between the tile and the substrate while cutting the mastic bond.

(d) If the mastic is especially tenacious, use a heat gun to loosen the bond between the tile and the substrate and to make the tile more pliable.

(e) Non-toxic organic solvents may be used to remove mastic.

(f) Continuously use a HEPA vacuum around the individual tiles that are being removed. Do not allow any dust or debris to accumulate on the floor or other surfaces of the abatement work area.

(g) Do not allow dislodged tiles to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness. Place sealed asbestos debris in second 0.15 mm plastic bag, appropriately labeled, and remove from abatement work area.

(h) After removal of asbestos-containing material, wet-clean all surfaces in the abatement work area to remove residual accumulated material. Continue wet-cleaning until surfaces are visibly free of material.

*****OR USE THE FOLLOWING STANDARD FOR FLOOR TILE*****

3.16.3 Removal of asbestos-containing floor tile and mastic, baseboard and mastic shall be performed in accordance with the procedure outlined below.

(a) All critical barriers, including ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, speakers, and other openings into the work area shall be individually sealed with 0.15 mm plastic sheeting and tape. Elevator doors, fire extinguisher cabinets and all other penetration in the floor, walls, or ceiling shall be sealed in the abatement work area.

(b) Prepare a worker and/or equipment decontamination and waste load-out enclosure as previously specified.

(c) Cover all walls in the abatement work area with two layers of 0.15 mm polyethylene sheeting and seal-with duct tape or spray-glue. The sheeting shall be applied to a height of 1.5 m above the floor. The seams shall be staggered and separated by at least 150 mm.

(d) Wet asbestos-containing materials with amended water to minimize fiber release during removal. Use amended water sparingly to eliminate standing water and to prevent water from traveling on the floor.

(e) Remove tiles individually and minimize breakage. Heat guns may be used to heat tile and soften the adhesive. Immediately place tiles in disposal bags.

(f) Non-toxic organic solvents may be used to remove mastic.

(g) Wet clean all surfaces to remove residual material. Continue cleaning until abatement work area is free of visible material.

(h) Proceed to clearance testing following approval from COTR that abatement work area is visually free of asbestos-containing materials.

3.17 Requirements for Specific ACM and Methods - Roofing

Use the wet removal method for ACM to eliminate visible emissions in accordance with NESHAP regulations. Controls shall be used to prevent re-entrainment into building HVAC system. Dispose as ACM.

(a) Spray large areas of asbestos-containing roofing material thoroughly with amended water using spray equipment recommended by surfactant manufacturer capable of providing a "mist" application to reduce the release of fibers. Spray the asbestos material repeatedly

during the abatement work process to maintain wet conditions, but do not use excessive amounts of water that result in ponding or entry into building.

(b) Remove the asbestos-containing material in small sections. Do not allow material to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness. Place sealed asbestos debris in second 0.15 mm plastic bag, appropriately labeled, and remove from abatement work area.

(c) Carefully lower removed and bagged asbestos-containing material to the ground without dropping or throwing, or transport to the ground via dust-tight chutes or containers, in accordance with the procedures set forth in EPA 40 CFR 61.147 Code of Federal Regulations.

(d) Clean area of all debris and notify COTR for visual inspection.

3.18 Requirements for Specific ACM and Methods – Exterior and Interior Window Caulk

(a) Exterior: Work will be done from the exterior of the building. If lifts are needed, lift platforms should be covered with canvass drop cloths.
(b) Interior: If lifts are needed, lift platforms should be covered with canvass drop cloths.

(c) Cover the ground or floor area below the abatement work area with 2 layers of 0.15 mm polyethylene sheeting.

(d) Wet the asbestos-containing materials with amended water to minimize fiber and dust release during removal. Use amended water sparingly to eliminate standing water and to prevent water from traveling on the ground sheeting.

(e) Remove the window caulk in small sections using manual methods, not power tools. Keep the material wet with amended water and do not allow the material to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness, and completely seal the bag. Place sealed debris bag into a second 0.15 mm plastic bag, and completely seal the bag.

(f) Carefully lower the sealed material debris bag to the polyethylene sheeting on the ground without dropping or throwing.

(g) After removal of the sealed material debris bags from the work area, HEPA vaccum and wet-clean all surfaces and equipment in the abatement work area to remove residual accumulated material. Continue cleaning until the surfaces are visibly free of material.

(h) Place dropcloths and other abatement related disposable materials into sealable plastic bags of 0.15 mm minimum thickness, and completely seal the bag. Place sealed debris bag into a second 0.15 mm plastic bag, and completely seal the bag. Remove from the work site and dispose as asbestos waste per these specifications.

(i) Notify COTR for visual inspection.

3.19 Requirements for Specific ACM and Methods - Gypsum Wallboard Joint Compound

(a) All critical barriers, including ventilation openings supply and exhaust), lighting fixtures, clocks, doorways, windows, speaker, and other openings into the abatement work area shall be individually sealed with 0.15 mm plastic sheeting and tape. Elevator doors, fire extinguisher cabinets and all other penetrations in the floor wall, or ceiling shall be sealed in the abatement work area.

(b) Prepare worker/equipment decontamination and waste load-out enclosure as previously specified.

(c) Isolate the abatement work area by constructing a temporary double layered 0.15 mm polyethylene/stud wall.

(d) Cover the floor of the abatement work area with 2 layers of 0.15 mm polyethylene sheeting turned up at walls at least 600 mm.

(e) Wet the asbestos-containing materials with amended water to minimize fiber and dust release during removal. Use amended water sparingly to eliminate standing water and to prevent water from traveling on the floor.

(f) Remove the gypsum wallboard and joint compound in small sections. Do not allow the material to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness. Place sealed debris in a second 0.15 mm plastic bag, and remove from the work area.

(g) Carefully lower the material to the floor without dropping or throwing.

(h) After removal of the material, HEPA vacuum and wet-clean all surfaces in the abatement work area to remove residual accumulated material. Continue cleaning until the surfaces are visibly free of material.

3.20 Requirements for Specific ACM and Methods - Duct Insulation Mastic

(a) All critical barriers, including ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, speaker, and other openings into the abatement work area shall be individually sealed with 0.15 mm plastic sheeting and tape. Elevator doors, fire extinguisher cabinets and all other penetrations in the floor wall, or ceiling shall be sealed in the abatement work area.

(b) Prepare worker/equipment decontamination and waste load-out enclosure as previously specified.

(c) Isolate the abatement work area by constructing a temporary double layered 0.15 mm polyethylene/stud wall.

(d) Cover the floor of the abatement work area with 2 layers of 0.15 mm polyethylene sheeting turned up at walls at least 600 mm.

(e) Wet the asbestos-containing materials with amended water to minimize fiber and dust release during removal. Use amended water sparingly to eliminate standing water and to prevent water from traveling on the floor.

(f) Removed the duct wrap and insulation and the duct mastic in small sections. Do not allow the material to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness. Place sealed debris in a second 0.15 mm plastic bag, and remove from the work area.

(g) Carefully lower the material to the floor without dropping or throwing.

(h) After removal of the material, HEPA vacuum and wet-clean all surfaces in the abatement work area to remove residual accumulated material. Continue cleaning until the surfaces are visibly free of material.

3.21 Requirements for Specific ACM and Methods - Contaminated Soils

Saturate dry soil with amended water or a removal encapsulant for a depth of 75 mm. Remove the top 25mm of soil. Start removal at the point of work farthest from the entrance to the soil floor area and proceed toward the entrance. Do not permit traffic into the fresh soil surface. After the entire first layer of soil is removed, completely change coveralls and at the entrance to the soil removal area don clean boot covers. Use amended water to keep the surface of the soil continuously wet throughout removal and decontamination. Remove the second 25 mm of soil in the same manner as the first. Remove the third 25 mm of soil in the same manner as the previous 50 mm.

3.22 Requirements for Specific ACM and Methods - Contaminated Carpeting

Deface carpeting with a light coat of contrasting spray paint before the abatement work. Coat lightly enough that wetting will not be retarded. Prior to cutting, thoroughly wet the asbestos-contaminated carpeting to be removed to reduce fiber dispersal into the air. Accomplish the wetting by using a fine spray (mist) of amended water or encapsulant. Saturate material completely without causing excess dripping. Allow time for water or encapsulant to penetrate material thoroughly. Roll up carpeting and dispose of as ACM.

3.23 Requirements for Specific ACM and Methods -Removal of Asbestos-Containing Transite Panels.

(a) Develop a daily removal plan indicating the square footage of panel material that will be removed during the abatement working day.

(b) Establish a regulated area by posting necessary barricades and warning signs to isolate the abatement work area.

(c) Prior to commencing work, establish a regulated area by covering the surface with plastic sheeting a minimum of 4.5 m from the panels being removed.

(d) At all times, keep the panels misted with water.

(e) Remove the panels individually and minimize breakage.

(f) Gently place the panels in bags or wrap the panels in two layers of 0.15 mm plastic sheeting.

(g) Collect and dispose of any debris that falls on the plastic sheeting as asbestos-containing material.

(h) Wet-clean all surfaces of the structure which secured the panels to remove residual ACM.

(i) Encapsulate the structure surfaces wet-cleaned in (h) above.

(j) Wet wipe the plastic sheeting prior to disestablishing the regulated area and dispose of the sheeting as contaminated waste.

3.24 Requirements for Specific ACM and Methods - Glove-Bag Removal Method

(a) Preparation: Before any work commences, a layer of polyethylene sheeting shall be placed on the floor, as a drop cloth, beneath the glove bag abatement work area. A temporary enclosure shall be constructed around the general removal area to separate it from occupied areas of the building and to serve as a physical barrier should accidental fiber release occur. Appropriate warning signs shall be posted outside this barrier in areas of high visibility. A HEPA filtered air filtration unit shall be on-site to be used to contain an emergency fiber release.

(b) Remove asbestos-containing material inside a glove bag according to manufacturer's guidelines. Thoroughly wet material to be removed with amended water or removal encapsulant and allow to soak through to substrate.

(c) Each glovebag shall be installed so that it completely covers the circumference of pipe or other structure where the work is to be done.

(d) Glovebags shall be smoke-tested for leaks and any leaks sealed prior to use.

(e) Glovebags may be used only once and may not be moved.

(f) Glovebags shall not be used on surfaces whose temperature exceeds 65^{o} C.

(g) Before beginning the operation, loose and friable material adjacent to the glovebag/box operation shall be wrapped and sealed in two layers of 0.15 mm plastic sheeting or otherwise rendered intact.

(h) Use two people for glove-bag operation. One shall remove insulation, the other shall operate water sprayer and repair any leaks in bag.

(i) Using a small HEPA vacuum, create a negative pressure inside the glove-bag before starting any asbestos removal and maintain throughout the use of the bag.

(j) Gently remove insulation from pipe and place it in bottom of bag.

(k) After removal of insulation, brush and wet-clean pipe to remove residual material. Continue wet cleaning until surfaces are free of visible material. Clean area of all debris and notify COTR for visual inspection.

(l) Spray all tools with water inside bag and place back in pouch.

(m) Where system uses attached waste bag, such bag shall be connected to collection bag using hose or other material which shall withstand pressure of ACM waste and water without losing its integrity.

(n) Sliding valve or other device shall separate waste bag from hose to ensure no exposure when waste bag is disconnected.

(o) Wet and seal visible ends of remaining pipe insulation.

(p) Spray the inside of the bag with amended water and remove the watering wand, taping the water sleeve closed.

(q) Tape the make-up air opening closed.

(r) Using the HEPA-vacuum, collapse bag and seal off lower portion containing asbestos-containing material and gloves of the bag.

(s) Remove bag from pipe and tools from pouch.

(t) Glove-bag shall be considered the first container for material. Dispose of properly.

(u) Encapsulate abated section of pipe and any adjacent pipe as required.

(v) Accidental Fiber Release During Glove Bag Removal: If the glove bag is accidentally cut open, duct tape from inside the bag shall be used to seal the opening. If the glove bag should rupture during abatement, the drop cloth sheeting beneath the bag shall be used to contain the bag by bringing the edges together, twisting, taping and folding over in gooseneck fashion and taping again. The area around and under this cloth shall be cleaned with a HEPA vacuum.

3.25 Requirements for Specific ACM Methods: Negative Pressure Glove Box Systems

Negative pressure glove box systems shall be used to remove ACM or PACM from pipe runs with the following specifications and work practices:

(a) Glove boxes shall be constructed with rigid sides and made from metal or other material which can withstand the weight of the ACM and PACM and water used during removal.

(b) A negative pressure generator shall be used to create negative pressure in system.

(c) An air filtration unit shall be attached to the box.

(d) The box shall be fitted with gloved apertures.

(e) An aperture at the base of the box shall serve as a bagging outlet for waste ACM and water.

(f) A back-up generator shall be present on site.

(g) Waste bags shall consist of 0.15 mm thick plastic, double-bagged before they are filled, or plastic thicker than 0.15.mm.

Work Practices:

(a) At least two persons shall perform the removal.

(b) The box shall be smoke tested prior to each use.

(c) Loose or damaged ACM adjacent to the box shall be wrapped and sealed in two layers of 0.15 mm plastic prior to the job, or otherwise made intact prior to the job.

(d) A HEPA filtration system shall be used to maintain pressure barrier in box.

3.26 Requirement for Specific ACM Methods: Water Spray Process System

A water spray process system may be used for removal of ACM and PACM from cold line piping if, employees carrying out such process have completed a 40-hour separate training course in its use, in addition to training required for employees performing Class I work. The system shall meet the following specifications and shall be performed by employees using the following work practices.

Specifications:

(a) Piping shall be surrounded on three sides by rigid framing.

(b) A 360 degree water spray, delivered through nozzles supplied by a high pressure separate waterline, shall be formed around the piping.

(c) The spray shall collide to form a fine aerosol which provides a liquid barrier between workers and the ACM and PACM.

Work Practices:

(a) The system shall be run for at least ten minutes before removal begins.

(b) All removal shall take place within the water barrier.

(c) The system shall be operated by at least three persons, one of whom shall not perform removal, but shall check equipment, and ensure proper operation of the system.

(d) After removal, the ACM and PACM shall be bagged while still inside the water barrier.

3.27 Requirement for Specific ACM Methods: Mini Enclosure

A small walk-in enclosure which accommodates no more than two persons may be used if the disturbance or removal can be completely contained by the enclosure with the following specification and work practices.

Specifications:

(a) The fabricated or job-made enclosure shall be constructed of 0.15 mm plastic or equivalent.

(b) The enclosure shall be placed under negative pressure by means of a HEPA filtered vacuum or similar ventilation unit.

Work Practices:

(a) Before use, the mini-enclosure shall be inspected for leaks and smoke tested to detect breaches, and breaches sealed.

(b) Before reuse, the interior shall be completely washed with amended water and HEPA-vacuumed.

(c) During use air movement shall be directed away from the employee's breathing zone within the mini-enclosure.

3.28 Requirements for Specific ACM and Methods - Dry-Removal of Electrical Equipment

Do not begin dry removal work until authorized in writing by the EPA NESHAP coordinator and the COTR. A State regulatory authority waiver may be required and if so shall be obtained by the contractor. Use where wetting may create a hazard for workers or damage equipment or finishes, such as electrical closets, transformer vaults, high pressure steam lines, etc. Work on active electrical equipment is to be performed by qualified trades person with prior experience in the installation or repair of the involved equipment. Restrict access to electrical equipment.

3.29 Post Removal: Cleaning and Clearance

3.29.1 Provide general clean-up of abatement work area concurrent with the removal of all asbestos-containing materials. Do not permit accumulation of debris on workspace floor.

3.29.2 Do not perform dry dusting or dry sweeping.

3.29.3 Maintain the minimum required pressure differential of 0.50 mm of water inside the abatement work area enclosure at all times, and until the COTR authorizes the Contractor to remove the enclosure.

3.29.4 During decontamination of automatic sprinkler and smoke detectors, the Smithsonian security office must be contacted for possible nuisance alarms. Care must be taken in the wiping down of the sprinkler heads and smoke detectors so as not to

damage them. Smoke detectors must be vacuumed clean as directed by the Fire Alarm Shop, Office of Physical Plant.

3.29.5 Initial Phase Cleanup Sequence

(a) Remove all visible accumulations of asbestos-containing material and debris.

(b) Wet clean and HEPA-vacuum all surfaces in the abatement work area.

(c) Clean all equipment (excluding that which will be needed for further cleaning phases) used in the abatement work area and remove from abatement work area via the Equipment Decontamination Enclosure.

(d) Remove the top layer (secondary barrier) of plastic sheeting, change all air filtration system pre-filters, and proceed with the second cleaning.

(e) Replace all HEPA-filters and pre-filters in air filtration air machines with clean filters. Clean all air filtration machines.

(f) Notify SI IH for observation of cleaning to determine completeness. Plastic sheeting surfaces will be considered clean when free from dust, dirt, residue, film, or discoloration resultant from abatement operations or other activities subordinate to these operations.

(g) Perform no activity in abatement work area for at least 12 hours in order to allow settlement of airborne fibers. No reduction in this settling period will be allowed.

3.29.6 Secondary Phase Cleanup Sequence

(a) Wet clean and HEPA-vacuum all surfaces in abatement work area at least one more time.

(b) Notify SI IH for observation to determine completeness of cleaning.

(c) SI IH will perform a visual observation of the abatement work area in general accordance with ASTM 1368, *Standard Practice for Visual Inspection of Asbestos Abatement Projects.*

(d) If visual clearance is not attained, then subsequent re-cleaning will be required. This sequence will continue until visual clearance is attained.

(e) When visual clearance has been obtained, the plastic barriers down to the critical barriers may be removed.

3.29.7 Final Air Clearance Testing.

(a) SI IH will test for the final air clearance levels, in accordance with 3.5.7 of this specification, when areas have passed the visual clearance phase. Final air testing shall be performed using aggressive air sampling techniques.

(b) Re-clean and continue to clean at Contractor's expense, areas which do not comply with the specified final clearance level.

3.29.8 Consider abatement work areas and all other decontaminated and cleaned areas clean when:

(a) All phases of clean up have been completed and level of cleanliness is approved by COTR.

(b) All asbestos final clearance testing results will be as specified in 3.5.7 of this specification.

3.29.9. After area passes final air clearance dismantle Decontamination Enclosure Systems and thoroughly HEPA-vacuum and wet clean immediate areas.

3.29.10 Dispose of debris from removal operation, used cleaning materials, unsalvageable materials used for sturdy barriers, and any other remaining materials. Consider the materials to be contaminated, and dispose of accordingly.

3.29.11 The "COTR's Certification of Visual Inspection and Final Air Sampling for Asbestos Abatement" form (see page 45) or equivalent shall be completed, signed by the Contractor, SI IH, COTR and included with the COTR project records. The COTR shall provide written results of all visual inspections and final clearance testing to the facility safety coordinator.

3.30 Post Clearance: Application of Lockdown Encapsulant To Base Material

3.30.1 Pre-Lockdown Encapsulant Mock-up Test: Prior to beginning lockdown encapsulant work, provide a sample area for approval by the COTR. Notify the COTR a minimum of 72 hours in advance to schedule the test. Lockdown encapsulant shall be applied using methods set forth in ASTM Proposed Specification P-189 "Specification for Encapsulants for Friable Asbestos Containing Building Materials". The test must be witnessed by the COTR or as otherwise designated by the COTR. The approved procedures and materials shall serve as a standard for the balance of the lockdown encapsulant work.

3.30.2 Apply encapsulant only when environmental conditions in the abatement work area are as required by the manufacturer's instructions and the COTR. Prior to applying any encapsulant, ensure that its application will not cause the base material to fail and allow the encapsulated material to fall of its own weight or separate from the substrate.

3.30.3 Apply encapsulant with an airless spray gun with air pressure and nozzle orifice or as otherwise recommended by the encapsulant manufacturer.

3.30.4 Encapsulant Application to Plaster Scratch Coat: Apply two coats of encapsulant to the scratch coat plaster after all ACM has been removed. Apply in strict accordance with the manufacturer's printed instructions. Any deviations from such printed instructions must be approved by the COTR in writing prior to commencing work.

3.30.4.1 Apply the first coat of encapsulant while the plaster scratch coat is still damp from the asbestos removal procedures. If the surface has been permitted to dry, vacuum surface with a HEPA vacuum prior to applying the encapsulant.

3.30.4.2 Apply second coat over first coat in strict conformance with manufacturer's instructions.

3.30.4.3 Color the encapsulant with contrasting colors in alternate coats so that visual confirmation of complete and uniform coverage of each coat is possible. Adhere to manufacturer's instructions for coloring. At the completion of work, the encapsulated surface must be a uniform third color produced by the mixture.

3.30.4.4 Sealing Exposed ACM edges: Prior to encapsulation, permit the exposed edges to dry completely to permit penetration of the encapsulant. Seal edges of ACM with two coats of encapsulant. Label the joint for the portions which are asbestos and non-asbestos.

3.31 Containment Barrier Removal

3.31.1 Following area final clearance and lockdown encapsulation, leave pressure differential units running as long as feasible during containment barrier removal.

3.31.2 Equipment, machinery, scaffolding, tools, etc., within the abatement work area shall not be removed without first being thoroughly cleaned with amended water or in the case of delicate items susceptible to rust, an acceptable substitute.

3.31.3 After the abatement work area is found to be in compliance, the remaining sealed areas and exits are unsealed and the plastic sheeting, tape, and any other trash and debris are disposed of in sealable plastic bags and treated as asbestos waste. The SI IH will conduct a final walkthrough and document results for the COTR.

3.31.4 Before removal from the abatement work area, remove and properly dispose of pre-filter, decontaminate exterior of machine and seal intake to the machine with 0.15 mm polyethylene to prevent environmental contamination from the filters.

3.31.5 The contractor shall patch and paint and repair all damaged areas and restore them to their original, pre-contract condition.

3.32 Waste Disposal

3.32.1 The COTR reserves the right to restrict when containerized ACM will be moved outside of the abatement work area and pass through the building. Times chosen to move containerized ACM in the building shall be during non-public hours and when limited staff is in attendance or under other appropriate conditions as determined by the COTR.

3.32.2 Asbestos-contaminated waste that has been containerized shall be transported out of the abatement work area either through the personnel/equipment decontamination enclosure or through a separate waste load-out enclosure. Waste load-out procedures shall be performed by two teams. The team inside the abatement work area shall clean the outside of properly labeled asbestos waste containers using HEPA vacuums and/or wet wiping, and place them into the waste load-out enclosure. No personnel from the inside team shall exit any further from the abatement work area. The team inside the waste load-out area (wearing protective clothing and respirators) shall retrieve the waste containers from the load-out enclosure, double-bag the waste and pass them to an uncontaminated area outside the enclosure. No unprotected personnel from the outside team shall enter this enclosure. As applicable, routes to the elevator, the elevator itself, and route to covered carts shall be lined with polyethylene sheeting.

3.32.3 For Amosite Fibers: If the material contains amosite fibers, evacuate air from disposal bags with a HEPA vacuum before sealing.

3.32.4 Water not disposed of with the asbestos-containing materials shall be filtered to remove asbestos fibers and debris before disposal into sanitary sewer.

3.32.5 Do not store containerized materials outside of the abatement work area. Take containers from the abatement work area directly to a sealed truck or dumpster.

3.32.6 Bulk and containerized asbestos waste shall be packed, labeled, and transported according to DOT Regulations 49 CFR 173.216 and 49 CFR 173.240. All removed ACM, plastic sheeting, tape, cleaning material, clothing, and all other disposable material or items used in the abatement work area shall be packed into double bagged sealable 0.15 mm plastic bags or double containerized with one bag and one drum. The bags shall be marked with the labels required by OSHA 29 CFR 1910.1001 and/or 1910.1200, and 1926.1101.

3.32.6.1 If the asbestos waste can reasonably be expected to damage double bagged 0.15 mm plastic bags, the following barrel decontamination procedures shall be followed.

(a) Line barrels with a 0.15 mm plastic liner to prevent leaking of contaminated material from the containers.

(b) As bags are moved out through the decontamination system, wet wipe bags to remove all contamination from them before they are moved into an uncontaminated space.

(c) Place bagged waste into appropriately labeled barrels for transport to landfill.

(d) After bagged contaminated waste is placed in barrels, seal lids on barrels.

3.32.6.2 Minimum labeling required:

First Label:

==========

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
==========

Second Label:

==========
PROVIDE IN ACCORDANCE WITH U.S. DEPARTMENT OF TRANSPORTATION REGULATION ON HAZARDOUS WASTE MARKING. 49 CFR PART 172, SUBPART D: "RQ ASBESTOS NA 2212". PROVIDE A "CLASS 9" LABEL, PER 49 CFR PART 172, SUBPART E.
==========

3.32.6.3 Notify COTR prior to removing each trailer or other waste transport from the jobsite.

3.32.6.4 Notify COTR not less than 48 hours prior to the proposed time of delivery of contaminated waste to the landfill. Owner may elect to observe this operation.

3.32.6.5 The Contractor shall transport the approved sealed drums to an approved waste disposal site.

3.32.6.6 Allow only sealed plastic bags or impermeable containers to be deposited in landfill. Leave damaged, broken, or leaking plastic bags in the impermeable container and deposit entire barrel in landfill.

3.32.6.7 Ensure that there are no visible emissions to the outside air from site where materials and waste are deposited.

3.32.7 Contractor shall submit a disposal certificate from the EPA approved landfill confirming final disposal in accordance with EPA standards and regulations before final payment. Retain receipts from landfill or processor for materials disposed off. At completion of hauling and disposal of each load, submit copy of waste manifest, chain of custody form, and landfill receipt to the COTR.

3.32.8 The COTR shall provide copies of all hazardous waste disposal manifests to the facility hazardous waste coordinator.

3.33 Job Close-Out

3.33.1 The Contractor shall submit to the COTR, Post Abatement Drawings to indicate location of the asbestos material removed. If required, the Contractor may edit the Project Drawing to show the actual or additional abatement work completed.

3.33.2 The Contractor shall remove from the site all other debris and rubbish resulting from removal and disposal operations and the temporary construction of containment barriers and enclosures.

3.33.3 The Contractor shall use positive means to demonstrate to the COTR that any building utilities that were temporarily disabled are now in full service. Notify the COTR when disabled building ventilation, systems, electrical power, smoke detectors, building access/egress passages may safely be re-started or used.

**** END OF SECTION 028200 ****

CERTIFICATION OF VISUAL INSPECTION AND FINAL AIR SAMPLING FOR ASBESTOS ABATEMENT

The COTR, Contractor, and SI Industrial Hygienist hereby certify that the abatement work areas have been visually inspected (all surfaces including pipes, beams, ledges, walls, ceiling and floor, plastic sheeting, etc.) and there is no dust, debris, or residue. The COTR also certifies that final air sample results meet abatement work area clearance specifications.

OEDC Project No_____ SI Contract No._____

Project Title/Location_____

_____

Date of Inspection_____

Date and results of final air sample

ASBESTOS ABATEMENT CONTRACTOR	Firm_____
	Print Name_____
	Print Title_____
	Signature_____
SI INDUSTRIAL HYGIENIST	Firm_____
	Print Name_____
	Print Title_____
	Signature_____
SI COTR	Firm_____
	Print Name_____
	Print Title_____
	Signature_____

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Interior non-load-bearing wall framing exceeding height limitations of standard, non-structural metal framing.

B. Related Requirements:

1. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
2. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of project.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated Design Submittal: For cold-formed steel framing.

1. Provide design and detailing for cold-formed steel framing and submit calculations and shop drawings under the seal and signature of an engineer licensed to practice in the District of Columbia. Design cold-formed steel framing members in accordance with the manual of the Light Gage Structural Institute, “Light Gage Structural Steel Framing System Design Handbook.: The submission shall also include:

a. Cross sections, plans, and elevations.1.3.C.1
b. Connection details to walls, floors, concrete floor and ceiling structure, showing required screws; Welds; paf’s.
c. Floor to floor elevations.
d. Dimensions.

e. Bridging locations.
f. Gauge, size, and frequency of members to meet required gravity and lateral loads.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, experienced in design of cold-formed metal framing and registered as a professional engineer in the District of Columbia, to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As required by code and indicated on the Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

    a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 239 Pa (5 lbf/sq. ft.).
    b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 239 Pa (5 lbf/sq. ft.).
    c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.

3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

    a. Upward and downward movement of 25 mm (1 inch.)

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and AISI S240, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Recycled Content of Steel Projects: Post Consumer recycled content plus one-half of preconsumer recycled content not less that 25 percent.

B. Framing Members, General: Comply with AISI S240 for conditions indicated.

C. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
2. Coating: Z180 (G60), ZF180 (A60), AZM150 (AZ50), or ZGF90 (GF30).

D. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: Z180 (G60).

2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 1.72 mm (0.0677 inch).
2. Flange Width: 41 mm (1-5/8 inches)
3. Section Properties: As required by the design.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 32 mm (1-1/4 inches).

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 1.37 mm (0.0538 inch).
2. Flange Width: 41 mm (1-5/8 inches).

2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 1.09 mm (0.0428 inch).
2. Flange Width: 41 mm (1-5/8 inches).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 32 mm (1-1/4 inches).

C. Vertical Deflection Clips, Interior: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 1.09 mm (0.0428 inch).
2. Flange Width: 25 mm (1 inch) plus twice the design gap for other applications.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Gusset plates.
7. Stud kickers and knee braces.
8. Joist hangers and end closures.
9. Hole-reinforcing plates.
10. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941M (ASTM F1941), Class Fe/Zn 5, unless otherwise indicated.

C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M MIL-P-21035B or SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: Closed-cell neoprene foam, 6 mm (1/4 inch) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.8 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1:960 (1/8 inch in 10 feet) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 3 mm (1/8 inch) from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 3 mm (1/8 inch).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1.6 mm (1/16 inch).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install sound attenuation batts and fire-safing insulation in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 3 mm (1/8 inch) between the end of wall-framing member and the web of track.

1. Fasten both flanges of studs to top and bottom tracks.
2. Space studs as indicated on shop drawings.

a.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on Drawings. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 150 mm (6 inches) deep.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 1220 mm (48 inches) apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within [305 mm (12 inches)] of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1:960 (1/8 inch in 10 feet) and as follows:

1. Space individual framing members no more than plus or minus 3 mm (1/8 inch) from plan location. Cumulative error is not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Testing: Smithsonian Institution will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and COTR.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pivot ladder for Mezzanine access.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufactured metal ladders.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Metal ladders.

C. Delegated Design Submittals: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Delegated design engineer qualifications.

1.5 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, registered in the District of Columbia, to design ladders.

B. Structural Performance of Aluminum Ladders: Ladders are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.

2.2 METALS

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

B. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

C. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

D. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

E. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.3 FASTENERS

A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

B. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

2.4 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.5 METAL LADDERS

A. General:

1. Comply with ANSI A14.3.

B. Aluminum Ladders:

1. Basis of Design Product: Model MP70 by ALACO Ladder company, or equal
2. Description: 70 degree pivotal ships ladder with mounting bracket-slide for flat storage against wall..
3. Space siderails 610mm (24″) apart unless otherwise indicated.
4. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
5. Steps: 102mm (4”) wide mounted at 303mm (12”) on center..
6. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.

7. Provide minimum 42-inch-high, hinged security and rails at top of ladder at mezzanine landing.

2.6 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

D. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

END OF SECTION 055000

PENETRATION FIRESTOPPING – SECTION 078413
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PENETRATION FIRESTOPPING – SECTION 078413

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provision of Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this section.

1.02 SUMMARY

A. Firestopping is defined as furnishing and installing tested and listed firestopping systems, combinations of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

1.03 ALLOWANCES – NOT USED

1.04 UNIT PRICES – NOT USED

1.05 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. FM: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NMAH: National Museum of American History

G. NFPA: National Fire Protection Association

H. NICET: National Institute for Certification in Engineering Technologies

I. OSHEM: Office of Safety Health and Environmental Management

J. Provide: To furnish and install the stated equipment or materials

K. UL: Underwriters Laboratories

1.06 SYSTEM DESCRIPTION

A. Firestopping shall be provided in the following locations:

1. Construction Joints: includes those used to accommodate expansion, contraction, wind, or seismic displacement. The firestopping material shall be a dynamic system and shall not detract from the intended movement of the joint.

2. Penetrations through floor slabs, fire-rated partitions, fire walls, and exterior walls where rated. Firestopping shall be provided for all new penetrations; penetrations left open by demolition/removal of duct, cable, conduit, and pipe; damaged firestopping, and existing abandoned penetrations in the contract area. Unless otherwise specified or shown on the drawings, the Contractor shall assume that all floor slabs are two-hour, fire-rated. Locations of fire walls or partitions shall be indicated on the drawings.

3. Penetrations of vertical shafts: assume a two-hour fire barrier unless noted otherwise.

4. Around openings and penetrations through fire-rated floor/ceiling and roof/ceiling assemblies.
5. Joint systems for floor-to-floor, wall-to-wall, floor-to-wall, and head of wall applications.

B. Other locations shown specifically on the drawings or where called for in other sections of the specifications.

1.07 PERFORMANCE REQUIREMENTS

A. Materials or combinations of materials used for firestopping shall be noncombustible and comply with the following as a minimum:
1. Flame Spread Index: 25 or less, as measured by ASTM E-84
a. Flame Spread Index (FSI) is a relative indication of the flammability of the material of interest with respect to a red oak standard. For example, an FSI of 25 indicates that a material has approximately 25% of the standard material's flame spread characteristics.
2. Smoke Developed Index: 100 or less, as measured by ASTM E-84
a. Smoke Developed Index (SDI) is a relative indication of the amount of smoke produced by a material when exposed to a certain heat source with respect to a red oak standard. The numbers carry the same meaning as the FSI values (25 indicates 25%).

B. Firestopping shall be asbestos free and shall be non-toxic to humans during installation and fire conditions

C. Examination Of Work By The Contractor
1. It shall be the responsibility of the prime contractor to provide firestopping for the entire project. The Contractor shall examine the area to receive firestopping prior to beginning work or to submitting the data required under 1.08, Submittals.
2. Data to be submitted shall be based on the findings of the Contractor's examination.

1.08 SUBMITTALS:

A. Submit the following for approval by the COTR and the OSHEM Fire Protection Engineer. Submit applicable data for each condition specified.
1. Certificates of conformance or compliance, accompanied by classification by a nationally recognized testing lab or by other supporting evidence satisfactory to the COTR and the OSHEM Fire Protection Engineer, that the material or combination of materials used meet the requirements specified for flame spread, smoke developed, and fire resistance.
2. Manufacturer's catalog data for all materials and prefabricated devices, including descriptions sufficient to identify them on the job, and instructions for installation. This data shall also include the Flame Spread Index and the Smoke Developed Index for the materials of interest.
3. Completed construction details (as-builts) showing material, reinforcement, anchorage, fastenings and method of installation. Catalog data with installation diagrams shall also be included. Clearly show which product will be used for each application. Firestopping materials of different manufacturers shall not be intermixed. Do not submit multiple products for the same application. Details for firestopping of penetrations and joint systems shall show compliance with the appropriate UL Design Number. Drawings shall accurately reflect job conditions pursuant to paragraph 1.07 C, Examination of the Work by Contractor.

4. Provide as-built drawings showing all penetration locations on floor plans. An identification key shall provide the rating and construction of the assembly penetrated, and the firestopping assembly used at each location.

1.09 QUALITY ASSURANCE

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

1. American Society for Testing and Materials (ASTM) Publications:

a) E84 Standard Test Method for Surface Burning Characteristics of Building Materials

b) E119 Standard Test Method For Fire Tests of Building Construction and Materials

c) E814 Test Method of Fire Tests of Through-Penetration Fire stops

d) E1966 Fire Resistive Joint Systems

e) E1399 Cyclic Movement And Measuring The Min & Max Joint Widths of Arch Joint Systems

2. Underwriters Laboratories (UL) Publications:

a) UL-1479 Fire Tests of Through-Penetration Fire Stops

b) UL-2079 Tests for Fire Resistance of Building Joint Systems

c) FRD Fire Resistance Directory

B. Installer's Qualifications. Provide data to show that the firm has at least two years of experience in the installation or application of systems similar in complexity to those required for this project. In addition, provide data to show that the firm is qualified by providing at least 5 comparable scale projects using the manufacturer's systems.

C. Pre-Installation Conference

1. Conduct a pre-installation conference with all sub-contractor representatives to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials indoors, under cover, above ground, away from moisture, and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.11 PROJECT CONDITIONS

A. All work is interior. Work areas are in exhibition spaces are subject to specific building use temperature and humidity conditions that must be maintained.

1.12 COORDINATION

A. Coordinate installation of all penetration firestopping systems with mechanical, electrical, fire protection, and other trades so that installation is complete and to minimize rework due to the addition of penetrants or other modifications.

1.13 WARRANTY

A. Provide a written warranty by the manufacturer against defects in manufacturing and materials and by the installer against defects in workmanship.

1.14 SERVICE AGREEMENT – NOT USED

1.15 EXTRA MATERIALS – NOT USED

PART 2 - PRODUCTS

2.01 GENERAL

A. All firestopping used throughout the project shall be the products of a single manufacturer.

2.02 MANUFACTURERS

A. Hilti

B. 3M

C. Specified Technologies, Inc.

D. Nelson

E. Any manufacturer approved by OSHEM and the COTR

2.03 FIRE RESISTANCE RATING

A. Firestop systems shall be UL Fire Resistance listed or FM P7825a approved with an “F” rating at least equal to the fire-rating of the fire wall or floor in which penetrated openings are to be protected. The “F” rating is permitted to be 3 hours in through-penetrations of 4 hour fire rated walls or floors. Firestop systems shall also have “T” rating where required by any applicable code.

1. F Rating: a rating usually expressed in hours indicating a specific length of time that a fire resistive barrier can withstand fire before being consumed or permits the passage of flame through an opening in an assembly.
2. T Rating: a rating usually expressed in hours indicating the length of time that the temperature on the non-fire side of a fire-rated assembly exceeds 325 degrees above its ambient temperature.

2.04 THROUGH-PENETRATIONS

A. Firestopping materials for through-penetrations shall provide “F” and “T” fire resistance ratings in accordance with ASTM E 814 or UL 1479.

2.05 CONSTRUCTION JOINTS AND GAPS

A. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested per ASTM E 119, ASTM E 1966 or UL 2079 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Prior to application, remove from surfaces all dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting or required fire resistance of the firestopping material for cast-in-place firestop devices. Formwork or metal deck to receive device prior to concrete placement and shall be sound and capable of supporting the device. Prepare surface as recommended by the manufacturer.

3.02 INSTALLATION:

A. Install in accordance with approved construction drawings (shop drawings), approved manufacturer's literature, installation instructions, UL Design Number or UL Report, and the following requirements:

B. Firestopping caulks must be installed in a neat and workmanlike manner. The finished installation shall have neat edge lines and a smoothed surface without excess masses of rough caulk on the surface of the wall.

C. Firestopping materials shall completely fill the void space regardless of geometric configuration, subject to tolerances established by the manufacturer when intumescent materials are used.

D. Apply firestopping materials at penetrations of insulated pipes and ducts, prior to application of the insulation. If insulation is already in place, remove it at the penetration prior to application of the firestopping materials, except where intumescent materials are used and removal is not necessary per manufacturer's instructions. Removed insulation shall be replaced with a material having equal thermal insulation characteristics and equal firestopping characteristics.

E. Firestopping for filling voids in floors, in which the smallest dimension is 101 mm (4 inches) or more, shall support the same load as the floor is designed or shall be protected by a permanent barrier to prevent loading or traffic on the fire stopped area.

F. Cable tray penetrations shall be protected by either UL-listed through penetration fire stop devices or through penetration fire stop systems that are re-enterable. Where penetrating cables in a cable tray are removed, replaced, or added, restoration shall be accomplished in an approved manner; the allowable number of penetrating items shall not be exceeded; only permitted penetrations shall be installed; and adequate clearances shall be maintained among penetrations, between penetrations, and the sides of the opening.

G. Damaged, disrupted, or removed firestopping shall be replaced with new.

H. Firestopping shall not be applied in conjunction with fire dampers, smoke dampers, or combination fire/smoke dampers unless specifically required by the damper manufacturer installation instructions.

3.03 INSPECTION

A. Approved installation instructions shall be present at each work area prior to the beginning of work and a test installation shall be produced for quality check by the COTR and OSHEM Fire Protection Engineer. The test installation shall be subject to inspection and/or test for conformance with contract requirements. Periodic quality checks shall be performed at the discretion of the COTR, and should installation prove to be substandard, all firestopping installed up to that time, not meeting approved standards, shall be replaced at no additional cost to the Government.

B. Area of work shall remain available for inspection by the COTR or his designated representative before and after application of firestopping.

C. Notification: Notify the COTR or his designated representative at least 24 hours prior to installation of firestopping in each area to allow opportunity for inspection.

D. The contractor shall submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers. Contractor records shall be maintained on site and provided to the COTR upon arrival for inspections.

3.04 ACCEPTANCE OF WORK

A. Acceptance of Work: As work is completed, remove materials, litter, and debris. All work shall be inspected and accepted by the Contracting Officer and OSHEM Fire Protection Engineer before materials and equipment are moved to the next scheduled work area. Insulation work and/or ceiling and wall close-in shall not occur before OSHEM acceptance has been obtained.

Labeling: Upon completion of unfinished areas only, affix label to or adjacent to each fire stopped penetration or joint assembly in fire-rated assemblies indicating material and proper replacement, if later disturbed. Suggested label is as follows:

ATTENTION

THIS IS A **FIRE-RATED ASSEMBLY**

BEFORE BREACHING

CONTACT BUILDING MANAGER AND PROJECT COTR

Hr Rating: _____ Installed by:

Install Date: _____ Company: _____

UL Design #: _____ Employee: _____

END OF SECTION 078143

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Mildew-resistant joint sealants.
3. Latex joint sealants.

B. Related Requirements:

1. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 13-mm- (1/2-inch-) wide joints formed between two 150-mm- (6-inch-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

E. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.

3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

D. Field-Adhesion-Test Reports: For each sealant application tested.

E. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 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.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content: Verify sealants and sealant primers comply with the following:

1. Architectural sealants have a VOC content of [**250**] g/L or less.
2. Sealants and sealant primers for nonporous substrates have a VOC content of [**250**] g/L or less.
3. Sealants and sealant primers for porous substrates have a VOC content of [**775**] g/L or less.

C. Colors of Exposed Joint Sealants: As selected by COTR from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. STPE, Mildew Resistant, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

2.4 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Terrazzo.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of 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 bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants 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 C1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. 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 one test for each 30 m (100 feet) of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

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.

B. 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.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
a. Perimeter joints between materials listed above and frames of louvers.

b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 100/50, NT. Nonstaining,
3. Joint-Sealant Color: As selected by COTR from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Vertical joints on exposed surfaces of walls and partitions.
b. Vertical joints between walls and stone facing.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by COTR from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex, paintable.
3. Joint-Sealant Color: As selected by COTR from manufacturer's full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Other joints as indicated on Drawings.

2. Joint Sealant: STPE, Mildew Resistant, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by COTR from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical joint sealants.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for elastomeric and latex joint sealants for nonacoustical applications.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Acoustical joint sealants.

1.3 WARRANTY

A. Installer's Special Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTICAL JOINT SEALANTS

A. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.

B. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.

C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

D. Use at all wall types having STC rating or sound attenuation batts.

2.2 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. Partition Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

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 acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect acoustical 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 acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079219

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Interior custom hollow-metal doors and frames.
3. Interior double egress frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly and fire-rated borrowed-lite assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Field quality control reports.

1.8 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 102-mm- (4-inch-) high wood blocking. Provide minimum 6-mm (1/4-inch) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.2 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B..

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 44.5 mm (1-3/4 inches).
c. Face: Uncoated steel sheet, minimum thickness of 1.0 mm (0.042 inch).
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Manufacturer's standard.
g. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 1.3 mm (0.053 inch).
b. Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 610 mm (24 inches) of frame height above 2.1 m (7 feet).
3. Postinstalled Expansion Anchor: Minimum 9.5-mm- (3/8-inch-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 51-mm (2-inch) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 12G (04Z) coating designation; mill phosphatized.

2.4 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

E. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

F. Glazing: Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q. Thickness: 6 mm (1/4”)

2.5 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.

    a. Provide double egress frames at double-acting egress doors.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 230 mm (9 inches) o.c. and not more than 51 mm (2 inches) o.c. from each corner.

D. Bottom Seals: Factory prepare hollow-metal doors to receive morticed bottom seal where scheduled, and provide bracing for surface mounted bottom seals where schedule.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

4. Solidly pack mineral-fiber insulation inside frames.
5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1.6 mm (1/16 inch), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1.6 mm (1/16 inch), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1.6 mm (1/16 inch), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1.6 mm (1/16 inch), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to COTR

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

2. Electrified door hardware.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
2. Section 283111 "Addressable Fire-Alarm Systems" for connections to building fire-alarm system.

1.3 COORDINATION

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

B. Security: Coordinate installation of door hardware, keying, and access control with Smithsonian’s security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Samples for Verification: For each type of exposed product, in each finish specified.

1. Sample Size: Full-size units or minimum 51-by-102-mm (2-by-4-inch) Samples for sheet and 102-mm (4-inch) long Samples for other products.

a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

2. Tag Samples with full product description to coordinate Samples with door hardware schedule.

D. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
e. Fastenings and other installation information.

f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
g. Mounting locations for door hardware.
h. List of related door devices specified in other Sections for each door and frame.

E. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Smithsonian Institution's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC).

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to COTR by registered mail or overnight package service.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
b. Exit Devices: Two years from date of Substantial Completion.
c. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

B. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

1. Door hardware is scheduled in Part 3.

C. Provide Scheduled Products according to the following requirements:

1. For Locksets, Lockset Trim, Cylinders, and Exit Devices, provide the scheduled product, in order to conform to the building standard.
2. For other door hardware items scheduled by reference to a specific manufacturer or product, those indications are a Basis of Design. Provide the indicated product or an approved equal product complying with all requirements specified in these Contract Documents.
3. For items scheduled by reference to a BHMA number, provide a product conforming to that standard, and with all other requirements in these Contract Documents.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 3 cu. m per minute/sq. m (0.3 cfm/sq. ft.) at the tested pressure differential of 75 Pa (0.3-inch wg) of water.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Means of Egress Doors: Latches do not require more than 67 N (15 lbf) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the ABA standards of the Federal agency having jurisdiction.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 22.2 N (5 lbf).
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 22.2 N (5 lbf) applied perpendicular to door.
    b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 13 mm (1/2 inch) high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum ½-inch latchbolt throw.
2. Mortise Locks: Minimum 19-mm (3/4-inch) latchbolt throw.

C. Lock Backset: 70 mm (2-3/4 inches) unless otherwise indicated.

D. Lock Trim: Provide all trim, fasteners and accessories necessary for a fully functioning installation.

1. Description: Match existing levers, escutcheons and roses in building.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.

G. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

2.5 ELECTRIC STRIKES

A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.

2.6 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 19-mm (3/4-inch) throw; designed for mortising into door edge.

2.7 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

2.8 DELAYED EGRESS EXIT DEVICES

A. Product: Subject to requirements, provide the following to adhere to existing building standard:

1. Von Duprin Chexit, delayed egress, vertical rod type (less bottom rod), fire exit devices. Fail Safe.

2.9 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.

1. Core Type: Interchangeable.

C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.10 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. Existing System:

a. Master key or grand master key locks to Owner's existing system.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: Information to be furnished by Owner.

2.11 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.12 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

2.13 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 75 Pa (0.3-inch wg), as follows:

1. Smoke-Rated Gasketing: 3 cu. m per minute/sq. m (0.3 cfm/sq. ft.) of door opening.
2. Gasketing on Single Doors: 3 cu. m per minute/sq. m (0.3 cfm/sq. ft.) of door opening.
3. Gasketing on Double Doors: 0.000774 cu. (0.50 cfm per ft.) m/s per m) of door opening.

2.14 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

2.15 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames.
2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.
2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.16 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 750 mm (30 inches) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. SI will furnish and install permanent cores.

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with COTR.

1. Configuration: Provide one power supply for each door opening with electrified door hardware.

F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

G. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

H. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

3.8 DEMONSTRATION

A. Maintenance Tools and Instruction: Furnish a complete set of specialized tools and maintenance instructions for Smithsonian Institution’s continued adjustment, maintenance, and removals and replacement of door hardware.

DOOR HARDWARE SCHEDULE

B. Hardware Set 1: 45-minute pair Doors 3 and 5, each pair to have the following:

Quantity	Item	Manuf. Or BHMA Designation	Finish
4 pr.	Bearing Hinges	BHMA A156.1	630
1	Electrified Mortise Lockset	Yale 8891 Operated by key or card reader from circulation side (fail secure). Always free egress from room side. Levers both sides.	630
1 set	Lever Trim w/ Escutcheon	Yale "Augusta – AU x CN"	630
1	Mortised Electric Power Transfer	For transfer of power into active leaf for electrified lockset.	630
1	Core	Yale, Large Format IC, six pin	630
1	Card Reader (Interior Side)	See Division 28 and security drawings.	
1 set	Manual flush bolts	Ives FB457, top & bottom, with 24" top rod	630
2	Closers (pull side)	BHMA C02011	
2	Overhead Stop - Concealed Slide Type	BHMA C06543	630
1	Power Supply/Door Control Interface Module	Of type recommended by manufacturer of electric lockset.	
2	Door contact	See Division 28 and security drawings.	
2 sets	Gasketing	Pemko 290AS Heavy Duty Perimeter Gasketing.	mill
2	Bottom seal	Pemko 411_PKL 48"	mill
1	Meeting Stile Gasket		
1 set	Silencers		Black

C. Hardware Set 2: 90-minute pair Doors 4, each pair to have the following:

Quantity	Item	Manuf. Or BHMA Designation	Finish
4 pr.	Bearing Hinges	BHMA A156.1	630
1	Mortise Lockset Classroom Function	Yale 8808FL, levers both sides. Always free egress from inside.	630
1	cylinder	Yale, Large Format IC, six pin	630
1 set	Lever Trim w/ Escutcheon	Yale "Augusta AU x CN"	
1 set	Manual flush bolts	Ives FB457, top & bottom, with 24" top rod	630
2	Closers (push side)	BHMA C02021	
2	Overhead Stop – Concealed Slide Type	BHMA C06543	630
2	Door Contacts	See Division 28 and security drawings.	
2	Kick Plate	BHMA J102	630
1 set	Silencers		Black

D. **Hardware Set 3: Smoke-rated single Doors 6 and 7, each door to have the following**:

Quantity	Item	Manuf. Or BHMA Designation	Finish
4	Bearing Hinges	BHMA A156.1	630
1	Mortise Lockset (Storeroom Function)	Yale 8805FL	630
1	cylinder	Yale, Large Format IC, six pin.	630
1 set	Lever Trim w/ Escutcheon	Yale “Augusta AU x CN”	
1	Closer (push side)	BHMA C02021	630
1	Overhead Stop - Concealed Slide Type	BHMA C06543	630
1 set	Silencers		Black

E. Hardware Set 4: Door 02, 45-minute double egress doors, each pair to have the following:

Quantity	Item	Manuf. Or BHMA Designation	Finish
4 pr.	Bearing Hinges	BHMA A156.1	630
1	Delayed Egress Fire Exit Device	Von Duprin Chexit, delayed egress, concealed vertical rod, fire exit device, exit only. Fail Safe. (Locate to provide delayed egress from Corridor into Conservation Space.) CX 9847-EO-F-630-3’-LBR	630
1	Fire Exit Device	VonDuprin concealed vertical rod fire exit device, exit only. (Locate to provide free egress from Conservation Space into Corridor.) 9847-EO-F-630-3’-LBR	
2	Top Strikes	As recommended by exit device manufacturer.	630
1	Concealed Mortised electric power transfer	Von Duprin EPT-2 or EPT-10 as recommended by manufacturer of delayed egress device	SP28
1	Closer (push side, parallel arm)	BHMA C02021 (mount both closers on Conservation Space side.)	689
1	Closer (pull side)	BHMA C02011 (mount both closers on Conservation Space side.)	
2	Overhead Stop	BHMA C01511 overhead concealed slide type	630
1	Power Supply/Door Control Interface Module	Von Duprin PS902, 24Volt, or model recommended by manufacturer for use with selected delayed egress system.	674, Paint
2	Door contact	See Division 28 and security drawings.	
2 sets	Gasketing	Pemko 290AS Heavy Duty Perimeter Gasketing.	mill
1	Meeting Stile Gasket		
2	Bottom seal	Pemko 411_PKL 48”	mill
1 set	Silencers		Black
1 set	Signage	Comply with NFPA 101 for Delayed Egress	

F. **Hardware Set 5: Door 01; Existing 2-hour rated double egress doors**.

Quantity	Item	Manuf. Or BHMA Designation	Finish
4 pr.	Bearing Hinges	Existing to Remain	612
1	Delayed Egress Fire Exit Device	Von Duprin Chexit, delayed egress, exposed vertical rod, fire exit device, exit only. Fail Safe. (Locate to provide delayed egress from American Presidency into Conservation Space.) CX 9847-EO-F-630-3'-LBR	630
1	Fire Exit Device	VonDuprin exposed vertical rod fire exit device, exit only. (Locate to provide free egress from Conservation Space to American Presidency.) 9847-EO-F-630-3'-LBR	
2	Exit only plate trim	VonDuprin 996EO (provide to replace existing passage lever trim on door.)	
2	Top Strikes	Exit device manufacturer's recommended strike (Existing may remain if compatible with new exit devices.)	630
1	Exposed power transfer	Armored cable from junction box on jamb to delayed egress exit device.	629
2	Closers	Existing to Remain	689
1	Power Supply/Door Control Interface Module	Von Duprin PS902, 24Volt, or model recommended by manufacturer for use with selected delayed egress system.	674, Paint
2	Door contacts	Existing to remain	
2	Kick plate	Existing to remain	630
2 sets	Gasketing	Pemko 290AS Heavy Duty Perimeter Gasketing.	mill
1	Meeting Stile Gasket		
2	Bottom seal (surface mount)	Pemko 4131_PKL 48"	mill
1 set	Silencers		Black
1	Signage	Comply with NFPA 101 for Delayed Egress	

END OF SECTION 087100

SECTION 088117 - FIRE-RATED GLASS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-rated glazing and frame materials installed in interior fire-rated wall at viewing windows

B. Related Sections include the following:

1. Section 07 92 00 – "Joint Sealants" for installation of joint sealants installed with steel fire-rated glazed curtain-wall systems and for sealants to the extent not specified in this Section.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. Fire safety related:

a. ASTM E 119: Fire Tests of Building Construction and Materials.

2. Material related:

a. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2007.
b. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2006b.

3. Sound related:

a. ASTM E 90-04: Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
b. ASTM E 413-04: Standard Classification for Rating Sound Insulation

B. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

C. Glass Association of North America (GANA):

1. GANA – Glazing Manual.
2. FGMA – Sealant Manual.

D. National Fire Protection Association (NFPA):

1. NFPA 80: Fire Doors and Windows.
2. NFPA 251: Standard of Methods of Fire Tests of Building Construction & Materials
3. NFPA 257: Standard for Fire Test of Window Assemblies

E. Underwriters Laboratories, Inc. (UL):

1. UL 10 C: Positive Pressure Fire Tests of Window & Door Assemblies
2. UL 263: Fire tests of Building Construction and Materials

1.4 DEFINITIONS

A. Manufacturer: A firm that produces primary glass, fabricated glass or framing as defined in referenced glazing publications.

1.5 SUBMITTALS

A. Product data:

1. Technical Information: Submit latest edition of manufacturer's product data providing product descriptions, technical data, Underwriters Laboratories, Inc. listings and installation instructions.

B. Shop Drawings:

1. Include plans, elevations and details of product showing component dimensions; framed opening requirements, dimensions, tolerances, and attachment to structure

C. Samples: For following products:

1. Glass sample-as provided by manufacturer
2. Sample of frame and trim
3. Verification of sample of selected finish

D. Glazing Schedule: Use same designations indicated on drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

E. Warranties: Submit manufacturer's warranty.

F. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements.

1. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a

quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to
   1. International Accreditation Service for a Type A Third-Party Inspection Body (Field Services ICC-ES Third-Party Inspections Standard Operating Procedures, 00-BL-S0400 and S0401)
   2. International Accreditation Service for Testing Body-Building Materials and Systems
      a. Fire Testing
         1) ASTM Standards E 119
         2) CPSC Standards 16 CFR 1201
         3) NFPA Standards 251, 252, 257
         4) UL Standards 9, 10B, 10C, 1784, UL Subject 63
         5) CAN Standards S 101, S 104, S 106

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

C. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

D. Fire-Rated Wall Assemblies: Assemblies complying with ASTM E119 that are classified and labeled by UL, for fire ratings indicated, based on testing in accordance with UL 263, ASTM E119.

E. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by Underwriters Laboratories® maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer's listing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle under provisions specified by manufacturer.

1.8 PROJECT CONDITIONS

A. Obtain field measurements prior to fabrication of frame units. If field measurements will not be available in a timely manner coordinate planned measurements with the work of other sections.

   1. Note whether field or planned dimensions were used in the creation of the shop drawings.

B. Coordinate the work of this section with others effected including but not limited to: other interior components beyond that provided by this section.

1.9 WARRANTY

A. Provide manufacturer's standard five-year manufacturer warranty.

PART 2 - PRODUCTS

2.1 FIRE-RATED GLAZING AND FRAME MATERIALS

A. Basis of Design Product: TGP Fireframes Clearview Series.

1. Manufacturer Glazing Material: "Pilkington Pyrostop®" fire-rated glazing as manufactured by the Pilkington Group and distributed by Technical Glass Products, web site http://www.fireglass.com
2. Frame System: "Fireframes® Heat Barrier Series fire-rated steel frame system; as manufactured and supplied by Technical Glass Products web site http://www.fireglass.com
3. Subject to complete conformance with the requirements, a system from another manufacturer may be used.

B. All glazing materials, frame system, and accessories must be obtained from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire Rating Requirements

1. Duration-- Walls: Capable of providing a fire rating for 60 minutes

B. Design Requirements

1. Dimensions – Framing:
   a. See [Heat Barrier] details.
2. Dimensions – Vertical Butt Joint:
   a. 5 mm (3/16")
3. Dimensions – Glazing:
   a. Low-iron, monolithic, multi-laminate glass with no internal glass spacers.

2.3 MATERIALS-GLASS

A. Fire Rated Glazing: Composed of multiple sheets of Pilkington Optiwhite™ low iron, high-visible-light transmission glass laminated with an intumescent interlayer.

B. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).

C. Properties for Glazing

1. Fire-rating: 60 minutes
2. Manufacturer's Designation: 60-201

3. Nominal Thickness: 1-1/16” (27 mm)
4. Weight: 12.5 lb/ft2 (61.0 kg/m2)
5. Daylight Transmission (approx.): 86%
6. Sound Transmission Coefficient: 44
7. U-Value: .83
8. Max. Exposed Area: 7,442 in2 (4.80 m2)
9. Max. Width of Exposed Glazing 63” (1.6 m) OR Max Height of Exposed Glazing 118-1/8” (3.0 m)
10. Minimum Width 31-9/16” (.80 m)

D. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacture, testing laboratory (UL), fire rating period, safety glazing standards, and date of manufacture.

E. Glazing Accessories: Manufacturer’s standard compression gaskets, spacers, setting blocks, intumescent strip, silicone sealant and other accessories necessary for a complete installation.

2.4 MATERIALS –FRAMES

A. Framing System-see Fireframes Heat Barrier system.

1. Provide frame section with offset glazing to be flush one side.

2.5 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

A. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air and vapor seal.

B. Butt Glazing Silicone Sealant: For the butt glazing assembly, silicone sealant shall be applied to seal the butt joint. The sealant shall be provided by the glass manufacturer.

1. Provide “Pick-proof” tamper resistant sealant to minimize damage from the public side.

C. Butt Glazing Intumescent Strip: For the butt glazing assembly, 9/16” in. (15 mm) wide by 3/16 in. (4 mm) thick tape, shall be installed along the vertical edges of the sections of glass at the butt joint.

1. GLUSKE — Kerafix 2000 Glazing Tape; or as acceptable to manufacturer.

D. Setting Blocks: Hardwood or calcium silicate; glass width by 4 inches by 3/16 inch thick.

E. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.

F. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.6 FABRICATION

A. Framing System-see Fireframes Heat Barrier and specifications.

2.7 FINISHES, GENERAL

A. Framing System: Provide manufacturer's standard powder coating system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Glass:

1. Examine glass framing, with glazier present, for compliance with the following:

a. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
b. Minimum required face or edge clearances.
c. Observable edge damage or face imperfections.

2. Do not proceed with glazing until unsatisfactory conditions have been corrected.
3. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

B. Frames:

1. Examine substrates and members to which the work of this section attaches or adjoins prior to frame installation.
2. Provide openings plumb, square and within allowable tolerances.
3. Notify COTR of any conditions which jeopardize the integrity of the proposed system.
4. Do not proceed until such conditions are corrected.

3.2 INSTALLATION

A. Glass:

1. Follow manufacturer's written instructions and approved shop drawings for butt-glazed system.

B. Frames:

1. Follow manufacturer's written instructions and approved shop drawings.

a. Install framing for flush glazing on Landmark / Corridor side and sill on Conservation Space side.

3.3 REPAIR AND TOUCH UP

A. Limited to minor repair of small scratches. Use only manufacturer's recommended products.

1. Such repairs shall match original finish for quality or material and view.

B. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged.

3.4 PROTECTION AND CLEANING

A. Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

1. Do not clean with astringent cleaners. Use a clean “grit free” cloth and a small amount of mild soap and water or mild detergent.
2. Do not use any of the following:

a. Steam jets
b. Abrasives
c. Strong acidic or alkaline detergents, or surface-reactive agents
d. Detergents not recommended in writing by the manufacturer
e. Do not use any detergent above 77 degrees F
f. Organic solvents including but not limited to those containing ester, ketones, alcohols, aromatic compounds, glycol ether, or halogenated hydrocarbons.
g. Metal or hard parts of cleaning equipment must not touch the glass surface

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 088117

SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Gypsum board shaft wall assembly to provide one-sided installation between Collections Storage Rm 3204A and existing to remain storage mezzanine.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.

B. Do not install finish panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Regional Materials: Manufacture products within 160 km (100 miles) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 160 km (100 miles) of Project site.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: 2 hours.

B. Gypsum Shaftliner Board:

1. Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, 25.4 mm (1 inch) thick, with double beveled long edges.

C. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.

1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, Z120 (G40) unless otherwise indicated.

D. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:

1. Depth: 102 mm (4 inches).
2. Minimum Base-Metal Thickness: 0.75 mm (0.030 inch).
3. Verify properties with those required for height shown on Drawings.

E. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 51 mm (2 inches) long and matching studs in depth.

1. Minimum Base-Metal Thickness: Matching steel studs.

F. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

G. Finish Panels: Gypsum board as specified in Section 092900 "Gypsum Board.".

2.3 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners are allowed only at ceiling, and must be of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Attach bottom track to existing to remain wood flooring with staggered double sided tape. Do not puncture or damage the floor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.

B. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

C. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.

D. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.

E. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

F. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by COTR while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 3 mm (1/8 inch) from the plane formed by faces of adjacent framing.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116.23

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.

B. Related Sections:

1. Section 054000" Cold-Formed Metal Framing for interior framing that exceeds height and deflection limits of non-load-bearing steel framing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 480 Pa (10 lbf/sq. ft.).

2.2 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
2. Protective Coating: ASTM A653/A653M, Z120 (G40), hot-dip galvanized unless otherwise indicated.

C. Studs and Tracks: ASTM C645.

1. Steel Studs and Tracks:
   a. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
   b. Depth: 92 mm (3-5/8 inches), unless indicated otherwise on Drawings.

D. Slip-Type Head Joints: provide the following:

1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: 0.836 mm (0.0329 inch).

G. Hat-Shaped, Rigid Furring Channels: ASTM C645.

1. Minimum Base-Steel Thickness: 0.836 mm (0.0329 inch).
2. Depth: 22.2 mm (7/8 inch).

H. Resilient Furring Channels: 13-mm- (1/2-inch-) deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 3.2 mm (1/8 inch) thick, in width to suit steel stud size.
3. Double sided tape: Tape with adhesive each side for stabilizing floor track to existing to remain floor without puncturing or damaging floor.

a. All new walls in this project are considered temporary.
b. Existing to remain flooring is mainly terrazzo or wood.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install floor track using double sided tape in staggered sections.

D. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

E. Install bracing at terminations in assemblies.

F. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: As required by horizontal deflection performance requirements 406 mm (16 inches) o.c. 610 mm (24 inches) o.c. unless otherwise indicated.
2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 610 mm (24 inches) o.c.

    a. Attachment to finished stone, terrazzo, or wood wall or floor surfaces must be by non-penetrating double sided tape only.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 3 mm (1/8 inch) from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARDs

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Sound-attenuation blankets
3. Acoustical sealant
4. Aluminum trim.

B. Related Requirements:

1. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Abuse-resistant gypsum board.
4. Gypsum board, Type C.
5. Sound-attenuation blankets.
6. Acoustical sealant.
7. Aluminum Trim

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Data: For adhesives and sealants, indicating VOC content.

C. Samples for Verification: For the follow product:

1. Trim Accessories: Full-size Sample in 300mm- (12”-) long length for each trim accessory indicated.

2.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups of at least 9 sq. m (100 sq. ft.) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

B. Regional Materials: Manufacture products within 100 miles (160 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site.

C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 12.7 mm (1/2 inch).
2. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 15.9 mm (5/8 inch).
2. Long Edges: Tapered.

C. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Core: 12.7 mm (1/2 inch), regular type or 15.9 mm (5/8 inch), Type X.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
5. Long Edges: Tapered.
6. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
7. Provide on public side of wall between Landmark and Conservation Spaces.

2.4 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.

1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
2. Long Edges: Tapered.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. L-Bead: L-shaped; exposed long flange receives joint compound.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Basis of Design manufacturer: Provide shapes by Fry Reglet or equal.
2. Aluminum: Extruded aluminum alloy and temper with not less than the strength and durability properties of ASTM B221M (ASTM B221), Alloy 6063-T5.
3. Finish: Class II anodic, clear.
4. Shapes:

    a. “L” trim molding with offset leg of 32mm (1 ¼”); Fry Reglet DRML-1250.
    b. Protruding Edge Profile: Similar to “L” with 15mm (1”) offset leg/raised profile; Fry Reglet DRMPET-100.
    c. “W” wall molding with 19 mm (3/4”) by 19mm (3/4”) reveal; Fry Reglet WRM-75-75-625. Provide at junction of metal ceiling and new wall at corridor.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

1. Verify sealant has a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1.5 mm (1/16 inch) of open space between panels. Do not force into place.

C. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

D. Form control and expansion joints with space between edges of adjoining gypsum panels.

E. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Fit gypsum panels around ducts, pipes, and conduits.

2. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 6.4- to 9.5-mm- (1/4- to 3/8-inch-) wide joints to install sealant.

F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 6.4- to 12.7-mm- (1/4- to 1/2-inch-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical surfaces unless otherwise indicated.
2. Type X: Where required for fire-resistance-rated assembly Vertical surfaces unless otherwise indicated Insert requirements.
3. Impact-Resistant Type: Public side of walls.
4. Type C: Where required for specific fire-resistance-rated assembly indicated.

B. Single-Layer Application:

1. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by COTR for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. L-Bead: Use at exposed edge terminations.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 4: Mechanical Room, Collections Storage, and unoccupied spaces.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3. Level 5: Conservation Space and Landmark / Corridor side of all walls.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vinyl base.
2. Vinyl molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Laboratory Test Reports: For resilient base and accessories, indicating compliance with requirements for low-emitting materials.

C. Samples: For each exposed product and for each color and texture specified, not less than 300 mm (12 inches) long.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 10 deg C (50 deg F) or more than 32 deg C (90 deg F).

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 21 deg C (70 deg F) or more than 35 deg C (95 deg F), in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.

3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 13 deg C (55 deg F) or more than 35 deg C (95 deg F).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL BASE

A. Product Standard: ASTM F1861, Type TV (vinyl, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style and Location:

a. Style B, Cove: Provide in areas with resilient floor coverings and public side of new walls.

B. Minimum Thickness: 3.2 mm (0.125 inch).

C. Height: 102 mm (4 inches).

D. Lengths: Coils in manufacturer's standard length.

E. Outside Corners: Job formed or preformed.

F. Inside Corners: Job formed or preformed.

G. Colors and Patterns: As chosen by COTR from manufacturer's standard colors.

2.2 VINYL MOLDING ACCESSORY

A. Description: Vinyl reducer strip for resilient floor covering.

B. Profile and Dimensions: curved roller strip at edge of tile to reduce to 0 mm; length equals 41 mm (1 5/8”) .

C. Locations: Provide vinyl reducer strip at linoleum tile edges to existing flooring.

D. Colors and Patterns: As chosen by COTR from manufacturer's standard colors.

E. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Verify adhesives have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 76 mm (3 inches) in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 76 mm (3 inches) in length.

a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096543 - LINOLEUM FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Linoleum floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For each type of linoleum flooring.

1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

D. Samples: For each exposed product and for each color and pattern specified in manufacturer's standard size, but not less than [152-by-230-mm (6-by-9-inch)] sections.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of linoleum flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish sufficient additional material to cover floor area under boat that cannot be installed until the boat is moved to its new position, plus one box for attic stock. Relocation of boat and installation of tile will be done by Others.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for flooring installation and seaming methods indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by flooring manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Minimum 9.3 sq. m (100 sq. ft.) for each type, color, and pattern in locations directed by COTR.

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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 18 deg C (65 deg F) or more than 32 deg C (90 deg F).

1. Floor Tile: Store on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 21 deg C (70 deg F) or more than 35 deg C (95 deg F), in spaces to receive flooring during the following periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 13 deg C (55 deg F) or more than 35 deg C (95 deg F).

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 72 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For linoleum flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LINOLEUM FLOOR TILE

A. Basis-of-Design Product: Subject to compliance with requirements, provide Forbo Marmoleum Modular tile or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. Forbo Industries, Inc.

B. Linoleum Floor Tile: ASTM F 2195, Type I, linoleum floor tile with fibrous backing.

1. Nominal Floor Tile Size: 500 by 500 mm (20 by 20 inches).

C. Thickness: 2.5 mm (0.10 inch).

D. Colors and Patterns: As chosen by COTR from by manufacturer's full selection.

2.3 UNDERLAYMENT PANELS

A. APA Underlayment Grade plywood; 6mm thickness; one fully sanded face, recommended for use as underlayment for fully adhered resilient flooring; free of any foreign material that may prohibit secure bond.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by linoleum flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.

1. Verify adhesives have a VOC content of 50 g/L or less.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by linoleum flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.

B. Underlayment:

1. Install underlayment over existing to remain flooring that are either terrazzo or random oak flooring.
2. Staple underlayment to oak flooring following manufacturer’s recommendations.
3. Adhere underlayment to terrazzo flooring, using minimal amount of adhesive dabs at edges and center of sheets.

C. Do not install flooring until materials are the same temperature as space where they are to be installed.

1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing flooring.

B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, thresholds, door frames, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

E. Install flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

F. Adhere flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 LINOLEUM FLOOR TILE INSTALLATION

A. Lay out linoleum floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay floor tiles square with room axis.

B. Match linoleum floor tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

1. Lay floor tiles with grain direction alternating in adjacent floor tiles (basket-weave pattern).

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.

B. Perform the following operations immediately after completing linoleum flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from linoleum flooring surfaces before applying liquid floor polish.

1. Apply two coat(s).

E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 096543

SECTION 099124 - INTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Steel and iron.
2. Galvanized metal.
3. Aluminum (not anodized or otherwise coated).
4. Plastic.
5. Gypsum board.
6. Plaster.
7. Cotton or canvas insulation covering.
8. ASJ insulation covering.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

2. Indicate VOC content.

B. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.
2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 200 mm (8 inches) square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

E. Product List: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. COTR will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 9 sq. m (100 sq. ft.).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 7 deg C (45 deg F).

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 10 and 35 deg C (50 and 95 deg F).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 3 deg C (5 deg F) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Behr Paint Company; Behr Process Corporation.
2. Benjamin Moore & Co.
3. PPG Paints.
4. Pratt & Lambert; a subsidiary of The Sherwin-Williams Company.
5. Sherwin-Williams Company.

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.

4. Primers, Sealers, and Undercoaters: 100 g/L.

D. Low-Emitting Materials: For field applications that are inside the weatherproofing system, verify 90 percent of paints and coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Colors: As selected by COTR from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.
2. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" and “MPI Maintenance Repainting Manual” applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

F. Aluminum Substrates: Remove loose surface oxidation.

G. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. 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.

D. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.

g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Items specified in other technical sections.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may 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 AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Hollow Metal Steel Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 5.1S:

    a. Prime Coat: Primer, rust inhibitive, water based MPI #107.

    b. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.

B. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 5.3N:

    a. Prime Coat: Primer, galvanized, water based, MPI #134.

    b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

C. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 5.4G:

    a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.

    b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

D. Gypsum Board and Plaster Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 9.2M:

    a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.

    b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

    c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

E. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings.

1. Institutional Low-Odor/VOC Latex System, MPI INT 10.1D:

    a. Prime Coat: Primer sealer, latex, interior, MPI #50.

    b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.

END OF SECTION 099124

SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes room-identification signs that are directly attached to the building. Signs must match existing signs in building.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

A. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half scale.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample.
2. Exposed Accessories: Full-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in Project.

D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction and Smithsonian Directive 214, Accessibility for People with Disabilities Policy, and Smithsonian Guidelines for Accessible Exhibition Design (SGAED).

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Laminated-Sheet Sign: Brushed aluminum face sheet with raised graphics laminated to backing sheet to produce composite sheet.

a. Room sign size: 152 mm (6”) x 152 mm (6”).
b. Sheet Thickness: 0.125 inch (3.18 mm).

c. Surface-Applied Graphics: Applied raised copy, machine-cut characters from matte-finished opaque acrylic sheet and chemically weld onto aluminum sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1) Finish: Painted
2) Raised Copy Thickness: 1 mm (1/32”)
3) Braille type: embedded “pin ball”.

d. Color(s): Match sample of building standard supplied by COTR.

2. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition: Square cut.
b. Corner Condition in Elevation: Square.

3. Mounting: Manufacturer's standard method for substrates indicated with two-face tape.
4. Text and Typeface: Accessible raised characters and Braille typeface matching COTR's sample variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Acrylic sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

D. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

B. Adhesive: As recommended by sign manufacturer.

1. Verify adhesives have a VOC content of 70 g/L or less.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls according to the accessibility standard.

1. Mounting height: 1524 mm (5’-0”) to centerline of sign.
2. Mounting position: 50 mm (2”) from edge of sign to edge of door frame.

C. Mounting Methods:

1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by COTR.

3.3 SIGN SCHEDULE

A. Conservation Space, to read:

CONSERVATION SPACE 3204 *[BRAILLE]*

1. Provide next to Door 3, Corridor side

B. Air handler Room, to read:

MECHANICAL ROOM 3204ME *[BRAILLE]*

1. Provide next to Door 5, Corridor side

END OF SECTION 101423.16

ECTION 104400 - FIRE EXTINGUISHERS AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provision of Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers

1.03 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. FM: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NFPA: National Fire Protection Association

G. NICET: National Institute for Certification in Engineering Technologies

H. OSHEM: Office of Safety Health and Environmental Management

I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

1.04 SYSTEM DESCRIPTION

A. Portable fire extinguishers for occupant use.

1.05 PERFORMANCE REQUIREMENTS

A. In accordance with NFPA 10.

B. Extinguishers installed throughout most occupancies shall have a minimum rating of 2A:10B:C

C. Provide clean agent, water mist, or CO2 portable fire extinguishers and one water extinguisher for class A fires in all IT specs. Dry chemical extinguishers shall not be permitted.

D. Exhibit display areas and ordinary collection storage spaces shall be provided with water mist type portable extinguishers. Dry chemical extinguishers shall not be permitted in these spaces.

1. Provide water mist-type portable extinguishers at the Conservation Space Room 3204.

E. Wet collection storage areas shall be provided with CO_2 portable fire extinguishers.

F. Provide fire extinguishers throughout the project site in accordance with NFPA 10.

1.06 SUBMITTALS

A. A. Submit manufacturers brochure and product data for each type of fire extinguisher, complete with manufacturers' warranty and inspection tag.

B. Submit data to illustrate cabinets and installation/mounting methods.

1.07 QUALITY ASSURANCE

A. American Disability Act (ADA)

1. ADA Accessibility Guidelines (ADAAG)

B. American Society for Testing and Materials (ASTM)

1. A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

2. ASTM A167-Stainless and heat resisting chromium-nickel steel plate, sheet and strip

3. ASTM A336-Cold rolled carbon steel sheets, commercial quality

4. C1036 Standard Specification for Flat Glass

5. E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops

C. National Fire Protection Association (NFPA)

1. NFPA 10 Portable Fire Extinguishers

D. Fire Extinguishers: Listed and labeled by Underwriter's Laboratory (UL) or Factory Mutual (FM) for type, rating, and classification

1. UL 8 Standard for water based agent fire extinguishers

2. UL 154 Standard for carbon dioxide fire extinguishers

3. UL 299 Standard for dry chemical fire extinguishers

4. UL 626 Standard for water fire extinguishers

5. UL 2129 Standard for halocarbon clean agent fire extinguishers

1.08 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver fire extinguishers to site until rooms in which they are to be installed are ready to receive them.

1.09 COORDINATION

A. Coordinate installation with finished wall surfaces.

1.10 WARRANTY

A. Provide a warranty by the manufacturer against defects in manufacturing and materials.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Ansul Inc.
2. J L Industries
3. Larsen's Manufacturing Co.
4. Encon Safety Products

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A1008/A1008M, commercial quality, stretcher leveled, temper rolled.

2.03 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated. See section 1.07 for requirements for specific spaces.

1. Product: A 10-lb, multi-purpose, UL listed, dry chemical fire extinguisher with rating based on spacing and hazard.

2. Product: A 1.75 gal (6.6L) or 2.5 gal (9.5L) UL listed, water mist fire extinguisher with a minimum rating of 2A:C.

B. Mounting Brackets: Manufacturer's standard steel bracket, designed to secure extinguisher, of sizes required for types and capacities of fire extinguisher indicated, with plated or baked-enamel finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged units.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF FIRE EXTINGUISHERS

A. Comply with manufacturer's written instructions for installing fire extinguishers and mounting brackets.

B. Mounting Height: Install extinguishers at heights indicated below.

1. Install fire extinguishers mounted on hangers or brackets attached to a wall so that the top of the fire extinguisher is not more than 3½ ft. above the floor.
2. In no case shall the clearance between the bottom of the fire extinguisher and the floor be less than 4 inches.

C. Locations: Install extinguishers at locations indicated below.

1. Install fire extinguishers at locations specified on the drawings or as directed by the COTR.
2. Fire extinguishers shall be conspicuously located, along normal paths of travel, including exits from areas. Extinguishers shall not be obstructed or obscured from view.

D. Install portable fire extinguishers on the hanger or in the bracket supplied. Verify that the extinguisher operating instructions face outward.

3.03 SIGNAGE

A. Identify bracket-mounted extinguishers with the words “FIRE EXTINGUISHER” in red letter decals applied to wall surface.

B. Where space layout limits ability to see fire extinguisher location, provide a wall sign that is nominally perpendicular to the wall. Sign shall have a fire extinguisher symbol on it.

END OF SECTION 104400

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manual roller shades with single rollers and accessories for black-out functions.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

2. Section 054000 “Cold-Formed Metal Framing” for support backing at shade and accessory attachments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified, 250 mm (10 inches) long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 250 mm (10 inches) square. Mark interior face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 400 mm (16 inches) wide by 900 mm (36 inches) long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 250 mm (10 inches) long.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer trained and certified by the manufacturer having at least ten years' experience installing products comparable to those specified in this section.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 WARRANTY

A. Roller Shade Hardware and Shadecloth: Manufacturer’s standard non-depreciating twenty-five-year limited warranty

B. Roller Shade Installation: One year from date of substantial completion, not including scaffolding, lifts and other means of access

PART 2 - PRODUCTS

A. MANUFACTURERS

B. Basis-of-Design Product: Subject to compliance with requirements, Mecho®/5

C. Subject to compliance with the specifications, products from the following manufacturers may be considered:

1. HunterDouglas Architectural
2. Levolor Contract
3. Lutron

D. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED, SINGLE-ROLLER SHADES

A. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

B. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

C. Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Exposed with endcaps and integral light seal at bottom where it meets the sill.
b. Color and Finish: As selected by COTR from manufacturer's full range.

D. Installation Accessories:

1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

    a. Height: Manufacturer's standard in height required to enclose roller and shadeband assembly when shade is fully open, but not less than 102 mm (4 inches).

2. Endcap Covers: To cover exposed endcaps.

3. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
4. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
5. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: Acrylic Coated Polyester; Mecho “Chelsea Blackout” series.
3. Roll Width: As required for design widths.
4. Orientation on Shadeband: Up the bolt or Railroaded, as required for stability of designwidths.
5. Features: Washable.
6. Color: As selected by COTR from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 23 deg C (74 deg F):
1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 51 mm (2 inches) to interior face of glass.

B. Roller Shade Locations: Interior windows, as indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by COTR, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Smithsonian Institution's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 210101 - FIRE SUPPRESSION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. General provisions and requirements for all fire-suppression work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 21.

B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for, including all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the COTR.

E. Fire-suppression work of this project includes, as a brief general description, the following:

1. Modification and extension of existing wet pipe sprinkler system

F. See Division 01 for requirements related to COTR's occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 21 specifications.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in the article "Substitutions," below for substitutions.

C. Products specified by reference standards or by description only: Any product meeting those standards or description.

D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance.

1. Where other acceptable manufacturers are named, Contractor may provide products of those named manufacturers only, which meet the specifications.
2. Where specification permits "equal" products, without naming other acceptable manufacturers, Contractor may use products of any manufacturer, which meet the specifications.

E. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 21 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to COTR.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse COTR for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project and of representative manufacture. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install.

E. All materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the COTR.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the COTR will determine sizes to be utilized.

H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the COTR of said uncertainty, doubt, or conflict and obtain a decision as to the intent before starting any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the COTR and await a written decision.

B. Plan and coordinate all work to proceed in an orderly and continuous manner without undue delay, and in conformance with project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate work so that work of each trade is completed before other construction begins which would obstruct it.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of all piping, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the COTR prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractor's assistants shall include a competent mechanical foreman, who shall be on the premises at all times to check, layout, coordinate and superintend the installation of work. The foreman shall establish all grades and lines relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SPECIALIST

A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.10 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor that may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The plumbing, mechanical, electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Code. (NFPA).
4. International Energy Conservation, Fire, Fuel Gas, Mechanical, and Plumbing Codes (ICC).

1.11 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless otherwise specified in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply. Products shall be certified by manufacturers to meet the requirements of referenced standards.

1. American National Standards Institute (ANSI)
2. ASME International (ASME)
3. American Society for Testing and Materials (ASTM)
4. American Society of Sanitary Engineering (ASSE)
5. American Water Works Association (AWWA)
6. International Code Council (ICC)
7. Manufacturer's Standardization Society of the Valve and Fittings Industry Inc. (MSS)
8. National Electrical Code, NFPA 70 (NEC)
9. National Electrical Manufacturer's Association (NEMA)
10. National Fire Protection Association (NFPA)
11. National Sanitary Foundation (NSF)
12. The Occupational Safety and Health Act (OSHA)
13. Piping and Drainage Institute (PDI)
14. Underwriters Laboratory Inc. (UL)
15. Maryland Occupational Safety and Health Act (MOSHA)

1.12 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

B. Area shall be maintained and shall be returned to original condition at the completion of the project.

1.13 PROTECTION

A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.
4. Construct dust partitions, where indicated on the drawings or as required.
5. Protect areas occupied by COTR's personnel or equipment.
6. Seal off all return air registers and other mechanical systems to prevent dust from entering.

B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.

2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

C. Repair all damage or soiling to the complete satisfaction of the COTR; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract Sum.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, provide in protective wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cool at manufacturer's recommended temperatures.

E. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.14 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.15 SECURITY REQUIREMENTS

A. Refer to Division 01 for security requirements.

1.16 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the COTR and COTR in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.17 WARRANTY

A. All work and equipment provided as work of this division shall be fully warranted under the general project warranty. In addition, provide added special warranties specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the COTR. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the COTR and revise schedule based on any COTR comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is one year after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Service reports for warranty work shall be provided to the COTR.

C. When use of the permanent equipment has been permitted for temporary heating or ventilation of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the COTR.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of pipes and appurtenances. Close superfluous openings and remove all debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the COTR.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or COTR finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, COTR and COTR shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

END OF SECTION 210101

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements applicable to more than one section of Division 21.

B. Basic material and equipment required for the fire-suppression piping work.

C. Identification of fire-suppression systems and equipment.

D. Cleaning and painting.

E. Operating instructions.

F. Piping tests.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 210101.

B. Operation and Maintenance Manuals: Division 01 and Section 210101.

C. Painting: Division 09.

1.3 REFERENCES

A. American National Standards Institute

1. ANSI 13.1: Standard for Identification of Pipes

B. ASME

1. ASME B31.9: Building Services Piping

C. ASTM International

1. ASTM A 234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
2. ASTM E 548: Standard Guide for General Criteria Used for Evaluating Laboratory Competence

D. American Welding Society

1. AWS D1.1: Structural Welding - Steel
2. AWS D10.9: Specification for Qualification of Welding Procedures and Welders for Piping and Tubing
3. AWS QC1: Specification for AWS Certification of Welding Inspectors

E. National Fire Protection Association

1. NFPA 70: National Electric Code

1.4 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

C. DN: Dimension Nominale, nominal pipe size in millimeters, in accordance with the metric system for construction, Systeme Internationale (SI).

D. NPS: Nominal pipe size in inches, in accordance with standard U.S. designations for manufactured pipe. Pipe sizes do not change when projects are designed and built in metric units; each size has a consistent name (nominal dimension) in each system.

1.5 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed based on using the particular manufacturer's products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that render their use impractical, or cause functional fit, access, or connection problems.

1.6 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the plumbing, mechanical, electrical, building, fire, health and safety, and other applicable codes and regulations of the state, county or city in which the work is performed.

B. Welding procedures and operator qualifications for structural welding: AWS D1.1, Structural Welding Code Steel, electric arc process.

C. Welding, brazing, and soldering procedures and operator qualifications for fire suppression piping:

1. AWS D10.9, Qualification of Welding Procedures and Welders for Piping and Tubing.
2. ASME B31.9, Building Services Piping.

D. Qualifications of independent testing laboratory personnel:

1. Welding inspectors: AWS QC1, Certification of Welding Inspectors.

PART 2 - PRODUCTS

2.1 GENERAL

A. General piping techniques, testing, identification, painting, and operating instructions specified in this section apply to products specified in other sections of Division 21.

2.2 PIPING MATERIALS

A. Weldolets and thredolets: Fittings designed for installing branches on piping, with either welded or threaded connection to branch; conforming to ASTM A 234.

B. Pipe jointing compound:

1. Polytetrafluoroethylene (PTFE) pipe thread tape, "Teflon."
2. Pipe cement and oil.

2.3 IDENTIFICATION DEVICES AND MATERIALS

A. Stenciling materials:

1. Stencils: Manufactured standard stencils prepared for required applications, conforming to ANSI A13.1 for color and size of legend letters, including arrows showing direction of flow.
2. Paint: Exterior type enamel, colors conforming to ANSI A13.1, or black.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify COTR if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. The contract drawings are diagrammatic and do not indicate all fittings or offsets in pipe, all access panels, or all specialties required. Provide required fittings, offsets, access panels, and specialties to coordinate the work.

C. No pipe shall be run below the head of a window or door.

D. Equipment and pipes installed in areas without a suspended ceiling shall be as tight to structure as possible, but at least above a height of 6'-8", unless otherwise noted.

E. Items which require access for operation or maintenance shall be easily accessible. Do not cut or form hand holes for operation or maintenance of appliances through walls or ceilings.

3.2 PIPE INSTALLATION

A. Install pipe exposed to view parallel to building lines and as close to walls, columns, and ceilings as may be practical, maintaining proper clearances for access at all parts requiring servicing.

B. Install pipe a sufficient distance from other work to permit a clearance of not less than 0.5 inch (15 mm) between its finished covering and adjacent work.

C. Remove burrs resulting from cutting pipe or from any other operation.

D. Interface with other products:

1. Where pipe is provided through walls, provide finished, permanent, waterproof installation complete with inserts, sleeves, supports or hangers, seals, and other appurtenances as required. Do not pierce, cut, or notch any footing or other structural member.
2. Waterproofing and dampproofing of the building shall be unharmed by the installation of the work. Where pipe has to pierce waterproofing or dampproofing, including outside walls, the penetration shall be made watertight. Waterproofing damaged or destroyed shall be repaired or replaced with new waterproofing.

E. Thoroughly clean pipe and fittings before they are installed, and keep them clean until the acceptance of the completed work. Cap or plug the ends of the lines so as to prevent earth and other debris from entering during construction.

F. Threaded connections:

1. Cut threads full and clean.
2. Apply specified pipe jointing compound or tape on male threads only.

G. Do not weld galvanized piping.

H. Use welding fittings, tees, wyes, reducers, eccentric reducers, and caps as required. Branches at least two nominal pipe sizes less than the main may be made with "Weldolets" or "Thredolets" installed with full size opening in larger pipe and in accordance with manufacturer's printed instructions. Flanges shall be welded neck or slip-on pattern of class to suit the valves or equipment connections. Flanges shall have machine bolts with hex nuts and washers.

3.3 IDENTIFICATION

A. General: Do not apply identification until insulation and finish painting work is complete.

B. Piping:

1. Mark by stenciling.

2. Mark to identify service with arrows showing direction of flow. Apply markings near building walls where pipes enter or leave an accessible space and in intermediate locations so that markings are no more than 30 feet (9 m) apart. They shall be readily visible to a person standing on the floor.
3. Fully identify all piping installed as work of the project.
4. Mark pipe with letters of height and colors required by OSHA and conforming to ANSI A13.1.

3.4 CLEANING AND PAINTING

A. Cleaning: Clean piping and equipment. Where items are to be painted, clean and prepare surfaces for painting.

B. Painting: Coordinate painting with requirements of Division 09 and Section 211313, Wet Pipe Sprinkler Systems.

END OF SECTION 210500

SECTION 211313 - WET PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. The following sections apply to the work of this section:

1. 078413 Penetration Firestopping
2. 283111 Fire Detection and Alarm Systems
3. 210101 Fire Protection General Provisions
4. 210500 Common Works Results for Fire Protection

1.2 SUMMARY

A. Scope: Provide a complete, code compliant wet pipe sprinkler system, and associated equipment, ready for operation.

B. The work includes designing and modifying an automatic wet-pipe fire extinguishing sprinkler system for Ordinary Hazard II and uniform distribution of water by hydraulic design to afford complete fire protection coverage throughout the contract area.

C. Existing Sprinkler Equipment: Existing sprinkler equipment shall be maintained fully operational until the new equipment has been tested and accepted by the COTR and OSHEM fire protection engineer.

D. Authority Having Jurisdiction: Any reference in the specifications or applicable codes to the "authority having jurisdiction" shall be interpreted to mean the OSHEM Fire Protection Engineer.

1.3 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. FM: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NFPA: National Fire Protection Association

G. NICET: National Institute for Certification in Engineering Technologies

H. OSHEM: Office of Safety Health and Environmental Management

I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

1.4 SYSTEM DESCRIPTION:

A. The design shall conform to NFPA 13 and the requirements specified herein. Design of the automatic wet pipe sprinkler system shall be for Ordinary Hazard II occupancy by hydraulic calculation. The design, equipment, materials, installation, workmanship, examination, inspection and testing shall be in strict accordance with NFPA 13, except as modified herein.

B. The system shall include all materials, accessories, and equipment inside and outside the building to provide a system complete and ready for use.

C. Design and provide each system giving full consideration to obstructions, blind spaces, piping, electrical equipment, duct work and other construction and equipment in accordance with detailed drawings to be submitted for approval.

D. Equipment for fire protection service shall be UL listed or FM approved for use in wet pipe sprinkler systems.

E. In the NFPA publications referred to herein, the advisory provisions shall be considered mandatory, as though the word "shall" had been substituted for "should," wherever it appears.

1.5 PERFORMANCE REQUIREMENTS

A. Water Distribution: Distribution shall be uniform throughout the area which it is assumed the sprinkler heads will open. Variation in discharge from individual heads in the hydraulically most remote area shall be between 100 and 120 percent of the specified density.

B. Piping Restrictions: Piping is prohibited in the following areas, except when solely supplying sprinklers in such areas:

1. Transformer, switchgear, or similar rooms
2. Elevator machine rooms and elevator shafts.
3. IT Computer spaces (mission critical).
4. Collection storage rooms.

C. Clearance from Electrical Equipment: Piping and automatic sprinklers are prohibited directly over:

1. Transformers.
2. Substations.
3. Switchboards.
4. Motor control centers.
5. Emergency generators.
6. Bus Ducts.
7. Electrical panels.

D. If installing pipe over electrical equipment is unavoidable, provide drip pans under piping to protect electrical equipment.

E. Location of Sprinkler Heads: Heads in relation to the ceiling and the spacing of sprinkler heads shall not exceed their listed area of coverage for Ordinary Hazard II. Uniformly space sprinklers on the branch piping. Locate sprinkler heads in a consistent pattern with ceiling grid, lights, and supply air diffusers.

F. Sprinkler Discharge Area: The sprinkler discharge area shall be the hydraulically most remote areas as defined in NFPA 13. Remote area reductions permitted per NFPA 13 shall not apply.

G. Hose Allowances: System design shall include an allowance of 100 gpm (6.31 l/s) for inside hose stream, and 250 gpm (15.77 l/s) for total combined inside and outside hose streams.

H. Hydraulic Calculations: Hydraulic calculations shall be in conformance with NFPA 13 and the following requirements:

1. Water Supply: Base hydraulic calculations on the most recent fire pump test dated 10/29/19, including a discharge pressure of 130.0 psi with 757.8 gpm available at a suction pressure of psi at 95.0. The existing fire pump test is available by request from the COTR. The Contractor shall determine the characteristics of the water supply and if necessary, conduct appropriate flow tests at their expense. Provide a copy of the most recent waterflow test with the hydraulic calculations. The water supply test may be no more than 10 months old when used for hydraulic calculations.
2. Margin of Safety: The sprinkler system shall be hydraulically designed so that the total waterflow and pressure demand is at least 10% less than the available water flow and pressure at the site.
3. Friction Losses: Calculate losses in piping in accordance with the Hazen-Williams formula with "C" value of 100 for unlined ductile iron piping, 120 for steel piping, 140 for cement-lined ductile-iron piping, 150 for copper tubing and plastic piping.
4. Flow Velocity: Piping shall be sized so that the water flow velocity does not exceed 20 ft/sec (6.1 m/s) at any point in the system during maximum water flow (including inside hose demand). Flow velocity in each pipe segment is to be provided in the calculations.
5. Test Point: Calculations shall be brought back to the flow test point.
6. Area of Coverage and Density: The area of coverage and density for each sprinkler shall be provided in the calculations.
7. Equivalent Lengths: The equivalent lengths for all types of fittings and valves used shall be provided.
8. Supply and Demand Graph(s): A graph comparing the water supply and the sprinkler and hose stream demand for each remote area shall be provided. Pressure and flow values for the supply and demand curves are to be provided on N 1.85 graph paper.

1.6 SUBMITTALS

A. Partial submittals will not be acceptable. Any installation work performed prior to the approval of the submittal shall be at the Contractor’s own risk.

B. Before any work is commenced, submit manufacturer's data (with listing or approval), system calculations, water supply data, and complete sets of working drawings.

C. The OSHEM Fire Protection Engineer shall review and approve submittals.

D. Manufacturers' Data: Annotate descriptive data to show the specific model, type and size of each item the Contractor proposes to furnish. Include data for proper installation of each system including:

1. Pipe and fittings
2. Sprinkler heads
3. Pipe hangers and supports
4. Lubricating compound/PTFE tape.
5. Signs
6. Caps, chains

E. Shop Drawings: Prepare working drawings on sheets not smaller than 24 in by 36 in (610 mm by 914 mm), in accordance with the requirements for "Working Plans" as specified in NFPA 13. A scaled site plan, with the location and elevation of the water flow test, shall be provided on the drawings.

F. As-Built (Record) Working Drawings: On a weekly basis, the Contractor Superintendent, in conjunction with the COTR, shall review and record as-built conditions on a set of drawings maintained at the job site. After completion, but before final acceptance of the work, furnish a complete set of as-built drawings for review and approval by OSHEM. Make all necessary corrections to the drawings and furnish four sets of as-built drawings for record purposes. All deviations from the approved shop drawings shall be highlighted on the as-built drawings; if required by OSHEM the Contractor shall also provide hydraulic calculations justifying deviations. The drawings shall not be smaller than 24 in by 36 in (610 mm by 914 mm) on reproducible sepia with title block similar to full size contract documents. Provide 1 compact disc containing CAD based drawings in DXF and PDF based format of all as-built drawings and schematics.

G. Operation and Maintenance Manuals: Furnish four (4) instruction manuals containing complete operation and maintenance instructions for the specific make and model of all check valves, detector check valves, alarm valves, waterflow and tamper switches, backflow preventers, and other trim furnished. Serial numbers and ordering information shall be provided. Place one copy of each instruction manual in a flexible, oil-resistant protective binder and mount in an accessible location in the vicinity of each alarm control valve. Furnish three additional copies of each instruction manual.

1.7 QUALITY ASSURANCE

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. All publications listed below refer to the most current edition.

B. Manufacturers Qualifications

1. American Society for Testing and Materials (ASTM) Publications:

a. A53 Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless
b. A135 Welded and Seamless Steel Pipe

2. Factory Mutual System (FM) Publications

a. Approval Guide

3. National Fire Protection Association (NFPA) Publications

a. 13 Standard for the Installation of Sprinkler Systems
b. 14 Standard for the Installation of Standpipe and Hose Systems
c. 70 National Electrical Code
d. 72 National Fire Alarm and Signaling Code
e. 101 Life Safety Code
f. 291 Recommended Practice for Fire Flow Testing and Marking of Hydrants
g. 1963 Standard for Fire Hose Connections

4. International Code Council (ICC)

a. International Building Code

5. Underwriters Laboratories, Inc. (UL) Publications:

a. Fire Protection Equipment Directory
b. 262 Gate Valves for Fire Protection Service
c. 789 Indicator Posts for Fire Protection Service

6. American Society of Mechanical Engineers (ASME)

a. A17.1 Safety Code for Elevators and Escalators

C. Qualifications of Installer:

1. Prior to installation, submit data for approval by OSHEM, showing that the Contractor has successfully installed automatic wet pipe fire extinguishing sprinkler systems of at least 200 sprinkler heads each, or there is a firm contractual agreement with a subcontractor having such required experience. These systems shall be the same type and design which have been retrofitted into existing museums and historical buildings as specified herein. The data shall include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. The Contractor shall indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.
2. Design (including hydraulic calculations) shall be by a NICET Level III or IV Technician (in automatic sprinkler system design) or a Professional Engineer (P.E.), licensed in Fire Protection Engineering. Qualifications of the designer must be submitted to OSHEM for approval. The designer's NICET or P.E. stamp shall be present on each sheet of the working drawings.

D. Service Organization: The Contractor shall furnish, to the COTR, evidence that there is an experienced and effective service organization which carries a stock of repair parts for the system in order to readily conduct repairs throughout the warranty period. Should the Contractor fail to comply with the service requirements of this section, the Government will then have the option to make the necessary repairs and back charge the Contractor without any loss of warranty or guarantee as provided by the contract documents.

1.8 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

C. Automatic sprinklers must be kept in original packaging until they are installed. Loose carrying or storage is not permitted. Loose sprinklers shall be discarded immediately and replaced at Contractor's expense.

1.9 COORDINATION

A. Coordinate sprinkler head layout with reflected ceiling plan and all ceiling – mounted equipment, including diffusers, lights, security cameras, fire alarm devices, exit signs, and other devices.

B. Coordinate major equipment and piping layouts with other trades to avoid obstructions and excessive changes in direction for piping.

1.10 WARRANTY

A. The Contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the Government.

B. Final acceptance includes, but is not limited to, the receipt and OSHEM approval of, as-built drawings and operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All products are subject to the following listed acceptable manufacturers. If the product is not addressed herein the product shall be from a US based manufacturer and listed for fire protection use.

B. All products shall be FM approved/UL listed.

C. Sprinklers

1. Tyco Fire & Building Products
2. Reliable Automatic Sprinkler Co.
3. Viking Corporation
4. Victaulic Corporation

2.2 ABOVEGROUND PIPING SYSTEMS

A. Provide fittings for changes in direction of piping and for all connections. Arrange piping so that it can be drained at the main riser. Make changes in piping sizes through standard tapered, reducing pipe fittings; the use of bushings is not permitted. Perform welding in the shop; field welding is not permitted.

B. Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape only, applied on the male threads.

C. Use of pipe dope is not permitted.

D. Lubricant used on gaskets for mechanical fittings must be non-petroleum based and approved by OSHEM.

E. Run piping concealed in areas with suspended ceilings, except as noted on the drawings.

F. Sprinkler Pipe and Fittings: Provide in accordance with NFPA 13, except as modified herein. Steel piping shall be Schedule 40 per ASTM A53 for sizes less than 4 inches (101.6 mm) and Schedule 10 or 40 per ASTM A53 for sizes 4 inches (101.6 mm) and larger. ASTM A135, Schedule 40 piping may be used for pipe sizes less than 2 ½ inches (63.5 mm).

1. Standard Installation:

a. Nominal pipe sizes 4 inches or larger: Schedule 10 or 40 Pipe meeting ASTM A-53, A-135 or A-795 with factory- or field-formed, roll-grooved for Schedule 10 or 40 ends, or cut-grooved for Schedule 40 ends.
b. Nominal pipe sizes smaller than 4-inches: Schedule 40 Pipe meeting ASTM A-53, A-135, and A-795 with factory- or field-formed threaded ends.
c. For connections between 4 inch and larger pipes on risers, feed mains, cross-mains and drain lines, the requirements are as follows: .

1) Grooved pipe couplings and fittings for grooved pipe.
2) Outlet coupling with screwed connection for grooved pipe.

d. For connections from risers, feed mains, cross-mains, or drains to branch lines, the requirements are as follows:

1) Welded outlet with screwed connection or threaded coupling or fittings.

e. For connections to and between branch line pipes less than 4 inches the requirement is as follows:

1) Threaded pipe couplings and fittings only.

f. For connections between drain pipes requirement is as follows:

1) Galvanized threaded or cut-grooved pipe couplings and fittings.

2. Pressure ratings: All fittings and gaskets shall meet or exceed maximum working pressures present within the system.

3. Corrosion protection: All piping and hangers where exposed to the weather or installed in a corrosive atmosphere shall be protected against corrosion.
4. Pipe and Hanger Supports: Provide pipe supports, hangers, and clamps conforming to NFPA 13 and listed by UL or approved by FM. Provide galvanized supports, hangers, and clamps for all galvanized piping.
5. Joint Construction

    a. Plain-end fittings with mechanical couplings, hole-cut mechanical threaded outlet fittings, hole-cut mechanical grooved outlet fittings, and hole-cut saddle clamp outlet fittings are not permitted for new systems. The above fitting types are only permitted on a case-by-case basis when approved by OSHEM.
    b. Procedures for welding outlets shall be in strict conformance with the welding requirements of NFPA 13, including submission of welding certifications. Welding shall not be performed on-site.
    c. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe with wall thickness less than Schedule 40.
    d. Grooved Joints and Fittings: Assemble joints and fittings with listed coupling and gasket, lubricant, and bolts from the same manufacturer. Fittings and attached couplings shall be from the same manufacturer.
    e. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
    f. If the galvanized coating on piping is found to be chipped or cracked upon grooving of joint, two coats of liquid galvanizing material shall be applied to groove. The first coat shall be thoroughly dry prior to applying the second coat.

G. Use of restriction orifices, reducing flanges, unions, and plain-end fittings is not permitted.

H. Flanged fittings shall be used in lieu of unions with the exception of drain lines.

I. The corrosion resistance ratio of pipe and fitting method shall not be less than 0.95.

J. Pipe Hangers and Supports: Provide in accordance with NFPA 13.

K. Identification Signs: Attach properly lettered approved metal or polycarbonate signs conforming to NFPA 13 to each valve and alarm device. Polycarbonate signs shall be red with engraved white letters. Signs at valves shall describe the sprinkler zone it controls and state that the valve is to remain open. Permanently affix design data nameplate to the riser of each system.

L. Drains: Provide drain piping to discharge at safe points outside the building or to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure. All drain piping and fittings are to be galvanized. Provide auxiliary drains as required by NFPA 13. Splash guards are to be provided where necessary at discharge outlets.

M. Pipe Sleeves and Seals. Provide where conduit or piping passes through walls, floors, roofs and partitions. Provide clearance between exterior of piping and interior of sleeve in accordance with NFPA 13. See Section 078413 Penetration Firestopping, for sleeves and seals through fire-rated assemblies. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through the entire thickness of walls, floors, roofs, and partitions.

1. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide ASTM A53, Schedule 40, zinc-coated steel pipe sleeves. Sleeves in floors shall project 4 inches (101.6 mm) above finished floors to prevent seepage.
2. Sleeves in Partitions and Other than Masonry and Concrete Walls, Floors and Roofs: Sleeves shall be constructed from either zinc-coated schedule 40 steel pipe or zinc-coated 26 gauge steel sheet.

N. Escutcheon Plates: Provide one piece or split-hinge-type metal plates for piping passing through floors, walls, and ceilings in exposed and concealed areas. Provide chromium-plated or color-coordinated metal plates where pipe passes through finished ceilings. Securely anchor plates in proper position. Provide sprinkler escutcheon plates to match sprinkler head finish.

2.3 SPRINKLER HEADS

A. Provide quick response sprinklers in offices and all other areas where their use is listed or approved. Heads located within the air streams of unit heaters or other heat-emitting equipment or skylights shall be selected for proper temperature rating.

B. Where only a portion of the automatic sprinklers in a space are being replaced as part of a renovation, the response characteristics of the new sprinklers shall match those existing in the space.

C. Heads shall have a nominal ½ inch (12.7 mm) orifice. Heads installed where they might receive mechanical injury or are less than 7 feet (2.13 m) above the floor level, shall be protected with approved guards in accordance with NFPA 13. Provide finish as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment, materials, installation, workmanship, examination, inspection and testing shall be in accordance with NFPA 13, except as modified herein. Install piping straight and true to bear evenly on hangers and supports. Install piping as close to the ceiling as possible, without interfering with other equipment and construction. Nipples shall be perpendicular to ceilings.

B. Accurately align sprinkler heads in suspended ceilings symmetrically with diffusers, lights, and ceiling tiles. Install sprinkler heads in the center of the ceiling tiles unless directed otherwise. Concealed head covers shall not be installed until ceiling construction is complete and an inspection to determine height compliance has been conducted by OSHEM.

C. Keep the interior and ends of all piping affected by Contractor's operations thoroughly clean of water and foreign matter by means of plugs or other approved methods. Inspect piping before placing into position. All pipe, fittings, and gaskets are to be cleaned of oil prior to installation.

3.2 FIELD CHANGES

A. Do not make field changes in the piping layout, pipe sizes, or type of equipment, without the prior approval of the COTR.

3.3 CONNECTIONS TO EXISTING SPRINKLER SYSTEM

A. Connection to the existing sprinkler system shall be done only after successfully testing new piping. Connections shall be as shown on the drawings. The COTR shall be notified at least 4 days prior to interruption of sprinkler protection.

B. A schedule of any interruption of service shall be provided to the COTR and approval received before any service is interrupted. In no case shall the existing sprinkler system be shut off during periods other than normal Contractor construction hours.

3.5 FIELD PAINTING

A. Painting shall be per Section 099000, Painting, except as modified herein. The above-ground steel piping systems including valves, piping, pipe sleeves and hangers shall be cleaned, pre-treated, primed and painted. Coatings shall be applied only to clean, dry surfaces using clean brushes. Surfaces shall be cleaned to remove all dust, dirt, rust and loose mill scale.

B. Immediately after cleaning, provide the metal surfaces with one coat of primer, applied to a minimum dry film thickness of 1.0 to 1.5 mil. Due care shall be exercised to avoid the painting of sprinkler heads or protective devices or allowing paint to drip or splatter on any equipment, artifacts, building structures, and floors. Materials which are used to protect sprinkler heads while painting is in progress shall be removed upon completion of painting.

C. The Contractor shall remove all sprinkler heads which are painted and provide new, clean sprinkler heads of the proper type at his own expense. In addition to the primer, surfaces shall receive the following:

1. Above-Ground Piping Systems in Unfinished Areas: Unfinished areas are defined as attic spaces, mechanical equipment spaces, spaces above suspended ceilings, crawl spaces, pipe chases, and spaces where walls or ceilings are not painted or not constructed of a pre-finished material. Provide primed surfaces with one coat of red enamel.
2. Above-Ground Piping Systems in Other Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except valves and operating accessories shall receive one coat of red enamel. Provide piping with 2 inch (50.8 mm) wide red enamel bands or self-adhering red plastic bands spaced at a maximum of 10 ft (3.05 m) intervals. In finished areas such as offices, the red bands may be omitted.
3. All other coatings (e.g., zinc for galvanized pipe) shall be in compliance with NFPA 13.

3.6 FIELD TESTING AND FLUSHING

A. All testing shall be scheduled with the COTR.

B. At the discretion of the OSHEM Fire Protection Engineer, an air pressure test may be required prior to filling the system with water. The test shall be conducted by raising the air pressure in the system to 40 psi (275.8 kPa) and allowing it to stand for 24 hours. There shall be no loss of air pressure greater than 1.5 psi (10.34 kPa) over the 24 hour period. Air pressure during this test shall be tracked via a graph over the 24 hour period by a pressure monitoring device or pressure monitoring gauge.

C. Hydrostatic tests shall be conducted at the greater of 200 psi (1379 kPa) or the normal system pressure plus 50 psi (345 kPa) for a 2 hour period with no leakage or reduction in gage pressure. Hydrostatic test pressures shall not be maintained on the system overnight. Flush piping with potable water in accordance with NFPA 13.

D. Preliminary Tests and Procedures: Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. Prior to the hydrostatic test, perform an air test on the system. In areas where piping will be concealed by ceilings, walls, or other construction before the system is complete and ready for final testing, the preliminary hydrostatic test shall be conducted prior to piping being concealed. This test shall be witnessed by the COTR and the OSHEM Fire Protection Engineer. When all tests and procedures are completed and corrections made, submit a signed and dated certificate, similar to that specified in NFPA 13, with a request for formal inspection and tests.

E. Formal Inspection and Tests: At this time, all piping, sprinklers, and other system components shall be in-place and all adjustments to the system completed. The OSHEM Fire Protection Engineer shall be notified by the COTR, shall witness all tests, and shall approve all systems before they are accepted. Submit a request for a formal inspection at least five working days prior to the date the inspection is to take place. A competent representative of the sprinkler installer shall be present during testing and inspection. As-built drawings shall be on-site for the inspection. At this inspection, the system shall be hydrostatically tested. Any or all of the required tests shall be conducted by the Contractor at his own expense and additional tests made until it has been demonstrated that the systems comply with all contract requirements. The Contractor shall furnish all appliances, equipment, instruments, connecting devices and personnel for the tests. Any costs incurred by the SI for repeat tests, due to the failure of the Contractor to adequately demonstrate that the system complies with the contract requirements, shall be borne by the Contractor.

F. CONNECTIONS TO EXISTING PIPING: During air and hydrostatic testing, the Contractor shall test new piping prior to connecting to the existing system. If the Contractor chooses to test the new piping while it is connected to existing piping or valves, the Contractor shall assume responsibility for all piping and equipment which is pressurized, as well as any damage caused by the failure of existing or new sprinkler systems. The SI accepts no responsibility for existing valves' performance to withstand hydrostatic pressure testing.

END OF SECTION 211313

SECTION 230100 - OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Service for heating, ventilating, and air conditioning equipment required for the work as indicated on the drawings, including the items listed in “Related Sections”.

1.2 RELATED SECTIONS

A. Operating manuals: Division 01 and Section 230101.

B. General project warranty: General Conditions.

C. Air terminal units: Section 233600.

1.3 DESIGN REQUIREMENTS

A. The products specified, scheduled, and shown on drawings are the basis of the design of this project.

B. For requirements affecting use of optional manufacturers, or substitutions, see Division 01 and Section 230101, HVAC General Provisions, and Section 230500, Common Work Results for HVAC.

1.4 SUBMITTALS

A. Shop drawings:

1. Proposed service or test agreement of each type included in the project, showing conformance to specifications. Include detailed list of work to be performed at each visit.

B. Certifications:

1. Each installation and service organization: A list of at least ten projects, similar to this project in type, size, and components, which have been operating satisfactorily for at least two heating and cooling seasons.
2. Include evidence of each requirement specified in the article below for qualifications of each service and maintenance agency.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with the plumbing, electrical, building, fire and safety codes of the state, county or city in which the work is performed.

B. UL label and local testing (if required): As specified in Section 230500, Common Work Results for HVAC.

C. HVAC equipment shall meet the energy performance requirements of ASHRAE 90.1 Energy Efficient Design of New Buildings Except Low-rise Residential Buildings.

1.6 QUALIFICATIONS OF EACH SERVICE AND MAINTENANCE AGENCY

A. Regularly engaged in performing installation, startup, and service work for equipment and systems of the types included in this project.

B. Located in the Baltimore/Washington, DC, metropolitan area.

C. Staff factory-trained by the manufacturer of the equipment included in this project.

D. Provides emergency service on call 24 hours a day.

E. Maintains an adequate stock of manufacturer's genuine or approved parts to service this equipment.

F. Has service contracts available, which can meet requirements specified for the equipment and systems of this project.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 ELECTRIC WIRING FOR MOTORS, STARTERS, AND CONTROLS

A. Furnish and install and in most cases factory-wire motor starters specified under each technical section in this division. Furnish and install under Division 26 magnetic starters not specifically specified with equipment. Unless specified otherwise, automatic control devices for equipment are furnished with the equipment.

B. Unless explicitly specified otherwise, mount and completely wire under Division 26 all starters and automatic control devices, except those which are factory-mounted on equipment.

C. Unless specified otherwise, motor disconnects, manual starters, pushbutton stations, and pilot lights are specified in Division 26, Electrical. Equipment specified in Division 23 shall be suitable for operation in conjunction therewith.

D. Unless specified otherwise in a particular section, electric motors shall comply with the requirements of Section 230513.

3.2 IDENTIFICATION

A. Identify equipment as required in Section 230500, Common Work Results for HVAC.

B. Thermometers, gauges, and control devices shall be identified.

3.3 TESTING MECHANICAL EQUIPMENT

A. Check and adjust all heating and cooling equipment installed.

B. Operate heating and cooling equipment and check controls including high and low limit controls.

C. Mechanical equipment shall be proven to function properly by actual operation prior to final acceptance.

3.4 EQUIPMENT LUBRICATION

A. Bearings of equipment shall be provided with adequate facilities for lubrication. Oiling devices shall be accessible. Lubricate bearings upon completion of work prior to startup of the equipment. Lubricants shall be as specified by equipment manufacturers.

END OF SECTION 230100

SECTION 230101 - HVAC GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for all HVAC work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

B. Construction waste management: Division 01.

C. Commissioning requirements: Divisions 01 and 23.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 23.

B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for, including all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the COTR.

E. HVAC work of this project includes, as a brief general description, the following:

1. Terminal unit with electric reheat coil and associated ductwork and control systems
2. Modification and salvage of existing terminal units and associated ductwork
3. The project includes commissioning under the direction of a Commissioning Agent (CxA).

F. See Division 01 for requirements related to Owner’s occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 23 specifications.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in the article "Substitutions," below for substitutions.

C. Products specified by reference standards or by description only: Any product meeting those standards or description.

D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance, and shall not be construed as limiting competition. Contractor may use products of any manufacturer, which meet the specifications.

E. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 23 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project, and of representative manufacture. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install.

E. All materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the COTR.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the COTR will determine sizes to be utilized.

H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the COTR of said uncertainty, doubt, or conflict and obtain a decision as to the intent before starting any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the COTR and await a written decision.

B. Plan and coordinate all work to proceed in an orderly and continuous manner without undue delay, and in conformance with project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate HVAC work so that work of each trade is completed before other construction begins which would obstruct it.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of all piping, ductwork, light fixtures, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the COTR prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractors' assistants shall include a competent foreman, who shall be on the premises at all times to check, lay out, coordinate and superintend the installation of work. The foreman shall establish all grades and lines relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for all equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of shop drawings and product data for every item of equipment. Shop drawings or product data will not be considered until manufacturers' lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.
2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.
3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
4. All exclusively electrical items furnished as items associated with mechanical items but not specifically described in the mechanical item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the mechanical item by identification specification paragraph.
5. Product data sheets shall be 8.5-inches by 11-inches cut sheets for operating and maintenance manual.

C. After the work is completed, submit all required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the COTR prior to final acceptance of the work.

1.10 SPECIALIST

A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.11 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

    a. Contract drawings.
    b. Specifications.
    c. Addenda.
    d. Change orders and other modifications to the Contract.
    e. Reviewed shop drawings, product data, and samples.

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

    a. Manufacturer's name and product model and number.
    b. Product options, substitutions, or alternates utilized.
    c. Changes made by addenda and modifications.

5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

    a. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
    b. Field changes of dimension and detail.
    c. Details not on original Contract Drawings.

6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Binders: Three-ring binders with vinyl-covered hard covers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
3. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. Print on spine of binder "O & M INSTRUCTIONS." If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.
4. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
5. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
6. Part 1: Directory, listing names, addresses, and telephone numbers of mechanical engineers; Contractor; mechanical subcontractors; and major mechanical equipment suppliers.
7. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria, including fan curves and similar performance charts.
    b. List of equipment, including operating weight of each piece.
    c. Parts list for each component, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

8. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data.
    b. Air and water balance reports.
    c. Photocopies of certificates.
    d. Photocopies of warranties and guarantees.
    e. Test reports: Copies of the results of all tests required under all sections of specifications.

9. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
10. Submit final volumes revised, within ten days after final inspection.

1.12 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The plumbing, mechanical, electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Code. (NFPA).
4. International Energy Conservation, Fire, Fuel Gas, Mechanical, and Plumbing Codes (ICC).

1.13 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply. Products shall be certified by manufacturers to meet the requirements of referenced standards.

1. Federal Specifications (FS)
2. Military Specification (MS)
3. Military Standards (Mil. Std.)
4. Air Conditioning and Refrigeration Institute (ARI)
5. Air Movement and Control Association (AMCA)
6. Associated Air Balance Council (AABC)
7. American Association State Highway and Transportation Officials (AASHTO)
8. American National Standards Institute (ANSI)
9. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
10. ASME International (ASME)
11. American Society for Testing and Materials (ASTM)
12. American Society of Sanitary Engineering (ASSE)
13. American Water Works Association (AWWA)
14. International Code Council (ICC)
15. Manufacturer’s Standardization Society of the Valve and Fittings Industry Inc. (MSS)
16. National Electrical Code, NFPA 70 (NEC)
17. National Electrical Manufacturer’s Association (NEMA)
18. National Fire Protection Association (NFPA)
19. The Occupational Safety and Health Act (OSHA)
20. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
21. Underwriters Laboratory Inc. (UL)
22. Maryland Occupational Safety and Health Act (MOSHA)

1.14 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

B. Area shall be maintained and shall be returned to original condition at the completion of the project.

1.15 PROTECTION

A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.
4. Construct dust partitions, where indicated on the drawings or as required.
5. Protect areas occupied by Owner's personnel or equipment.
6. Seal off all return air registers and other mechanical systems to prevent dust from entering.

B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

C. Repair all damage or soiling to the complete satisfaction of the COTR; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract Sum.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer's recommended temperatures.

E. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.16 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.17 SECURITY REQUIREMENTS

A. Refer to Division 01 for security requirements.

1.18 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the Owner and COTR in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.19 WARRANTY

A. All work and equipment provided as work of this division shall be fully warranted under the general project warranty. In addition, provide added special warranties specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the COTR. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the COTR and revise schedule based on any COTR comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is one year after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Service reports for warranty work shall be provided to the COTR

C. When use of the permanent equipment has been permitted for temporary heating or ventilation of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the COTR.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.20 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractors' and subcontractors' responsibilities are described in Divisions 01 and 23.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, and other appurtenances for the passage or accommodation of pipes, ducts and appurtenances. Close superfluous openings and remove all debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the COTR.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or COTR finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, COTR and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

3.4 COMMISSIONING

A. Comply with requirements of “Commissioning” in Part 1 above.

END OF SECTION 230101

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to more than one section of Division 23.

B. Identification of HVAC systems and equipment.

C. Cleaning and painting.

D. Operating instructions.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 230101.

B. Operation and Maintenance Manuals: Division 01 and Section 230101.

C. Painting: Division 09.

D. Construction waste management: Division 01.

E. Commissioning requirements: Division 01 and Division 23.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME Boiler and Pressure Vessel Code.
2. ASME A 13.1: Scheme for the Identification of Piping Systems.

B. American Society of Testing and Materials

1. ASTM A 234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
2. ASTM B 32: Standard Specification for Solder Metal
3. ASTM B 88: Standard Specification for Seamless Copper Water Tube
4. ASTM B 813: Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
5. ASTM D 635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
6. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials
7. ASTM E 548: Standard Guide for General Criteria Used for Evaluating Laboratory Competence

C. American Welding Society

1. AWS D1.1: Structural Welding - Steel
2. AWS A5.8: Specification for Filler Metals for Brazing and Braze Welding.
3. AWS D10.9: Specification for Qualification of Welding Procedures and Welders for Piping and Tubing
4. AWS QC1: Specification for AWS Certification of Welding Inspectors

1.4 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

C. DN: Dimension Nominale, nominal pipe size in millimeters, in accordance with the metric system for construction, Systeme Internationale (SI).

D. NPS: Nominal pipe size in inches, in accordance with standard U.S. designations for manufactured pipe. Pipe sizes do not change when projects are designed and built in metric units; each size has a consistent name (nominal dimension) in each system.

1.5 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed based on the use of the particular manufacturer’s products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that render their use impractical, or cause functional fit, access, or connection problems.

1.6 SUBMITTALS

A. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in the article "Quality Assurance" below.

1.7 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the plumbing, mechanical, electrical, building, fire, health and safety, and other applicable codes and regulations of the state, county or city in which the work is performed.

B. Welding procedures and operator qualifications for structural welding: AWS D1.1, Structural Welding Code Steel, electric arc process.

C. Qualifications of independent testing laboratory personnel:

1. Welding inspectors: AWS QC1, Certification of Welding Inspectors.

D. Electrical control panels, equipment, materials and devices provided or installed as work of Division 23 shall bear UL label or, if UL label is not available, the item shall be tested and labeled by a qualified testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70 (NEC). Provide testing, if required, without addition to the contract sum.

E. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

F. Products shall contain no urea-formaldehyde content.

1.8 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent. Contractors' and subcontractors' responsibilities are described in Division 01 and Division 23.

PART 2 - PRODUCTS

2.1 GENERAL

A. Piping techniques, testing, identification, painting, and operating instructions specified in this section apply to products specified in other sections of Division 23.

B. Equipment that uses or processes date and time data in order to perform its function shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

2.2 IDENTIFICATION DEVICES AND MATERIALS

A. Stenciling materials:

1. Stencils: Manufactured standard stencils prepared for required applications, conforming to ASME A 13.1 for color and size of legend letters, including arrows showing direction of flow.
2. Paint: Exterior type enamel, colors conforming to ASME A 13.1, or black.

B. Equipment identification tags:

1. Laminated plastic with adhesive back, white core and black outer layers, which, when engraved, will produce white letters and numerals on a black background.
2. Tags installed on curved surfaces shall be aluminum or brass.

2.3 RUST INHIBITIVE PAINT

A. Rust-inhibitive paint:

1. Alkyd based, white, black, or bronze tone.
2. Applied in a wet film thickness of at least 2.9 mils (0.07 mm).
3. Equal to Benjamin Moore Super Spec HP D.T.M. Alkyd Low Lustre P23.

PART 3 - EXECUTION

3.1 GENERAL

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify COTR if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. The contract drawings are diagrammatic and do not indicate all fittings or offsets in pipe and ductwork, all access panels, or all specialties required. Provide required fittings, offsets, access panels, and specialties to coordinate the work.

C. No pipe or duct shall be run below the head of a window or door.

D. Equipment, ducts, and pipes installed in areas without a suspended ceiling shall be as tight to structure as possible, but at least above a height of 6'-8", unless otherwise noted.

E. Items which require access for operation or maintenance shall be easily accessible. Do not cut or form hand holes for operation or maintenance of appliances through walls or ceilings.

3.2 IDENTIFICATION

A. General: Do not apply identification until insulation and finish painting work is complete.

B. Equipment:

1. Stencil equipment with minimum two-inch (50-mm) -high letters or provide identification tags. Clearly indicate equipment designation and area served.
2. Firmly fasten each identification tag to its appropriate piece of equipment with drive screws, sheet metal screws, or rivets. Do not interfere with operation of, or damage the item being marked.

C. Ductwork: Stencil ductwork after insulation is applied, if required, with minimum two-inch (50-mm)-high letters, clearly identifying service (supply, return, exhaust) and showing direction of flow with arrows. Mark ducts near building walls where they enter or leave a space, and at intervals of not more than 30 feet (9 m). Identification shall be visible to a person standing on the floor.

3.3 CLEANING AND PAINTING

A. Cleaning: Clean all piping and equipment. Where items are to be painted, clean ready for painting.

B. Painting: Coordinate painting with requirements of Division 09. Paint the items identified below to be painted. Use paint materials and systems specified in Division 09.

C. Items to be painted:

1. Items identified below to have protective coating.
2. Items furnished with manufacturer's prime coat.
3. Mechanical rooms (including but not limited to boiler, chiller, and air-handling unit rooms):

    a. Insulation and uninsulated steel: Piping, pumps, tanks, and vessels.
    b. Hangers and supports.

4. Piping and ductwork exposed in finished spaces, insulated and uninsulated.
5. Inside ducts behind registers, grilles, and diffusers.

D. Items not to be painted: Copper, stainless steel, and equipment furnished with manufacturer's finish.

E. Paint systems in mechanical rooms: Paint piping with conforming to ASME A 13.1.

1. Galvanized steel: One coat of primer recommended for galvanized surfaces and one coat of glossy alkyd enamel.
2. Ferrous metal: One coat of primer recommended for ferrous metal and one coat of glossy alkyd enamel.
3. Items protected with rust-inhibitive primer: Finish coat of compatible glossy enamel.

F. Paint systems for exposed piping and ductwork: Primer compatible with the substrate, whether steel, galvanized steel, insulation jacket, or other material; one coat or two, if required to cover, of paint to match adjacent surfaces in color and texture.

G. Painting inside ducts behind registers, grilles, and diffusers: Matte black, compatible with substrate and suitable for the temperatures at which the duct will operate, extending from the duct opening to a depth such that no unpainted surface will be visible to a person standing on the floor or adjacent balconies.

3.4 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish the necessary technicians, skilled workers, and helpers to operate all the HVAC systems and equipment of the entire project for one 8-hour day.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the COTR or designated personnel in operation, maintenance, lubrication, and adjustment of all systems and equipment.

1. Instructions by manufacturer's technical representative for each type of equipment shall include the performance of the recommended preventive maintenance procedures for that equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions, for use by instructors and COTR personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and COTR.

END OF SECTION 230500

SECTION 230504 - HVAC DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Extent and location of demolition are shown on the drawings.

B. Work includes reuse and salvage of items identified on the drawings.

1.2 RELATED SECTIONS

A. Demolition: Division 02.

1.3 QUALITY ASSURANCE

A. Demolition shall be carried out as expeditiously as possible in accordance with accepted practice and applicable building code provisions.

1.4 PROJECT CONDITIONS

A. If, in the course of the work, workers encounter a material they suspect to be asbestos, to contain lead or PCBs, or to present some other hazard:

1. Promptly notify the Owner and COTR in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

B. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.

C. Locate, identify, and protect mechanical and electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Comply with demolition and disposal requirements of Division 02.

B. Perform removal work neatly with the least possible disturbance to the building.

C. Provide temporary barriers, danger signals, and appurtenances for protection of personnel and equipment during removal operations.

D. Drain and refill portions of existing piping systems necessary to implement the work of this project.

1. Isolation valves shall be installed, if necessary, to keep systems operational in Owner-occupied portions of the building.
2. Activities for draining systems shall be scheduled and coordinated with the COTR in accordance with Division 01 requirements for system shutdowns.

E. Demolish, remove, demount, and disconnect inactive and obsolete piping, fittings and specialties, equipment, ductwork, controls, fixtures, and insulation.

1. Piping and ducts embedded in floors, walls, and ceilings may be abandoned in place if they do not interfere with new installations. Cut back to at least one inch below finished surface.
2. Remove materials above accessible ceilings.
3. Drain and cap items to remain behind finished surfaces.
4. Patch and repair surface materials as required in Division 01 and Section 230101 article, "Cutting and Patching."

F. Remove anchors, bolts, and fasteners associated with piping and equipment to be removed.

3.2 ITEMS FOR REUSE AND SALVAGE

A. The Owner has salvage rights to all mechanical, plumbing, and electrical equipment. Dispose of all equipment not identified for salvage by the Owner.

B. Items to be reused or salvaged are identified on the drawings.

C. Remove items to be reused or salvaged in a manner to prevent damage. Pack or crate if required to protect the items from damage in storage.

D. Items to be salvaged: Identify contents of crates. Repair items damaged during removal or replace with new to match existing. Deliver to location where directed.

3.3 DISPOSAL

A. Dispose of equipment and materials removed, and rubbish and waste material, as work progresses. Do not allow demolition debris to accumulate on site. Remove products of demolition from the building daily.

3.4 PROTECTION

A. Provide adequate and positive protection to existing building and equipment that is to remain, particularly to prevent entry of either dust or water. Ensure weathertightness at all times. Keep standby patching materials on hand to patch and maintain protection as required.

END OF SECTION 230504

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall engage and the COTR shall approve an independent balancing and testing subcontractor.

B. This section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Measuring electrical performance of HVAC equipment.
4. Setting quantitative performance of HVAC equipment.
5. Verifying that automatic control devices are functioning properly.
6. Reporting results of the activities and procedures specified in this section.

1.2 RELATED SECTIONS

A. Testing and adjusting requirements unique to particular systems and equipment are included in the sections that specify those systems and equipment.

B. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment sections.

1.3 PERFORMANCE REQUIREMENTS

A. Select and obtain approval of the testing and balancing subcontractor at the earliest possible time and before beginning ductwork installation.

B. The testing and balancing subcontractor shall visit the job site periodically, beginning with the initial stages of construction of the mechanical systems, and shall ensure that the necessary devices are properly installed so that specified testing and balancing can be performed.

1.4 SUBMITTALS

A. Submit pre-construction certified balance report of existing systems.

B. Submit certified balance report.

1.5 QUALITY ASSURANCE

A. Testing and balancing subcontractor qualifications:

1. Current certified member of the Associated Air Balance Council, or certified by National Environmental Balancing Bureau for air and hydronic systems testing and balancing.
2. Has successfully completed at least five projects of similar size and scope.

3. Not affiliated with any other subcontractor participating in this project. Work performed by the subcontractor shall be limited to testing, adjusting, and balancing HVAC systems.

B. Testing and balancing work shall comply with one of the following standards:

1. National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems, published by the Associated Air Balance Council.
2. Procedural Standards for Testing Adjusting Balancing of Environmental Systems, published by the National Environmental Balancing Bureau.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Instruments: Approved and properly calibrated.

B. Pyrometer surface temperature measurements may be used for piping system water temperatures where thermometer wells are not provided in the piping.

PART 3 - EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Before beginning balancing, ascertain that systems are ready. Verify that filters for regular service are in place, as required in Section 234100, Particulate Air Filtration.

3.2 PREPARATION

A. Witness air duct leakage tests required in Section 233113, Metal Ducts, and advise and approve the methods and instruments used.

B. Using bench-calibrated instruments, field-calibrate pressure gages and dial-type duct thermometers.

3.3 BALANCING OF SYSTEMS, GENERAL

A. Tabulate settings of temperature control devices and ascertain that thermostats, controllers, and valves are set at specified or approved positions. Verify and certify that the sequence of operation for each system is as shown on drawings, specified, or approved.

B. Provide all labor and devices necessary for the testing and balancing work.

3.4 AIR SYSTEMS BALANCING

A. Balance all air distribution, supply, return air systems and equipment.

B. Test and adjust fans to deliver design airflow at lowest possible speed. Adjust air-handling equipment to deliver the required air volumes. Note that air quantities scheduled on drawings do not include allowances for duct leakage. Preliminary adjustments of fan speed should be slightly in excess of scheduled airflow delivery. Make adjustments by changing wiring connections of motors, or adjusting speed controller.

C. Test and adjust system to design airflow requirements to the greatest extent possible. Manual volume dampers in ducts shall be adjusted to obtain required airflow rates at grilles, registers, and diffusers. Dampers integral to airflow devices should be fully open or minimally closed for airflow fine adjustments.

D. Make pitot tube traverse of main supply, return, and outdoor air ducts to obtain total airflow for fan or air-handling unit.

E. Adjust rooms or zones to design airflow (supply, return, and exhaust).

F. Adjust general HVAC systems to design airflow within the following tolerances:

1. Total system supply, return: (design to plus 10 percent).
2. Total supply, return for a room or space: (minus 5 percent to plus 5 percent).
3. Grilles, registers, and diffusers:

    a. One per room or space: (minus 5 percent to plus 5 percent).
    b. Two or more per room or space: (minus 10 percent to plus 10 percent).

G. Grilles, registers, and diffusers:

1. Identify each grille, register, and diffuser as to location and area. List manufacturer, type, and size.
2. Identify type of testing equipment used.
3. Test and adjust each grille, register, and diffuser to design airflow. List (design-actual) cfm (cubic meters per minute) and (design-actual) velocity in fpm (meters per second) when applicable.
4. Adjust diffusers, grilles, and registers to minimize drafts. Adjust blades in supply diffuser straightening grids to ensure uniform air distribution across diffuser.

H. Test and record the following data, as applicable, for air-handling equipment:

1. Manufacturer and model number.
2. Total airflow (design-actual).
3. Return air airflow (design-actual).
4. Outdoor air airflow (design-actual).
5. Total and external static pressure (design-actual). Include static pressure at suction, discharge, and between unit coil and filter components.
6. Entering air temperatures (db heating, db and wb cooling).
7. Leaving air temperatures (db heating, db and wb cooling).
8. Motor horsepower (rated-actual).
9. Voltage and phase (rated-actual).
10. Fan speed, rpm (rated-actual).
11. Amperage (rated-actual).

I. In cooperation with the control manufacturer’s representative, set adjustments of automatically operated dampers to operate as specified.

J. Adjust air systems feeding terminal reheat units to deliver design airflow with a maximum static pressure at any unit air inlet not over 0.5 inches wg. Eliminate excess static pressure by slowing fan rpm and modulating duct dampers, and not at the reheat unit where excess noise may result.

3.5 VARIABLE VOLUME SYSTEM BALANCING

A. Balance system air distribution, supply, return, and exhaust including air distribution equipment in accordance with AABC standards for Testing and Balancing Variable Volume systems and as specified below.

B. Static pressure sensor locations shall be in those duct runs which are of the longest equivalent length (greatest friction loss).

1. Measure the supply duct static pressure at each location.
2. Monitor each location during the adjusting and balancing to assure proper inlet static pressure is being maintained to the air terminal units.
3. Determine pressure setpoints at each location and forward data to the control subcontractor.

C. Calibrate supply fan variable frequency drives.

1. Balance system at 100 percent airflow, noting supply and return cfm (L/s) and the resulting cfm (L/s) differential.
2. Set the system to operate at 50 percent of total supply airflow, noting supply fan motor frequency. Adjust the return fan motor frequency so that the cfm (L/s) differential is the same as at 100 percent airflow.
3. Set the system to operate at 100 percent outdoor air and traverse the ducts. Adjust outdoor air, return air, and exhaust air dampers to maintain total airflow.
4. Set duct system static pressure controllers to provide adequate static pressure for the most demanding air terminal unit.
5. Forward test and setpoint data to the control subcontractor.

D. Determine the static pressure setpoint in mixed entering air plenum of each unit.

1. Set system to operate at 100 percent airflow.
2. Balance outdoor and return air dampers to provide minimum outdoor airflow scheduled. Adjust dampers to produce a mixed air plenum static pressure which is within the control range of the sensor provided as specified for the automatic temperature control system. Verify the return fan capacity control and static pressure controls functions throughout the 30 to 100 percent airflow range.
3. Forward test and setpoint data to the control subcontractor.

E. Balance the secondary duct system and make adjustments to the VAV terminal unit volume regulators. Record the following data:

1. Terminal unit designation.
2. Manufacturer, model number, and size.
3. Minimum primary airflow (design - actual).
4. Maximum primary airflow (design - actual).
5. Heating Coil Entering air - D.B.
6. Heating Coil Leaving air - D.B.
7. Heating Coil Capacity (design - actual).

F. Walk through the building and listen for noise generated by the air distribution system. Correct balancing to eliminate excess noise. Report noise not related to balancing.

3.6 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan and equipment.
2. Measure and record flows, temperatures, and pressures of each piece of equipment in each hydronic system. Compare the values to design or nameplate information, where information is available
3. Measure motor voltage and amperage. Compare the values to motor nameplate information.
4. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. TAB After Construction: Before performing testing and balancing of renovated existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished in accordance with renovation scope indicated by Contract Documents. Verify the following:

1. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed.
2. Verify that the indicated airflows of the renovated work result in fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.

3.7 MARKING OF SETTINGS

A. Following final balance procedures, permanently mark the settings of valves, splitters, dampers, and other adjustment devices, so that adjustment can be restored if disturbed at any time. Set memory stops on balancing valves. Return and make required adjustments after submittal and approval of the Certified Balance Report.

END OF SECTION 230593

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Definitions and general requirements applicable to the insulation systems specified in “Related Sections.”

1.2 RELATED SECTIONS

A. Duct insulation: Section 230713.

1.3 REFERENCES

A. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

B. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials

C. UL 723: Standard for Test for Surface Burning Characteristics of Building Materials

1.4 DEFINITIONS

A. Ceiling space: The space between the ceiling and the floor of an air-conditioned space above.

B. Air-conditioned areas or spaces: Areas or spaces where the occupied room temperature is maintained between 65 and 80 degrees F (18.3 and 26.7 degrees C).

C. Concealed insulation shall include work:

1. Above ceilings.
2. Where furred in and in pipe chases.

D. Exposed insulation shall include work:

1. In all rooms and areas.
2. In mechanical equipment rooms, penthouses, or other similar utility spaces.
3. In storage rooms.

E. Finished spaces: Areas of the building accessible to the public and to building occupants other than service personnel.

1.5 QUALITY ASSURANCE

A. Perform work in strict accordance with the building, fire and safety codes of the state, county or city in which the work is performed.

B. Insulation, including fittings and butt strips, jackets, facings, and accessories such as adhesives, mastics, cements, tapes and cloth, shall have a fire and smoke hazard rating and label as tested by ASTM E84, NFPA 255, and UL 723, not exceeding Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.

C. All insulation and accessories shall be free of asbestos.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation and accessory products in manufacturers' wrapping or cartons, identified on the exterior and bearing labels showing conformance to flame and smoke rating requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to sections listed in "Related Sections."

PART 3 - EXECUTION

Not Used.

END OF SECTION 230700

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct insulation as with the thickness and R-value indicated in the schedule at the end of this section.

B. Work of this section includes:

1. Insulation for new ductwork installed under this contract.
2. Patching existing insulation where removed to make connections to existing ductwork.
3. Patching existing insulation damaged during demolition and construction.

1.2 RELATED SECTIONS

A. Painting: Division 09.

B. Definitions and general insulation requirements: Section 230700.

1.3 REFERENCES

A. American Society of Testing and Materials

1. ASTM C 553: Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
2. ASTM C 612: Standard Specification for Mineral Fiber Block and Board Thermal Insulation
3. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

1.4 SUBMITTALS

A. Material list: Each type of insulation and accessory, with manufacturer's name and material name and number. Identify locations for use, thickness of material, type of jacket, vapor barrier, and method of application.

B. Product data: Sufficient to show that the product meets the specified requirements for materials, composition, and performance.

C. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

1.5 QUALITY ASSURANCE

A. Installer qualifications: Installers shall be mechanics skilled in this trade, employed with a firm that has a minimum of five years of experience installing mechanical insulation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store rigid insulation products so as to protect them from breakage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The listed manufacturers and particular products are intended to set a standard for materials, composition, and performance. Products of other manufacturers may be proposed as permitted by the provisions of Division 01 and the article “Product Options” in Section 230101.

B. Mineral fiber insulation:

1. CertainTeed Corporation.
2. Johns Manville.
3. Knauf Fiber Glass GmbH.
4. Owens-Corning.

C. Coatings, adhesives, and fabrics:

1. Childers
2. Foster
3. Manville Building Materials Group
4. Rock Wool Manufacturing Company
5. Trimac

2.2 MINERAL FIBER INSULATION MATERIALS

A. Flexible mineral fiber insulation: ASTM C 553, Type I, nominal density at least 1 pound per cubic foot (16 kg per cubic meter), k-factor of 0.27 at 75 degrees F (k(SI) of 0.037 at 24 degrees C) mean temperature, of thickness as specified in Part 3 below, with foil-scrim-kraft vapor-barrier jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

1. Minimum R-value of R-4.5 (RSI-0.79) with 1.5 inches (38 mm) of thickness in the installed condition with 25% compression.
2. Minimum R-value of R-6 (RSI-1.06) with 2 inches (50 mm) of thickness in the installed condition with 25% compression.

B. Rigid mineral fiber insulation: ASTM C 612, Types IA-IB, nominal density at least 6 pounds per cubic foot (96 kg per cubic meter), with k-factor of 0.22 at 75 degrees F (k(SI) of 0.032 at 24 degrees C) mean temperature, of thickness as specified in Part 3 below, with factory-applied jacket composed of a reinforced white kraft and aluminum-foil laminate with the white kraft facing out. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

1. Minimum R-value of R-6.8 (RSI-0.79) with 1.5 inches (38 mm) of thickness.
2. Minimum R-value of R-9.1 (RSI-1.06) with 2 inches (50 mm) of thickness.

C. Mineral fiber insulation accessories

1. Mechanical fasteners: Adhesively attached, minimum 12-gauge zinc-plated steel pin welded to a 2 inch by 2 inch, 22 gauge minimum galvanized steel perforated baseplate and self-locking retaining washer. Pin length as required. Comply SMACNA HVAC Duct Construction for Mechanical Fasteners. Provide adhesive recommended by fastener manufacturer. Peel and press (self-sticking) type fasteners are not acceptable.
2. Tape for flexible mineral fiber insulation: Self-adhesive foil-scrim-kraft vapor-barrier tape with removable backing and pressure-sensitive acrylic adhesive, 3" (75 mm) wide minimum. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
3. Tape for rigid mineral fiber insulation: Self-adhesive foil faced vapor-barrier tape with removable backing and pressure-sensitive acrylic adhesive, 2" (50 mm) wide minimum. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
4. Mineral fiber insulation vapor barrier mastic:

    a. Vapor barrier coating for use over ASJ jackets to give a vapor barrier seal at joints, laps and punctures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
    b. Basis of design: Foster 30-65 "Vapor-Fas".

5. Corner Angles: Aluminum, 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm).
6. Trapeze hanger support inserts: Calcium silicate insulation, ASTM C 533, Type I.

2.3 FIELD-APPLIED JACKETS

A. Canvas jacket:

1. Jacket material: 8 ounces per square yard (270 grams per square meter), fire-retardant treated.
2. Lagging adhesive:

    a. Polyvinyl acetate water-based adhesive and coating used indoors to adhere and size canvas, glass cloth or other lagging fabric over pipe insulation, and able to be top coated with solvent-based paints. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
    b. Basis of design: Foster 81-42W "Lagfas".

3. Lagging finish coating:

    a. Washable, abrasion-resistant, indoor insulation coating for canvas. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
    b. Basis of design: Foster 30-36 "Sealfas".

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Apply insulation in a neat and workmanlike manner and in accordance with manufacturer's printed instructions.

B. Tape and seal terminations of insulation with vapor barrier mastic.

C. Provide continuous insulation and jacket through trapeze hanger supports. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

D. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

E. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

G. Install insulation with longitudinal seams at top and bottom of horizontal runs.

H. Install multiple layers of insulation with longitudinal and end seams staggered.

I. Install insulation with least number of joints practical.

J. Stagger joints.

K. Install insulation continuously around hangers.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

3.2 INSTALLATION INSIDE BUILDINGS

A. Install in accordance with the Minimum Insulation Thickness and R-Value Schedule at the end of this section.

B. Concealed ducts: Provide flexible mineral fiber insulation.

1. Mechanical fasteners: On ducts more than 24 inches (610 mm) wide, secure insulation on the underside with mechanical fasteners as required to prevent sagging, 16” (406 mm) maximum on center and 3” (75 mm) maximum from joints. Secure insulation in place with washers firmly embedded in insulation. Cut excess portion of pins extending beyond washers. Cover exposed pins and washers with tape.
2. Transverse joints and longitudinal seams: Butt insulation with facing overlapping at least 2 inches (50 mm). Staple and seal with tape.
3. Seal breaks and punctures with tape.

C. Exposed ducts: Provide rigid mineral fiber insulation.

1. Mechanical fasteners: Fastened with mechanical fasteners. Fasteners shall be spaced 16" (406 mm) on center with a minimum of two rows per side of duct and 3" (75 mm) maximum from joints. Secure insulation in place with washers firmly embedded in insulation. Cut excess portion of pins extending beyond washers. Cover exposed pins and washers with tape.
2. Transverse joints and longitudinal seams: Provide a continuous unbroken vapor barrier. Create a facing lap by removing 2 inches (50 mm) from one edge and one end of insulation segments. Secure laps to adjacent insulation section with staples, 6 inches (150 mm) on center maximum. Seal seams and joints with tape.
3. Seal breaks and punctures with tape.
4. Apply corner angles to all outside corners and straight edges.
5. For curved surfaces, such as exposed elbows, score or cut insulating board in narrow strips as necessary for snug and neat fit.
6. Installing canvas jacket: Adhere canvas jacket with lagging adhesive. Finish with lagging finish coating, ready for painting.

D. Ductwork which transmits air that may be either cooled or heated, or untempered air, shall be insulated as specified below for cooling systems.

E. Where necessary to conceal the standing seams and reinforcing angles on exposed ducts, increase insulation thickness to 2 inches (50 mm).

3.3 SCHEDULES

Minimum Insulation Thickness and R-Value for Duct Insulation Inside Buildings		
	Default Unless Otherwise Noted[1]	Ceiling Space in Air Conditioned Area
Cooling Systems		
Supply air	1.5 inch (38 mm)	Default
Return air	1.5 inch (38 mm)	Not required

Notes:
1: Default insulation thickness shall be increased to 2 inches (50 mm) where necessary to conceal standing seams and reinforcing angles on exposed ducts.

END OF SECTION 230713

SECTION 230923 - INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section

B. Refer to DIVISION 23 for general provisions, installation requirements and additional HVAC equipment control information.

C. All electrical work shall be in accordance with Division 26 Specification Sections.

1.2 SUMMARY

A. This Section includes all labor, materials, equipment, and service necessary for a complete and operating control system for all HVAC equipment including control of units not supplied with factory-wired controls and installation and wiring of loose controls shipped with equipment.

B. All new HVAC equipment to be provided with Direct Digital Controls (DDC) controlled through the new Building Automation System (BAS).

C. Furnish all labor, materials, equipment, and service necessary for a complete and operating Building Automation System (BAS), utilizing a high speed peer to peer network of interoperable Direct Digital Controls (DDC), Graphical User Interface (GUI) with color graphic displays available on at least 64 client computers, and electronic interfaces and actuation devices, as shown on the drawings and as described herein.

D. The new BAS system shall be fully compatible with the existing SI Wide Siemens Facility Management and Control System (FMCS) and shall interface directly with the next generation Siemens Desigo CC BAS. All new controls shall be fully accessible through the existing site-wide operator's terminals and FMCS Database Server located within the SI – NMNH Facility and Herndon Data Center (HDC). Division 23 contractor is responsible for determining compatibility prior to submitting bid.

E. Smithsonian Institute operates a FMCS manufactured by Siemens Apogee \ Desigo CC Building Automation System and services HVAC systems installed in previous projects. The intent of this specification is to extend and interoperate with the FMCS and to provide a peer-to-peer, networked control system for the control work that is part of this project. All components, software and operation shall be interoperable with the existing FMCS. The installed system will interface directly with the existing FMCS Database Server located within the SI - NMNH Facility and HDC. The existing software and database will be modified to accept the new equipment being installed under this project to maintain integrity for centralized scheduling, graphic trending, programming, alarming and remote notification. Personal Computer (PC) Desktop icons that "link" to a separate system are not acceptable. Any costs associated with connecting to the existing FMCS, including licensed software, programming, training, etc., shall be part of the controls contractor's bid. The contractor must demonstrate their ability to perform the integration to the existing FMCS prior to bid submittal acceptance. All systems as described in the sequence of operation will be shown via dynamic graphics with all pertinent system alarms for proper

operation and maintenance. The use of separate PC workstations, gateways, metalinks, replacement of existing controllers and control devices and additional software graphic packages to accomplish this integration will not be accepted. ***SI will not interphase with third party controllers and operational.***

1.3 DEFINITIONS

A. BAS: Building Automation System

B. Control Contractor: Contractor for this section

C. DDC: Direct Digital Control

D. I/O: Input/output

E. MS/TP: Master slave/token passing

F. NIST: National Institute of Standards and Technology

G. PC: Personal computer

H. PID: Proportional plus integral plus derivative

I. OWS: Operator Work Station

J. RTD: Resistance temperature detector

K. FMCS: Facility Management and Control System

L. ATC: Automatic Temperature Control

M. TAB: Testing Adjusting and Balancing

N. BACnet: Building Automation and Control Network

O. TCP: Transmission Communication Protocol

P. IP: Internet Protocol

1.4 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than 2 seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or work station within 6 seconds.

5. Alarm Response Time: Annunciate alarm at work station within 45 seconds. Multiple work stations must receive alarms within 5 seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values or update changes and outputs at least once per second. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within minimum tolerances as follows:

    a. Water Temperature: Plus (+) or minus (-) 1 deg. F
    b. Water Flow: + / - 5 percent of full scale
    c. Water Pressure: + / - 2 percent of full scale
    d. Space Temperature: + / - 0.5 deg. F
    e. Ducted Air Temperature: + / - 0.5 deg. F
    f. Outside Air Temperature: + / - 0.5 deg. F
    g. Dew Point Temperature: + / - 3 deg. F
    h. Temperature Differential: + / - 0.25 deg. F
    i. Relative Humidity: Critical Areas + / - 1 percent
    j. Relative Humidity: Non-critical Areas + / - 3 percent
    k. Airflow (Pressurized Spaces): + / - 3 percent of full scale
    l. Airflow (Measuring Stations): + / - 2 percent of full scale
    m. Airflow (Terminal): + / - 10 percent of full scale
    n. Air Pressure (Space): + / - 0.01-inch wg.
    o. Air Pressure (Ducts): + / - 0.1-inch wg.
    p. Carbon Dioxide: + / - 50 ppm
    q. Electrical: + / - 5 percent of reading

1.5 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator work station equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices. Contractor’s detailed installation drawings will not be accepted in lieu of schematic flow diagrams.
3. Wiring Diagrams: Power, signal, and control wiring.

4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Schedule of dampers including size, leakage, flow characteristics, and normal positions.
7. Schedule of valves including flow characteristics and normal positions.
8. All data sheets shall indicate accessories and options included.
9. DDC System Hardware:

    a. Wiring diagrams for control units with termination numbers.
    b. Schematic diagrams and floor plans for field sensors and control hardware.
    c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator work station and control unit locations.

10. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
11. Controlled Systems:

    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Written description of sequence of operation including schematic diagram.
    c. Points list.

C. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC work stations and control systems.

D. Qualification Data: For Installer and manufacturer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Maintenance instructions and lists of spare parts for each type of control device.
2. Index sheet, listing contents in alphabetical order.
3. Manufacturer's equipment parts list of all functional components of the system, Auto-CAD disk of system schematics, including wiring diagrams.
4. Description of Sequence of Operations.
5. As-built interconnection wiring diagrams.
6. Operator's manuals.
7. Trunk cable schematic showing all remote electronic panel locations, and all trunk data wiring runs.
8. All commissioning documentation specified herein.
9. Copies of all graphic screens.
10. Keyboard illustrations and step-by-step procedures indexed for each operator function.
11. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

12. Calibration records and list of set points.

G. Per submittal process, full point names must be submitted. All point names must adhere to SI point naming conventions for points, panels programs, equipment controllers and graphics.

H. Obtain latest revision of SI BAS naming convention from Smithsonian System Engineering Division (SED).

1. Smithsonian Point Naming.xlsx

1.6 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire system for a period of one year after acceptance. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.

B. The on-line support services shall allow the system supplier to remotely connect using Citrix using a token to monitor and control the facility's building automation system. This remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.

C. If the problem cannot be resolved on-line by the local office, the national office of the building automation system manufacturer shall have the same capabilities for remote connection to the facility. If the problem cannot be resolved with on-line support services, the system supplier shall dispatch the appropriate personnel to the job site to resolve the problem within 4 hours of the time that the problem is reported.

1.7 QUALITY ASSURANCE

A. Installer Qualifications

1. Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
2. The system shall be installed, commissioned, and serviced by manufacturer employed, factory trained personnel.
3. Installer of control system shall have a branch office within 50 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.
4. A minimum of 5 years’ experience installing systems of similar complexity, size and scope.

B. Manufacturer's Qualifications

1. Acceptable Manufacturers:

a. Siemens Industry, Inc., Beltsville Branch Office.
b. Office # (301) 837-2600

2. At least 20 years’ experience manufacturing control components and systems.
3. A single unified control software package with advanced graphics capabilities that has been in use for 10 or more years and is still fully supported (including revisions and upgrades).

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at project completion.

1.9 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate location of control panels, dampers, valves, and devices such that clearance can be maintained for proper access to all components.

C. Coordinate equipment and wiring with DIVISION 26 requirements to achieve compatibility of communication interfaces, drives, motor starters and annunciation devices.

D. Coordinate equipment with DIVISION 28 to achieve compatibility with equipment that interfaces with Fire Alarm system.

E. Coordinate and assist Testing, Adjusting and Balancing (TAB) Contractor with proper set up and operation of HVAC Systems.

F. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in DIVISION 03 Section "Cast-in-Place Concrete."

G. The minimum quantity of DDC/ATC panels are located on the contract documents. Provide additional panels as required. All panel locations must be approved by the Smithsonian Institute and COTR and coordinated with all trades prior to installation. If approval and/or coordination are not completed, then panels shall be relocated at no cost to Smithsonian Institute.

H. Do not locate DDC panels above ceilings. Panels shall be located in mechanical rooms or in equipment systems rooms.

I. Automatic Temperature Control (ATC) valves and thermowells furnished by Control Contractor shall be installed by DIVISION 23 Contractor under the supervision of Control Contractor.

J. Combination fire/smoke and smoke dampers in ducts with electric motors will be provided by Contractor as specified in Section 233300. Control Contractor shall wire electric motors.

K. Smoke detectors in ducts and at air handling units shall be wired into the Fire Alarm System by Division 28. Required power for those smoke detectors shall also be provided by Division 28. Provide wiring from smoke detectors/interface modules to respective air handling unit(s) and fan(s) for shutdown in the event of smoke conditions. Contractor for Section 233000 will install detectors in ductwork where shown or where required.

L. Comply with all requirements of specification sections 011900 TAB FOR HVAC and 019113 COMMISSIONING requirements. Furnish by contractors for specification sections 019100 and 019113 approved temperature control technical data and shop drawings, information relating to changes or revisions in work, and all other information required for proper balancing, adjusting and commissioning of systems.

M. Coordinate duct mounted static probes with specification section 233000 DUCTWORK AND DUCTWORK ACCESSORIES.

N. BAS Contractor shall be responsible to coordinate quantity and locations of wall and floor penetrations. Refer to DIVISION 07.

O. BAS Contractor provide all power wiring and devices required for electric/electronic operators/actuators.

P. BAS Contractor provide air volume (constant or variable) box controls. Furnish control valves for field installation and provide additional wiring as required for a complete installation.

Q. All deviations from specifications shall be documented separately. Obtain approval for deviations prior to fabrication or installation. All issues shall be reviewed.

R. All mechanical equipment sent with loose controls shall be mounted and wired by DIVISION 25 (DIVISION 23).

S. BAS Contractor shall provide all conduit, trays, etc. required for power and control wiring to his devices.

T. Control Contractor shall interlock fans or pumps through hard wiring where indicated on contract documents; software interlocks shall not be acceptable.

U. Coordinate equipment with DIVISION 26 “Network Lighting Controls” to achieve compatibility with equipment that interfaces with that system.

V. Provide communications interface with equipment furnished with factory microprocessor controls such as variable frequency drives, chillers, boilers, etc. as required by the contract documents.

PART 2 - PRODUCTS

2.1 CONTROL SYSTEM

A. Acceptable Manufacturers: Provide system by the following:

1. Installer/Manufacturer: Siemens Industry, Inc., Beltsville Branch Office.
2. OFFICE # (301) 837-2600.

B. Provide a direct digital control (DDC) system consisting of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems and to perform functions as specified.

C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator work station permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

D. Provide extension of existing FMCS consisting of sensors, controllers, indicating devices, interface equipment, other apparatus, and accessories to operate mechanical equipment and to perform functions as specified.

E. Provide all materials and field work necessary for a complete system.

F. Provide electric operator for each damper and valve to be controlled, unless one is specified elsewhere.

G. Unless specified otherwise, provide proportional/integral/inverse derivative components for variable air volume controls, proportional/integral components for air handling unit discharge control, and fully proportional/integral components elsewhere.

H. Actuator motors that respond to incremental "pulse" signals or do not fail to the specified position shall be acceptable as indicated.

I. Provide all electrical wiring, communication cabling, relays or other devices for interlocking of equipment as described in Sequence of Operations or as shown on drawings.

J. DDC system shall be capable of operating in environmental conditions of 30 deg. F to 120 F and 10% RH to 90% RH non-condensing. Sensors and final control elements shall be capable of operating in environment in which they are installed.

K. Graphics: New global graphics to provide a user friendly interface to the new and existing detail graphics. Provide an overall riser diagram page which will allow instant access to new floor plan graphic pages, individual air handling units and central plants. An individual floor plan graphic will be provided for each floor of the building. The floor plan will show air handling zone layout and provide a link to the associated air handler graphic within each zone. Each space temperature available on the DDC system shall be interactively displayed on the floor plan. Provide sub-area graphics as required to fit all temperatures. All graphics that have a system or a piece of equipment shall have graphic links at the bottom linking to any system that is associated to that piece of equipment. Graphics shall use the standard backgrounds. All points shall be associated in the database to the graphic related to the piece of equipment. There will be a defined graphic for all FLN/MSTP devices. All points alarmed in the BAS not related to a fan, chiller, or other large system, shall be on a floor plan showing the location of the alarm.

L. All new hardware and software will be the latest model/version that is fully compatible with the existing FMCS.

M. Control System architecture and programing must be set up and configured in such a way so that network traffic associated with point / object sharing will be set up and configured to limit communication between panels to an absolute minimum.

N. All BACnet devices shall comply with SI BACnet configuration convention. This includes BACnet devices with or without a driver. The installer shall consult SI for the BACnet configuration convention to use.

2.2 DDC CONTROLLER INTEGRATION TO EXISTING BAS NETWORK

A. Once the new DDC controllers are commissioned, the BAS contractor shall make the physical connection to the existing FMCS network.

B. Once the tie-in is complete, the BAS contractor shall confirm communication with the FMCS Database Server located in National Museum of Natural History (NMNH) and Herndon Data Center (HDC).

C. Upload all data to the server.

D. Create graphics that represent the new systems, including but not limited to AHU layouts, navigation, screens, and room graphics.

E. Map all BAS alarmed points into the existing Remote Notification (RENO) software installed on the FMCS Database Server.

F. All alarms are to be managed by the Control Contractor through project completion.

G. All control devices that control a piece of equipment energized by an Emergency Power source need to be energized by the corresponding Emergency Power source.

H. Database Clean Up: When points are deleted from the database. All references to those points need to be removed.

I. Reports need to be run to find all references. Items include but are not limited to graphics, reports, programs, etc. A copy of the reports must be made available for SI before, during and after replacement and new construction.

J. Make safe and or remove existing controls and appurtenances of equipment indicated to be demolished in the mechanical demolition drawings including but not limited to DDC controllers, sensors, transducers, devices, etc.

2.3 ETHERNET COMMUNICATIONS AND EQUIPMENT

A. The DDC Controllers shall communicate via TCP/IP over Ethernet. The BAS contractor shall furnish and install cables and operator workstation(s) connected to the SI.EDU WAN.

1. The BAS contractor shall design the network to accommodate all the DDC Controllers and PC’s provided for the BAS system.
2. The BAS contractor shall coordinate: node names, IP addresses, access privileges, and system configuration with the Smithsonian Institute prior to startup.

3. Provide modular 8-pin, Category 6 information outlets at all DDC controllers. The cable shall be terminated inside the field panel at the information outlet. A patch cable shall be provided to connect the field panel to the information outlet.

    a. Do not exceed 328 ft. from the field panel to the nearest hub, router, switch, or signal repeater. This shall include the length of the patch cable between the information outlet and the field panel.
    b. All new Ethernet BLN networks shall be a minimum of Category 6 certified 1Gb Base-T Ethernet cable, for future expansion.
    c. Use plenum-certified Ethernet cable when run through a plenum.
    d. Ethernet cable shall only be buried in an insulated electrical tunnel. Ethernet wiring is not certified for direct burial.

2.4 DDC EQUIPMENT

A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator work station or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

    a. Global communications.
    b. Discrete/digital, analog, and pulse I/O.
    c. Monitoring, controlling, or addressing data points.
    d. Software applications, scheduling, and alarm processing.
    e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

3. Application Programs:

    a. Include control programs capable of performing functions as described in Sequence of Operations.
    b. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
    c. Remote communications.
    d. Units of Measure: Inch-pound and SI (metric).

B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator work station or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

    a. Global communications

b. Discrete/digital, analog, and pulse I/O
c. Monitoring, controlling, or addressing data points

C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Universal I/Os: Provide software selectable binary or analog outputs.

D. Power Supplies: Transformers with Class 2 current-limiting type or over-current protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-µs response time for 50 percent load changes.
3. Built-in over-voltage and over-current protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

E. Power Line Filtering: Internal or external transient voltage and surge suppression for work stations or controllers.

2.5 DDC CONTROLLERS

A. General

1. DDC controllers shall be capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
2. Configuration: diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72- hour battery backup.
3. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.

B. BAS system architecture to address DDC controller count to address the reliability of the facility project requirements. (At the Design Development submission AE shall define the level of reliability with System Engineering Division, and the building operators).

C. DDC controllers shall reside on a peer to peer network.

1. DDC controllers shall be a minimum of 16-bit stand-alone, multitasking, multiuser, real-time digital control processors.
2. Each primary networked DDC controller shall house a minimum of 32 MB RAM to support its own operating system, databases, and stand-alone software functions including:

    a. Control Processes
    b. Energy Management Applications.
    c. Alarm Management Applications including custom alarm messages for each level alarm for each point in the system.
    d. Historical/Trend data for points specified.
    e. Custom Processes.
    f. Operator I/O
    g. Remote Communications

3. DDC controllers shall provide a communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.
4. DDC controllers shall be provided with digital input and output LED status indication for visual confirmation of point conditions.
5. The operator shall have the ability to manually override automatic or centrally executed commands at the Networked DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
6. DDC Controllers shall be provided with communication ports for the control and monitoring of application specific controllers to coordinate control of major mechanical equipment with downstream terminal equipment.
7. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication to alert facility personnel of failure.
8. **(UPS required when a critical piece of equipment is on emergency power per project requirements)** In the event of the loss of normal power, there shall be an orderly shutdown of all DDC controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

    a. Upon restoration of normal power, the DDC controller shall automatically resume full operation, incorporating time delays to prevent surges, without manual intervention.
    b. Should DDC controller memory be lost for any reason, the user shall have the capability of reloading the DDC controller via the local communication port, via telephone line dial-in or from a network work station PC.

9. Controllers shall be provided with the capability to communicate TCP/IP directly over Ethernet, without the use of an external network interface card. Devices must:

    a. Auto-sense 10/100 Mbps networks.
    b. Receive an IP Address from a Dynamic Host configuration Protocol (DHCP) Server or be configured with a Fixed IP Address. (Smithsonian Institute shall provide IP addresses and relevant network information for each DDC controller provided under this specification.)

c. Resolve Name to IP Address for devices using a Domain Name Service (DNS) Server on the Ethernet network.

D. Each Application Specific Controller (ASC) shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multitasking, real-time digital control processor. Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device. All devices shall communicate using BACnet protocol or Siemens PI.

1. Provide for control of each piece of equipment, including, but not limited to, the following:

a. Air Volume Control Boxes (AVCB)

2.6 CONTROL PANELS

A. Provide panels of unitized cabinet type for each system.

B. Enclosure: Fabricate panels from 12 gauge steel or aluminum with baked enamel finish, with hinged key lock door and UL listing as NEMA 1. All panel locks shall be keyed alike.

C. Mount all relays, clocks, switches, transmitters and controllers within cabinet. Mount temperature indicators, pressure gauges, pilot lights, pushbuttons and switches flush on cabinet face.

D. Provide engraved plastic nameplates for instruments and controls inside cabinet and on cabinet face. Nameplates shall be white with black center core.

E. All Non Siemens field panels or 3RD party devices will be located under the panel where the control is being performed.

2.7 FIELD HARDWARE PANELS (FHP)

A. Provide field hardware panel whenever interfaces between field equipment and DDC panels are necessary. Devices such as transducers (current to pressure, pressure to current), relays, contactors, and other devices shall be labeled for quick identification.

B. Provide power from the same source as DDC panels.

C. Provide plastic engraved nameplates for instruments and controls inside cabinet and on cabinet face.

2.8 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:

1. Wire: Twisted, shielded-pair cable.
2. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
3. Averaging Elements in AHU/Ducts: Minimum 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.

4. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches
5. Room Sensor Cover Construction: Manufacturer's standard locking covers.

    a. Set-Point Adjustment: Exposed.
    b. Set-Point Indication: Exposed.
    c. Temperature Indication: Exposed Digital Display
    d. Color: Standard Orientation: Vertical.
    e. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

C. RTDs and Transmitters:

1. Wire: Twisted, shielded-pair cable.
2. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
3. Averaging Elements in Ducts: Minimum 8 feet in length; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.
4. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches; length as required.
5. Room Sensor Cover Construction: Manufacturer's standard locking covers.

    a. Set-Point Adjustment: Exposed.
    b. Set-Point Indication: Exposed.
    c. Temperature Indication: Exposed Digital Display
    d. Color: Standard Orientation: Vertical.
    e. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

D. Humidity Sensors: Bulk polymer sensor element. One percent full range with linear output; non-critical areas 2 percent full range with linear output. Due to the cost of the one percent sensors OPDC need to limit the use of sensors.

1. Acceptable Manufacturers:

    a. ROTRONIC Instrument Corp.
    b. Vaisala
    c. General Eastern

2. Accuracy: Critical areas 1 percent full range with linear output; non-critical areas 3 percent full range with linear output.
3. Room Sensor Range: 20 to 80 percent relative humidity.
4. Room Sensor Cover Construction: Manufacturer's standard locking covers.

    a. Set-Point Adjustment: Exposed
    b. Color: Standard.
    c. Orientation: Vertical

5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.

2.9 STATUS SENSORS

A. Current Switches

1. The current sensor shall be induce powered from the monitored load.
2. The current sensor shall provide on/off status indication of electrical loads from 1.5 to 200 amperes.
3. The selected switch shall match current VFD System output requirements.
4. The current sensor shall be capable of providing accurate status at temperatures from - 15° to 60°
5. The current sensor shall be isolated to 600 VAC rms.
6. The current sensor output shall be N.O. solid-state 1.0 ampere at 30 VAC/DC.
7. The current sensor shall be a self-gripping split-core type.
8. The current sensor shall detect drive belts slipping, breaking, or pump couplings shearing.

2.10 THERMOSTATS

A. Electric, solid-state, microcomputer-based room thermostat with remote sensor.

1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on every day of week.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:

    a. Time of day
    b. Actual room temperature
    c. Programmed temperature
    d. Programmed time
    e. Duration of timed override
    f. Day of week
    g. System mode indications include "heating," "off," "fan auto," and "fan on"

B. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod-and-tube, or averaging element.

2.11 HUMIDISTATS

A. Acceptable Manufacturers:

1. Vaisala
2. ROTRONIC Instrument Corp.

B. Duct-Mounted Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.12 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Division 23 Section "Electrical Requirements for HVAC Equipment."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Non-Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
5. Non-Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf. and breakaway torque of 300 in. x lbf.
6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Acceptable Manufacturers:

    a. Belimo Air Controls (USA), Inc.
    b. Siemens

2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
3. Dampers: Size for running torque calculated as follows:

    a. Parallel-Blade Damper with Edge Seals: 7 inch-lb. /sq. ft. of damper.
    b. Opposed-Blade Damper with Edge Seals: 5 inch-lb. /sq. ft. of damper.
    c. Parallel-Blade Damper without Edge Seals: 4 inch-lb. /sq. ft. of damper.
    d. Opposed-Blade Damper without Edge Seals: 3 inch-lb. /sq. ft. of damper.
    e. Dampers with 2- to 3-Inch wg. of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
    f. Dampers 3- to 4-Inch wg. of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
7. Power Requirements (Two-Position Spring Return): 24-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: - 22 to + 122 deg. F
11. Temperature Rating (Smoke Dampers): - 22 to + 250 deg. F
12. Run Time: 30 seconds open, 30 seconds closed.
13. Run Time (Smoke Dampers): 12 seconds open, 5 seconds closed

2.13 RELAYS AND CONTACTORS

A. General

1. Relays and contactors shall be manufactured and tested according to the latest applicable standards of the following agencies:

    a. NFPA 70 – National Electrical Code.
    b. CSA C22.2 No. 14, Industrial Control Equipment.
    c. NEMA ICS 2 – Controllers, Contactors and Overload Relays.
    d. NEMA ICS 5 – Control Circuit and Pilot Devices.
    e. NEMA ICS 6 – Enclosures for Industrial Controls and Systems.
    f. UL 508, Industrial Control Equipment.

2. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from potential damage from weather and construction operations. Store so condensation will not form on or in controller and if necessary, apply temporary heat where required to obtain suitable service conditions.
3. All contactors and relays shall be rated for continuous duty and for a minimum of 100,000 full load activations.
4. Relay and contactors shall be UL and cUL listed power control devices with a minimum AIC rating of 10,000A.
5. Relays and contactors shall be provided in dust proof enclosures.

B. Contactors

1. All contactors shall be NEMA rated general purpose contactors for single phase induction type motors rated up to 5 Hp @ 575 VAC.
2. NEMA ICS 2, AC general purpose Class A magnetic contactor for induction motors rated in horsepower. NOTE: Half sizes are not referenced in NEMA standards, but conform to specified regulatory requirements and shall be utilized where possible to reduce costs.
3. Provide two pole contactors for 2-wire loads and three pole for all 3-wire loads.
4. NEMA ICS 2, AC general purpose Class A magnetic contactor for induction motors rated in horsepower. NOTE: Half sizes are not referenced in NEMA standards, but conform to specified regulatory requirements and shall be utilized where possible to reduce costs.
5. Wiring: Straight-through wiring with all terminals clearly marked.
6. Enclosure: NEMA ICS 6, Type as required to meet conditions of installation.
7. Auxiliary Contacts: NEMA ICS 5 rated A600, two normally open and two normally closed contacts in addition to the seal-in contact.
8. Control Power Transformers: Provide fused primary and secondary and connect non-fused leg of secondary to enclosure.
9. Provide NEMA ICS 5 cover-mounted type or flange-mounted type indicating light based upon enclosure selection. Contacts shall be rated NEMA B600 for cover-mounted devices and NEMA A600 for flange-mounted 30mm devices.

C. Relays

1. Relays to be industrial grade DPDT or DP4T with LED status indicator.
2. Relay contacts to be NEMA rated for single phase induction type motors up to ½ HP @ 277V and for general use up to 10A @ 277V.

3. Relays located near control panels shall be plug-in type and shall be consolidated in a Field Hardware Panel. Relays shall be replaceable without tools or removing wiring.
4. Enclosed type relays may be used for terminal control applications.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that power supply is available to control units and operator work station.

B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.2 INSTALLATION

A. General

1. Install software in control units and operator work station(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
2. Connect and configure equipment and software to achieve sequence of operation specified.
3. Furnish automatic control dampers to Division 23 Section "Duct and Duct Accessories" for installation.
4. Install damper motors on outside of duct in tempered areas, not in locations exposed directly to outdoor temperatures.
5. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

B. Thermostats and Temperature Sensors

1. Verify location of thermostats and/or temperature sensors where shown on drawings and room interior elevations. Coordinate location with other wall mounted devices.
2. Install space thermostats and/or temperature sensors 60 inches (top of device) above finished floor.
3. Provide insulation pads for thermostats and/or temperature sensors mounted on exterior walls and columns.
4. Install averaging elements in ducts and plenums in serpentine, crossing or zigzag pattern across the area of duct or plenum in order to sense true average temperature. Secure averaging elements in such a manner as to prevent vibration from causing element fatigue.
5. Secure duct mounted sensors to ductwork in a vibration free area.
6. Furnish thermal wells for sensors to be installed in piping. Furnish extension necks where installed in insulated piping. Material for wells shall be compatible with material of piping where installed.

C. Humidistats and Humidity Sensors

1. Verify location of humidistats and/or humidity sensors where shown on drawings and room interior elevations. Coordinate location with other wall mounted devices.
2. Install space humidistats and/or humidity sensors 60 inches (top of device) above finished floor.
3. Secure duct mounted sensors to ductwork in a vibration free area.

D. Control Panels

1. Mount control panels adjacent to associated equipment either on walls or freestanding on steel supports. Mounting on ductwork or air handling units will not be permitted. Panels shall be free from vibration.
2. Panels shall be securely mounted with vertical and lateral bracing.

E. Current Switches

1. Shall be installed such that core is securely in place.
2. Shall be adjusted such that calibration trip point will detect drive belts slipping, breaking, or pump coupling shear.

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Provide signal and power wiring to all panels and devices furnished under the contract. Provide signal and safety device wiring to all equipment controlled under this contract.

B. Provide all interlock wiring between equipment being sequenced as required to accomplish the sequence of operations, which shall include supply and return air fans, exhaust fans, coil circulating pumps, chilled and condenser water pumps, cooling tower fans and chiller control panels, flow switches, etc.

C. Mount and wire all lose control components provided with packaged equipment.

D. Provide all required power wiring and conduit for all panels furnished by the contractor for the project. All BAS panels serving equipment connected to emergency power shall be circuited to the nearest emergency essential equipment panel. All other BAS panels shall be circuited to nearest normal power panel. Provide 20A single pole circuit breakers where required. Refer to electrical documents to ascertain exact location of nearest panel boards. Multiple panels may use same circuit within the electrical limitations. Indicate panel board name and circuit number for each panel on shop drawings.

E. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

F. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

G. Install signal and communication cable according to Division 26 Section "Communications Horizontal Cabling."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie-and-support conductors.

6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

H. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

1. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a BAS factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification by BAS Contractor:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.
10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
11. Check DDC system as follows:

a. Verify that DDC controller power supply is from emergency power supply, if applicable.

b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
c. Verify that spare I/O capacity has been provided.
d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.3 TESTING, ADJUSTING AND BALANCING

A. Testing, adjusting and balancing of air and water systems will be provided under Division 01“Testing, Adjusting and Balancing of HVAC Systems”.

B. Cooperate with testing, adjusting and balancing Contractor in coordination and scheduling of testing, balancing and adjusting work, as well as determining appropriate set point adjustments required for proper system operation.

C. Provide notice upon completion of all preparatory work and all initial operational testing required as part the Work. Perform additional operational testing on equipment, or systems, as directed and to extent and for duration deemed necessary, to demonstrate that systems are performing properly and delivering quantities in accordance with the requirements of the Contract Documents.

D. BAS Contractor shall set up and calibrate the mass flow control devices to the design contract values. BAS Contractor shall adjust the AVCB control so that final setup does not deviate more than + / - 5 percent from the design value.

E. BAS Contractor shall obtain static pressure readings from TAB Contractor at the various points in the system for programming and tuning final set point conditions.

3.4 COMMISSIONING

A. Commissioning will be provided as specified in Division 01 Section “Commissioning”. All contractors and subcontractors of the various sections of this specification shall cooperate and participate in the commissioning work in accordance with requirements of Division 01 Section “Commissioning”.

B. Ensure participation of major equipment manufacturers or their representatives.

C. Equipment and systems/subsystems installed under this section are expected to be in full compliance with the design intent at time of commissioning. Notify the Commissioning Agent when any specific piece of equipment or specific system/subsystem is ready for commissioning. Be prepared to demonstrate system readiness.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Smithsonian Institute 's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

B. Upon completion of all work and tests, operate systems for a sufficient length of time to demonstrate to COTR, mode of operation and definitively determine whether the system as a whole is in first class working condition. Before systems are turned over to Smithsonian Institute, a final demonstration test of 48 continuous hours, during which systems shall operate without adjustment, shall be performed.

C. Before installation is accepted, provide certification to Smithsonian Institute and COTR that control system and equipment have been inspected and found to be properly installed and functioning satisfactorily.

END OF SECTION 230923

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. HVAC metal supply, return, and exhaust ductwork and plenums in pressure classes from -2 to +10 inches w.g. (-500 to +2490 Pa).

B. Shop-fabricated or factory-fabricated ducts and fittings: Single-wall round duct.

C. Joint and sealing materials.

D. Air duct leakage testing.

E. Cleaning of existing duct systems.

1.2 RELATED SECTIONS

A. Duct identification: Section 230500.

B. Firestopping: Division 07.

C. Balancing: Section 230593.

D. Insulation: Section 230713.

E. Duct hanging: Section 233114.

F. Duct accessories: Section 233300.

1.3 REFERENCES

A. ACGIH-01: American Conference of Governmental Industrial Hygienists

1. Industrial Ventilation: A Manual of Recommended Practice.

B. ASHRAE

1. ASHRAE Handbook of Fundamentals.

C. ASTM

1. ASTM C 423: Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
2. ASTM C 1071: Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
3. ASTM D 1330: Rubber Sheet Gaskets.
4. ASTM E2336: Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
5. ASTM G 21: Determining Resistance of Synthetic Polymeric Materials to Fungi.
6. ASTM G 22: Determining Resistance of Synthetic Polymeric Materials to Bacteria.

D. SMACNA

1. HVAC DCS: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
2. RIDCS: SMACNA Round Industrial Duct Construction Standards.
3. HVAC Air Duct Leakage Test Manual.

E. UL 181: Factory-Made Air Ducts and Air Connectors.

1.4 DEFINITIONS

A. Seam: Joining of two longitudinal (parallel to the direction of airflow) edges of duct surface material. All other duct surface connections are joints.

B. Joints: Transverse joints (perpendicular to the direction of airflow); branch and subbranch intersections; duct collar tap-ins; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Do not change the layout or configuration of the duct system except as specifically approved in writing. Accompany requests for modifications with calculations showing that the proposed design will provide the original design results without increasing system total pressure.

1.6 SUBMITTALS

A. Shop drawings:

1. Schedule of duct systems with applicable pressure classes and leakage classes.
2. Fabrication, assembly, and installation for each duct system: Indicate duct dimensions, sheet metal thickness, reinforcement spacing, and seam and joint construction; and components and attachments to other work.
3. Calculations required as specified in the article “System Performance Requirements” above.
4. Include layout drawings for the entire ductwork system, drawn at the same scale as the contract drawings, except no smaller than 0.125 inch equals one foot.
5. Schedule of sealing methods for each type of seam and joint.

B. Product data:

1. Acoustical duct lining, adhesive, and sealants.
2. Factory-fabricated ducts and fittings.
3. Joint and sealing materials.
4. Manufacturer’s installation instructions.

C. Test reports: Air Duct Leakage Test Summary: Submit data on forms as indicated in the SMACNA HVAC Duct Leakage Test Manual. (See sample form at end of section.)

1.7 QUALITY ASSURANCE

A. Specified and scheduled duct construction exceeds SMACNA requirements. Comply with specifications and schedules, and for materials or methods not specified or scheduled, comply with SMACNA HVAC DCS and RIDCS.

B. Comply with NFPA 90A and 90B.

C. Where shop-fabricated ductwork and fittings are permitted, products shall meet or exceed the quality of material, quality of construction, and performance of the basis of design factory-fabricated product.

D. Where shop-fabricated ductwork and fittings are proposed, contractor shall provide a listing of ten comparable projects completed within the last five years using shop-fabricated ductwork and fittings of the type proposed as evidence of quality and performance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design products: Subject to compliance with requirements, provide specified or noted products, or comparable product by one of the following:

1. Factory-fabricated ducts and fittings:

   a. Eastern Sheet Metal
   b. Hamlin Sheet Metal
   c. LaPine Metal Products
   d. Linx Industries
   e. McGill Airflow Corp.
   f. MKT Metal Manufacturing
   g. Phoenix Metals
   h. Semco Mfg. Inc.
   i. SPIRAmir

2. Manufactured joint connectors:

   a. Ductmate Industries
   b. C.L. Ward & Family Inc.

B. Special use ducts and fittings: Scheduled manufacturers and named products are intended to set a standard for materials, quality of construction, and performance.

2.2 MATERIALS

A. Metal sheets:

1. Galvanized steel sheets: Lock-forming quality, ASTM A 653/A 653M, coating designation G90 (Z275).

B. Tie rods: Galvanized steel, minimum diameter 0.25 inch (6 mm) for ducts up to 36 inches (900 mm); 0.375 inch (9 mm) for ducts over 36 inches (900 mm).

2.3 SHOP-FABRICATED OR FACTORY-FABRICATED DUCTS AND FITTINGS

A. Single-wall, rectangular duct and fittings:

1. Fabricate according to SMACNA HVAC DCS.

B. Single-wall, spiral round duct and fittings for concealed applications: Provide the following construction unless otherwise indicated for special applications,

1. Material: Galvanized steel.
2. Seams: Spiral lock seam.
3. Joint basis of design: Round fittings, McGill Airflow “Uni-Seal” fittings, lap and riveted/screwed and sealed.
4. Fittings for branch connections shall be conical type.
5. Centerline radius of elbows shall be 1.5 times the diameter.
6. Duct access door basis of design: Type AR-W.
7. Basis of Design: McGill Airflow “Uni-Seal” spiral duct with “Uni-form” fittings.

2.4 JOINT AND SEALING MATERIALS

A. Flexible joint material for connections to vibrating equipment: Specified in Section 233300, Duct Accessories.

B. Duct joint and seam sealants: UL classified, fire-resistive, conforming to NFPA 90A and 90B, high pressure type (up to 10 inches (2490 Pa) SMACNA pressure class), the following products are the basis of design:

1. Indoor application: Hardcast “Iron Grip” (IG-601) brush-on water-based vinyl acrylic sealing mastic.
2. Silicone sealant (clear): Dow Corning 795, ASTM C920, Type S, Grade NS, Class 25, single component, indoor/outdoor application, UV resistive.
3. Flange gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

PART 3 - EXECUTION

3.1 COORDINATION

A. Before fabricating ductwork, make field measurements and coordinate layout of ductwork shown on the drawings with building components and work of other trades. Resolve conflicts and obtain written approval for deviations before fabrication or buying ductwork.

B. Provide for and install control dampers, manual volume dampers, thermometers, coils, sound attenuators, duct accessories and similar equipment furnished under this or other sections of the specifications.

C. Coordination with other work:

1. Wall, partition, ceiling penetrations:

a. Penetrations with fire dampers, smoke dampers, or fire/smoke dampers: Connect ductwork to the damper in accordance with the damper listing after the damper installation is complete. Do not install the ductwork through the wall.
b. Penetrations with fire dampers, smoke dampers, or fire/smoke dampers:

1. Fill void between the architectural element and the duct with mineral wool.
2. Provide metal trim angles around the perimeter of the rectangular duct.
3. Provide a slip on flange around the perimeter of round or flat oval ducts.

2. Electrical panels and equipment:

a. Do not install ductwork over electrical panels and equipment unless otherwise indicated.
b. Where ductwork must be installed over electrical panels and equipment, provide aluminum sheet metal drain troughs under piping with drains piped to a safe location.

3. Accessories with frames: Where ATC dampers and other accessories with frames are mounted in ductwork, connect ductwork to frames in a manner to provide 100 percent free area for air passage. Seal ductwork connections to frames with gaskets or duct sealant. Secure connections with pop rivets or sheet metal screws spaced no more than 3 inches (75 mm) on centers around both sides of entire frame.

3.2 INSTALLING METAL DUCTWORK

A. Dimensions indicated on drawings are outer dimensions of ducts. Dimensions indicated for double-wall ducts are outer dimensions of outer wall.

B. Construct ductwork using the Duct Construction Schedule on the drawings. Schedule includes duct system pressure class requirements, minimum sheet metal gauges, leakage allowances, and maximum reinforcement spacing. These requirements exceed the requirements of SMACNA HVAC DCS. Engineered duct systems using metal gauges or reinforcing less than required in the schedules on the drawings are not acceptable.

C. Material: Construct ductwork of galvanized steel, except where another material is noted on drawings or specified.

D. Joints: Provide one of the following duct joints, except where other criteria are noted on the drawings or specified. Snap-lock or flat-lock seams are not acceptable.

1. Joint connections constructed in accordance with SMACNA HVAC DCS,
2. Manufactured duct connection system basis of design: Ductmate Industries “Ductmate,” selected to assure compliance with leakage factors indicated on the drawings.

E. Where specific materials and seam and joint construction are specified for a specific application, all ductwork carrying any concentration of air for that application, no matter how dilute, shall be constructed according to the requirements of the application.

F. Provide duct systems complete with built-in accessories as specified herein, in other sections of the specifications, as indicated on the drawings, and, where not otherwise indicated, in accordance with SMACNA HVAC DCS.

G. Thoroughly clean duct and duct fittings before they are installed, and keep them clean until the acceptance of the completed work. Use a duct cap cover on all unfinished ends to prevent moisture, dirt particles, dust, and debris from entering the installed ductwork during construction.

H. Install metal ductwork neat in appearance. Interior surfaces shall be smooth and free of obstructions. Duct lines shall be true and smooth.

I. Contractor has the option to eliminate reducing transitions and extend ductwork full size, providing space is available and conflict with work of other trades does not occur.

J. Make bends and turns in ductwork using offsets and curved or square elbows as indicated on the drawings. Provide full radius elbows (centerline radius equals 1.5 times duct width). Provide turning vanes in square elbows. Make 90-degree branch duct connections using 45-degree entry fittings unless otherwise indicated.

K. Generally, it is intended that horizontal ductwork be a minimum of 10 inches (255 mm) above suspended ceiling (where applicable) to allow removal of ceiling panels and ceiling-mounted light fixtures and devices. Coordinate duct installation to achieve that clearance wherever possible.

L. Unless otherwise indicated, exposed ductwork shall be mounted as high as possible.

M. Brace large ductwork connected to fans and air handling units with metal angles to prevent vibration and duct damage, and to reduce noise.

N. Construct gravity duct systems (nonfan-powered), such as pressure relief ducts and transfer ducts, in accordance with SMACNA HVAC DCS minimum one inch pressure class unless otherwise scheduled.

O. Cross break or bead ducts of dimensions of 12 inches (305 mm) and over in pressure classes under 2 inches (500 Pa).

P. Where ducts will be exposed, remove labels and clean surfaces. Where required, prepare surface for painting.

Q. Single-wall plenums, casings, and access doors: Construct in accordance with SMACNA HVAC DCS.

3.3 INSTALLING ROUND DUCT

A. Provide round single-wall ductwork where indicated on plans.

B. Assemble spiral round ducts and fittings using duct sealant and sheet metal screws as recommended by the manufacturer.

C. Single-wall ductwork:

1. Pressure class 3.0 inches w.g. or greater: Spiral round duct and fittings unless otherwise indicated.
2. Serving other than a single diffusers: Spiral round duct and fittings unless otherwise indicated.

3.4 SEALING DUCTWORK

A. Seal all longitudinal and transverse joints, seams, and connections with the following exceptions:

1. Sealant may be omitted from welded joints and seams provided duct leakage is within the required tolerance.
2. Sealant may be omitted from locking-type joints and seams (other than snap-lock and button-lock) in ductwork with a pressure class below 2 inches of water column (500 Pa) where permitted by code requirements and provided duct leakage is within the required tolerance.

B. Sealing leakage performance: Seal ductwork to meet duct leakage factors scheduled on the drawings.

C. Sealing procedures:

1. Prior to sealing, ductwork shall be clean and dry, free of oil or grease.
2. Apply sealant in accordance with the manufacturer's recommendations.
3. Allow time for sealant to dry or cure, in accordance with manufacturer's recommendations, before leak testing.

D. Sealant material:

1. Galvanized steel ductwork: Brush-on or pressure sensitive sealant, as applicable.

3.5 AIR DUCT LEAKAGE TESTS

A. Continuously examine ductwork during construction to ascertain that it is sealed properly.

B. General test procedures:

1. Leakage test procedures shall be in accordance with SMACNA Leakage Test Manual.
2. After installation and prior to insulating, test all ductwork for air leakage. Ducts to be tested, test pressures, and leakage factors (maximum volume of leakage per 100 square foot (9.3 square meter) of duct surface area) shall be as scheduled on the drawings.
3. The ductwork quantity to be tested exceeds SMACNA leakage test manual recommendations.
4. Conduct tests before any equipment is connected that would be subject to damage from the test pressure. Provide temporary blank-offs or caps.
5. Notify parties whose presence is necessary for the test; and in all cases, the COTR and testing and balancing subcontractor in writing at least two normal work days prior to the actual test.
6. While system is under test pressure, survey joints for audible leaks. Mark leakage points, shut down blower, and make repairs. Retest after duct sealant has dried or cured.
7. If test duct sections exceed the allotted leakage levels, locate sources of leakage, make repairs and repeat test procedures until acceptable leakage levels are demonstrated.

END OF SECTION 233113
Leakage test form follows Section

PROJECT NAME _____ PROJECT NO. _____ PAGE _____ OF _____

AIR DUCT LEAKAGE TEST SUMMARY

AIR SYSTEM _____ LEAKAGE CLASS (GL)_____

FAN CFM (Q) _____ SPECIFIED TEST PRESSURE (Pt)_____

DUCT CONSTRUCTION PRESSURE CLASS (P_c)_____

DESIGN DATA				FIELD TEST DATA RECORD							
SUBJECT DUCT	SURFACE AREA (FT^2)	ALLOWABLE LEAKAGE		DIAMETER		PRESSURE "W.G."		DATE	PERFORMED BY	WITNESSED BY	ACTUAL CFM
		FACTOR (CFM/100 FT^2)	CFM (TEST SECTION)	ORIFICE	TUBE	DUCT	ACROSS ORIFICE				
TOTAL SYSTEM											
TEST SECTION(S)											

SECTION 233114 - HANGERS AND SUPPORTS FOR DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct hangers and supports.

B. Trapeze duct hangers.

C. Metal framing systems.

D. Fasteners.

1.2 RELATED SECTIONS

A. HVAC Duct Insulation: Section 230713.

1.3 REFERENCES

A. ASTM International

1. ASTM A 307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
2. ASTM A 492: Standard Specification for Stainless Steel Rope Wire
3. ASTM A 603: Standard Specification for Metallic-Coated Steel Structural Wire Rope
4. ASTM F 3125: Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated

B. American Welding Society

1. AWS-D.1.1: Structural Welding – Steel

C. Metal Framing Manufacturer’s Association

1. MFMA-4: Metal Framing Standards Publication
2. MFMA-103: Guidelines for the Use of Metal Framing

D. Manufacturer’s Standardization Society

1. MSS SP-58: Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

E. SMACNA

1. HVAC Duct Construction Standards - Metal and Flexible

1.4 SUBMITTALS

A. Product data:

1. Provide manufacturer's literature showing compliance with specifications for each type of framing system, fastener and accessory materials.
2. Provide a schedule of building attachment types and associated attachment hardware and methods.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Metal framing systems:

1. Anvil International
2. PHD Manufacturing, Inc.
3. PHP Systems/Design
4. Unistrut

2.2 HANGERS AND SUPPORTS

A. General: Comply with requirements of SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

B. Threaded rod: Continuously threaded, size and spacing in compliance with SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

1. Zinc-plated or galvanized carbon steel for indoor applications.

C. Nuts and washers: Provide the same material used for threaded rods.

D. Straps: Match duct material, size and spacing in compliance with SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

E. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

F. Metal framing systems:

1. Description: Shop- or field-fabricated, duct-support assembly made of channels, nuts, bolts, structural connections, accessories, fittings, and other manufactured components including brackets and braces required to resist lateral loads.
2. Standard: Comply with MFMA-4 for factory-fabricated components for field assembly.
3. Channels: Continuous slotted steel channel with inturned lips, width selected for applicable load criteria.
4. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Zinc-plated or galvanized carbon steel for indoor applications.

G. Duct attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Guying and bracing materials:

1. Provide galvanized steel cable and guying tensioners and/or galvanized steel angle to provide any required guying and bracing where forces on exterior ductwork are beyond the capability of the associated metal framing system and its attachment to structure.

2.3 FASTENERS

A. Mechanical expansion anchors:

1. Self-drilling type expansion shields or machine bolt drop-in anchors for drilled holes. Fasteners to floor slabs shall be vibration and shock resistant. Load applied to fasteners shall not exceed 25 percent of manufacturer's stated load capacity in 3500 psi (24,000 kPa) concrete. Provide zinc-coated anchors for indoor applications and stainless-steel anchors for outdoor applications.
2. Basis of design: ITT Phillips Anchors "Red Head."

B. Bolts, nuts, and washers: ASTM A 307, or ASTM F 3125 where high strength is required.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

B. Provide hangers, supports, fasteners, and attachments as required to properly support ductwork from the building structure.

C. Provide supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Hanger Spacing: Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible for maximum hanger spacing. Provide hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1220 mm) of each branch intersection.

E. Where required, provide structural steel shapes or metal framing system channels and hardware to transfer load from a support location to multiple locations in the structure in order to get support from an appropriate location or to increase the strength of the connection to the structure.

F. Support horizontal rectangular ductwork from above with trapeze hangers and threaded rod or straps where possible, unless otherwise indicated.

1. Ducts 54 inches (1370 mm) wide and under:

a. Support with trapeze hangers or straps.
b. Strap hangers, where used, shall extend down sides of ducts and attach to underside with at least two sheet metal screws per strap.

G. Fabricate wall-mounted and floor-mounted supports using metal framing systems or structural steel where required.

H. Trim threaded rods with a maximum excess length of 1 inch (25 mm). Provide protective rubber red end caps on the ends of threaded rods exposed and within 8 feet (2.4 meters) of the floor, roof, or grade below.

I. Install lateral bracing to prevent swaying.

J. Install supports so that duct loads not be transmitted to connected equipment.

K. Provide trapeze hangers where required to hang ductwork using threaded rod.

1. Weld steel according to AWS D-1.1.
2. Hang with threaded rods.
3. Design trapeze angers and supports based on supported load plus a 50 percent minimum safety factor.

L. Where ductwork is exposed, hang ductwork as follows:

1. Rectangular ductwork:

a. Provide trapeze supports.
b. Provide straps where duct dimensions allow.

3.2 BUILDING ATTACHMENTS

A. Attaching to structural walls:

1. Provide a minimum of two 0.375 inch (9.5 mm) minimum screw-type fasteners for attaching brackets and a minimum of three 0.5 inch (13 mm) minimum bolt-type fasteners for attaching structural supports.

B. Attaching to structural steel beams, channels, or angles:

1. Secure threaded rods to MSS SP-58 Type 20 adjustable beam clamps that are clamped to the bottom flange of steel beams.
2. Secure threaded rods to MSS SP-58 Type 23 beam clamps for beams with maximum flange thickness of 0.75 inch (19 mm).

C. Attaching to concrete slabs and composite slabs:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting ductwork from concrete slabs or composite slabs. Where approved, provide one of the following as required:

a. Mechanical expansion anchors and steel bolts or rods.
b. Screws designed for attachment to concrete.
c. Powder actuated fasteners.

END OF SECTION 233114

SECTION 233300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Volume extractors.

B. Air turning vanes.

C. Spin-in fittings.

D. Duct access doors.

E. Dampers.

F. Duct clamps.

1.2 RELATED SECTIONS

A. Access doors: Division 08.

B. Diffusers, registers, and grilles: Section 233713.

1.3 REFERENCES

A. AMCA 210: Laboratory Methods of Testing Fans for Rating.

B. ASTM E 477: Test for Measurement of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

C. ASTM E 2016: Standard Specification for Industrial Woven Wire Cloth.

D. NFPA 90A: Installation of Air Conditioning and Ventilating System.

E. NFPA 90B: Installation of Warm Air Heating and Air-Conditioning Systems.

F. NFPA 701: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

G. SMACNA-05: Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems.

H. SMACNA HVAC DCS: HVAC Duct Construction Standards, Metal and Flexible.

1.4 SUBMITTALS

A. Product data: Each type of duct accessory included in the project.

1. Include manufacturer's written installation instructions for each type of fire damper, combination fire/smoke damper, and smoke damper.

B. Certifications: Certified test data for dynamic insertion loss; sound power levels; airflow performance data, and static pressure loss.

1.5 QUALITY ASSURANCE

A. Work of this section shall comply with NFPA 90A and 90B, and SMACNA HVAC DCS.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers' names and specific products are described in the articles below to set a standard for materials, quality of construction, options and details, and performance. Provide named products, or equal products by other named manufacturers.

2.2 MANUFACTURED UNITS

A. Volume extractors: Equal to Hart & Cooley "Vectrol" Type AVLR, with the equal to Young Regulator Co. No. 429 FD end bearing and No. 443-B 3/8-inch operator; or Type VLK, with worm-driven mechanism accessible through face of diffuser or grille with an 18-inch-long removable key operator.

B. Air turning vanes: Double vane type, constructed in accordance with SMACNA HVAC DCS, from the same material as the duct.

C. Spin-in fittings in accordance with SMACNA HVAC DCS are acceptable for a round take-off connection from a rectangular duct, provided they meet the duct pressure classification.

2.3 DUCT ACCESS DOORS

A. SMACNA standard construction. Access doors to fire protection devices shall comply with NFPA 90A.

B. Construction: Door and frame fabricated of 24 gauge galvanized steel, minimum size 16 inches (406 mm) by 16 inches (406 mm), or 16 inches (406 mm) by maximum duct size.

C. Door: Hinged with continuous piano hinge; number of cam latches to suit door size. Insulated doors shall be double pan construction, one inch (25 mm) thick with one inch (25 mm) thick minimum 3.5 pound (56 kg per cubic meter) density fiberglass insulation cut full to require forcing into the pan.

D. Gaskets: Continuous around perimeter, sealing frame to duct and door to frame, neoprene or foam rubber.

E. Basis of design:

1. Square or rectangular access doors: Air Balance, Inc., Model FSA-100-H or equal by Ruskin, Inc., Airstream Products Company, Inc., or Commercial Acoustics.
2. Round access doors: Ventfabrics "Ventlok Twist-In."

2.4 DAMPERS

A. Manual volume dampers:

1. 13 inches (330 mm) and larger in height: Balanced multi-louver, opposed-blade type with maximum blade width of 8 inches (205 mm), with corrosion resistant, molded synthetic sleeve type bearing and 0.375-inch (9.5-mm) square control shaft; and with damper regulators designed with 2-inch high base for mounting on externally insulated duct.

a. Basis of design:

(1) Damper: Ruskin Model MD 35.
(2) Regulator: Young Regulator Co. Model No. 443B-3/8.

2. 12 inches (305 mm) or less in height: Constructed from 16-gauge metal with hemmed edges, 0.375-inch (9.5-mm) square rod, damper regulator designed with 2-inch high base for mounting on externally insulated duct and end bearing.

a. Basis of design:

(1) Regulator: Young Regulator Co. Model No. 443B-3/8
(2) End bearing: Young Regulator Co. Model No.429 FD.

3. Provide locking regulators.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Duct accessories shall be mounted or installed properly in accordance with the manufacturer's instructions and as indicated on the drawings.

3.2 INSTALLING MANUFACTURED UNITS

A. Install necessary devices to balance the air flow to produce air quantities at outlets as indicated on the drawings.

B. Install turning vanes in 90-degree square elbows.

C. Install spin-in fittings as indicated on the drawings. Mechanically fasten to duct main with screws or rivets.

3.3 INSTALLING DUCT ACCESS DOORS

A. Install duct access doors in ductwork for access to fire dampers, combination fire/smoke dampers, smoke dampers, ATC dampers, duct coils, control devices, and any other devices, equipment, or components requiring maintenance, service, or adjustment and located inside ducts or adjacent equipment.

B. Provide OSHA-approved labels on doors enclosing fire protection devices. Labels shall have lettering at least 1/2 inch (13 mm) high describing the protection device enclosed.

3.4 INSTALLING DAMPERS

A. Install dampers at locations indicated on drawings and where required to properly balance the systems and to deliver the air quantities indicated. Each damper shall have substantial operators of proper size with locking facilities.

END OF SECTION 233300

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single-duct constant-volume terminal units.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. The terminal unit manufacturer shall install controllers and damper actuators furnished as specified in Section 230901, Automatic Temperature Control System.

B. Provide the automatic temperature control subcontractor with a description of the terminal units and requirements for coordinating with control system.

C. Provide wiring, tubing, and hardware components necessary to produce complete operational units, including transformer, inlet airflow pickup, and access to controls.

1.3 RELATED SECTIONS

A. Controls: Section 230923.

B. Balancing: Section 230593.

1.4 REFERENCES

A. UL 181: Factory-made Air Ducts and Air Connectors.

B. NFPA 90A: Installation of Air Conditioning and Ventilating Systems.

C. NFPA 90B: Warm Air Heating and Air Conditioning Systems.

D. ARI 880: Air Terminals.

1.5 PERFORMANCE REQUIREMENTS

A. Coordinate controls with the control manufacturer to affect specified unit performances and unit operation as required by the control sequences.

B. Coordinate with and assist balancing agency to perform tests specified in section, Testing and Balancing.

1.6 SUBMITTALS

A. Product data: Each type of terminal unit and each component.

B. Shop drawings:

1. Show complete dimensions of complete assembled unit with accessories.

2. Include schedule of units, showing performance data for each unit.
3. Include unattenuated (raw) sound power levels for each size unit, at specified rating conditions, for both radiated and discharge sound. Submit sound data with no corrections or noise reduction factors applied, at the airflow rates indicated on schedules at end of section.

C. Certifications: Factory certification that sound data required in "Shop Drawings" above have no corrections or noise reduction factors applied; or, if data do include such factors, guaranteeing that the equipment will meet the scheduled sound level requirements.

1.7 QUALITY ASSURANCE

A. Terminal units shall be certified and listed in the current ARI Directory of Certified Applied Air-Conditioning Products. Listed sound power levels shall show that units meet requirements scheduled at the end of this section.

B. UL label and local testing (if required): As specified in Section 230500, Common Work Results for HVAC.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Scheduled units are the basis for design of the project. The following listed manufacturers also provide units of acceptable quality. If units by any of these manufacturers should be proposed, verify that they meet requirements specified in Division 01 and the article "Product Options" in Section 230101, and submit product data and shop drawings as specified in the article "Submittals" above.

B. Single-duct units:

1. Environmental Technologies, A Corporation.
2. Krueger.
3. Metalaire.
4. Nailor Industries, Inc.
5. Price Company.
6. Titus-Environmental Elements Corporation.
7. Trane Company.

C. Drawings show duct connections, and size and arrangement of unit, based on configuration of design basis unit. Do not propose another manufacturer's unit, which cannot be made to fit in the space shown. Revise duct and pipe connections and other conditions as necessary to make another manufacturer's unit meet the project requirements, without addition to the Contract Sum.

2.2 MATERIALS

A. Sheet metal: Galvanized steel.

B. Fiber-free insulation: Elastomeric closed cell foam insulation shall comply with the following:

1. Insulation shall not absorb water.
2. UL 181: No mold growth, humidity, or erosion from airflow.

3. ASTM E84 or UL 723: Flame, 25; smoke spread, 50.
4. ASTM G21: No fungal growth.
5. NFPA 90A and 90B: Installation of insulation in HVAC units.
6. Minimum thickness: 0.375 inches at 1.5 lbs/cubic foot with an R-value of 1.5.

2.3 AIR TERMINAL UNITS, GENERAL

A. Terminal units shall be pressure-independent, each a complete factory-assembled unit, including automatic controls and the features specified or scheduled on the drawings.

B. Provide units of the types, sizes, and capacities scheduled on the drawings.

C. Sound power levels: ARI 880, certified and listed in ARI Applied Products Directory, and not exceeding the levels scheduled at the end of this section.

D. Casing: Not less than 22 gauge steel; airtight, leakage no more than two percent at 3.0 inches wg (747 Pa).

E. Duct connections: Round or oval duct collar for primary air connection and a single rectangular flanged connection for discharge.

F. Wiring: Completely factory-wired, UL tested and listed as a complete assembly, with a single-point power connection and single-point control connection. Include control transformers and a power disconnect switch.

G. Air control valve (damper): Constructed of minimum 22-gauge steel, bolted or welded to a continuous shaft which rotates in self-lubricating Delrin or bronze oilite bearings, closing against a closed-cell gasket. Units with multiple blades shall be in the opposed-blade configuration. Blade(s) shall not deflect at inlet pressures up to 6 inches wg. Maximum leakage shall not exceed 2 percent of maximum inlet rated airflow at 3 inches wg inlet pressure.

H. Averaging velocity sensor: Mount in the inlet of the fan terminal. Sensor shall provide a minimum of one air pickup point for each 2.5 inches of inlet diameter (single-point differential sensors are not acceptable). Provide taps for field measuring and balancing.

I. Air control valve (damper) actuator: Type required by the automatic temperature control system, capable of operating air control valve under system air pressures.

J. Controller: Shall maintain airflow setpoint within five percent regardless of system pressure change (airflow-limiting devices are not acceptable).

1. Capable of field adjustment of minimum and maximum airflow settings without the use of tools.
2. Constantly monitors space thermostat input, and terminal unit inlet pressure, through the averaging velocity sensor, to maintain space temperature setpoint.
3. Label: Flow curve for field balancing, affixed to casing.
4. Provide factory-set maximum and minimum airflows scheduled on the drawings.
5. Controller shall maintain pressure independence to as low as 0.03 inch wg pressure differential.

K. Heating element: Provide the following heating elements as scheduled:

1. Electric heating coil with proportional SCR control: Manufacturer's complete assembly, UL listed, housed in a cabinet of not less than 24-gauge galvanized steel, with hinged access door to heater controls.

a. Heating element: Nickle-chromium 80/20 wire with ceramic isolators.
b. Electrical connection: Single-point.
c. Label: Complete wiring diagram, power requirement, and kW output.
d. Heater controls: As required for safe operation and for compliance with NEC and UL requirements.

(1) Disconnect: Door interlock type that will not allow the door to open while energized.
(2) Primary automatic-reset high-temperature control: Disc type.
(3) Secondary high-limit control: Include replaceable fusible links.
(4) Airflow switch: Proof of flow; fan contactor is not acceptable.
(5) Controller will accept a low-voltage control signal to adjust heating coil output proportionately.

2.4 SINGLE-DUCT TERMINAL UNITS

A. Terminal units as specified above.

B. Controls: Include a fail-in-place primary air-control valve (damper) with actuator, controller, and devices necessary to accomplish the control sequence.

C. Control sequence: Terminal unit controls shall be placed in the occupied, unoccupied, cycles by input signals from building automation system. Provide compatibility with related sequences of operation shown on the drawings.

2.5 SOURCE QUALITY CONTROL

A. Factory test units to assure that they operate in accordance with the sequence specified.

B. Factory calibrate and adjust controls. Pre-set minimum and maximum airflow setpoints to the values scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install terminals as recommended by the manufacturer and as detailed on the drawings, suspended from overhead structure. Support terminals independently of ductwork.

B. Install units so that access doors or panels can be opened or removed conveniently.

3.2 OPERATING INSTRUCTIONS

A. As specified in Section 230500, provide operating instructions.

B. Provide at least 2 of additional instruction time for the equipment specified in this section, consisting of 1 period of 2 consecutive hours, during a period of not more than 60 days.

3.3 SCHEDULES

A. Terminals shall not exceed the scheduled sound power levels at the scheduled air flow rates when tested in accordance with ARI 880.

Single-Duct Air Terminals													
Nominal Inlet Size	Rated Air Flow CFM	Radiated Sound Power Level, dB Octave Band Center Frequency, Hz						Discharge Sound Power Level, dB Octave Band Center Frequency, Hz					
		125	250	500	1000	2000	4000	125	250	500	1000	2000	4000
4”	150	65	54	49	43	41	39	70	65	59	55	53	52
5”	250	63	53	48	44	38	38	70	66	60	58	53	49
6”	400	66	63	50	44	42	38	73	69	61	59	52	53
8”	700	67	57	52	46	45	44	70	70	64	61	57	55
10”	1100	72	57	53	48	45	43	78	70	65	61	57	54
12”	1600	71	62	58	51	46	43	75	71	67	62	60	59
14”	2100	77	61	55	50	50	48	76	71	68	64	60	59

END OF SECTION 233600

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Diffusers, registers, and grilles.

1.2 RELATED SECTIONS

A. Balancing: Section 230593.

1.3 REFERENCES

A. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.4 SUBMITTALS

A. Product data: Each type of diffuser, register and damper, and grille, including frames and accessories, and performance data.

1. Schedule, including size, location, function, and finish of each diffuser, register, and grille.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Grilles, registers and diffusers:

1. Hart and Cooley Inc.
2. Krueger.
3. Metalaire.
4. Nailor Industries, Inc.
5. Price Company.
6. Titus Products.

2.2 DIFFUSERS, REGISTERS, AND GRILLES

A. Devices of one of the named manufacturers, with performance data, characteristics, features, and accessories of the model or type specified or indicated on the drawings. Model numbers specified below are Krueger except as noted otherwise.

B. See architectural drawings for type of walls and ceilings where diffusers, grilles, and registers are required. Coordinate margin and frame of each device with the substrate in which it will be installed. Where devices are installed in suspended ceilings, assure that they will fit correctly in the type of suspension supports shown or specified.

C. Materials and finish:

1. Construction: Steel

2. Finish: Manufacturer's standard white enamel, suitable for final finish or for field painting, unless indicated otherwise.

D. Where narrow margin grilles and registers are specified or indicated on the drawings, they shall be provided with mounting frames except where mounted on ductwork.

2.3 SUPPLY DIFFUSERS

A. Throw length is based on performance data of the scheduled or specified manufacturer and model. Select units of other manufacturers whose performance data meet the required conditions. Throw direction of square and rectangular ceiling diffusers shall be four-way unless otherwise indicated on the drawings.

B. Round, adjustable diffuser with round neck:

1. Exposed duct, 360 degree discharge with infinitely field-adjustable vane settings for discharge pattern from vertical to horizontal, combination air extractor/damper and grid with concealed adjustment, duct-mounted straightening grid (shipped loose for field installation). Provide safety cables to inner cones to prevent from falling during removal.
2. Basis of design: Krueger Series RA2.

2.4 RETURN REGISTERS

A. Duct-mounted near floor:

1. Registers, heavy-duty steel construction, 14 gauge fixed horizontal face bars set at 30 to 40 degrees deflection, spaced on 0.5 to 0.7-inch (13 to 18-mm) centers, and 14 gauge vertical support bars on maximum 8-inch centers, minimum 1.25-inch (32-mm) margin.
2. Basis of design: Krueger S-480H-OBD.

PART 3 - EXECUTION

3.1 INSTALLING GRILLES, REGISTERS AND DIFFUSERS

A. Securely attach grilles, registers, and diffusers in place. Do not install the grilles and registers until duct interiors have been painted as specified in Section 230500, Common Work Results for HVAC.

B. Install all air control devices complete with the accessories specified, securely attached in position. Make operating devices accessible.

C. Adjust diffuser straightening grids to provide uniform air distribution above diffuser face.

END OF SECTION 233713

SECTION 234100 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Disposable filters.

B. Filter gauges.

1.2 REFERENCES

A. ASHRAE 52.2: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size, including Appendix J for MERV 'A' testing

B. ARI 850: Commercial and Industrial Air Filter Equipment.

1.3 DEFINITIONS

A. MERV: Minimum Efficiency Reporting Value as determined by ASHRAE 52.2 and Appendix J.

B. Temporary service: Operation of equipment during the construction period, before air balancing.

C. Regular Service: Operation of equipment during air balancing and normal use during occupancy.

1.4 SUBMITTALS

A. Product data: For filters, include filter ratings, rated flow capacity, and fire classification.

B. Closeout submittals: As required for Operating and Maintenance Manuals in Division 01 and Section 230101, provide a schedule of locations of filters, identifying equipment and filter types and sizes, including pre-filters and final filters.

1.5 QUALITY ASSURANCE

A. Provide all filters for regular service from a single manufacturer.

B. Test filters by methods described in ASHRAE 52.2 Appendix J.

C. Comply with ARI 850.

1.6 EXTRA MATERIALS

A. Provide 3 sets of permanent filters for every item of equipment requiring filters, as follows:

1. One set of filters for regular service, installed before air balancing.
2. Remaining set or sets of filters for regular service, provided as extra materials for future use.

B. Identify each filter with its name and intended location and use.

C. Provide filters and media in protective packaging, with identifying labels or markings.

D. Except as otherwise required in Division 01, deliver to location designated by COTR, and shelve or stack as directed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design products: Subject to compliance with requirements, provide specified or scheduled products, or comparable product by one of the following:

1. Filters and filter-holding systems:

a. AAF International.
b. Airguard; Clarcor Air Filtration Products
c. Camfil Farr
d. Filtration Group
e. Flanders Filters, Inc.

2. Filter Gauges:

a. Dwyer Instruments, Inc.
b. H.O. Trerice Co.
c. Miljoco Corporation
d. Weksler Instruments

2.2 FILTERS, GENERAL

A. Coordinate with approved manufacturers of the various approved air handling units and equipment for filter size and thickness required.

B. Thickness: Generally, large air handling units shall have filters 2 inches and more thick. Smaller units such as fan-coil units may be limited to filters 2 inches thick.

C. Filter face areas: As scheduled, or equivalent to one square foot for each 300 cfm.

D. Size and thickness: Size and thickness required for each application

2.3 DISPOSABLE FILTERS

A. Disposable filters, MERV 13:

1. Pleated media, 4-inch depth, disposable.
2. UL 900: Class 2.
3. Efficiency: ASHRAE 52.2 MERV 13.
4. Medium: Fine pleated glass media bonded to a beverage board holding frame.
5. Enclosing frame: High-wet-strength beverage board, with diagonal supports bonded to media pleats. Filter media continuously bonded to frame so that no air leaks around edges.
6. Initial resistance: 0.1 inches w.g. at 200 feet per minute.

7. Recommended maximum final resistance: 0.2 inch w.g.
8. Guaranteed structural integrity with a pressure drop of up to 5 inches w.g. (1.24 kPa).
9. Basis of design: Camfil “AP-Thirteen SC”.

2.4 FILTER GAUGE

A. Filter gauge:

1. Range 0 to 3 inches w.g. (0 to 0.75 kPa), with divisions of 0.10 inch (0.025 kPa).
2. Accessory package: To adapt the “Magnehelic” gauge for use as a filter gauge. Package includes aluminum surface-mounting bracket with screws, two 5-foot lengths of 0.25-inch aluminum tubing, two static pressure tips, and two molded plastic vent valves, with integral compression fittings on both tips and valves.
3. Basis of design: Dwyer “Magnehelic”, Series 2000.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. See schedules on drawings and equipment specification sections for filtration requirements.

3.2 TEMPORARY FILTERS

A. Before startup of each item of equipment requiring a filter, install filters for temporary service.

1. Provide filters for temporary service for equipment with a single filter and a rack for disposable filters.

B. Provide temporary filter changes required in Division 01 for Indoor Air Quality Management. Dispose of used filters.

C. Immediately prior to air balancing, remove temporary filters, wash any permanent washable filters, and install filters required for regular service.

3.3 INSTALLING FILTER GAUGE

A. Mount across filter section in accordance with manufacturer’s instructions.

END OF SECTION 234100

SECTION 260101 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for electrical work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

B. Commissioning requirements: Divisions 01 and 23.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 26.

B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for, all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Owner.

E. Electrical work of this project includes, as a brief general description, the following:

1. Demolition of existing systems in the project area.
2. Installation of new lighting and receptacles in the project area.
3. Electrical work associated with new mechanical systems to support the project area.
4. The project includes commissioning under the direction of a Commissioning Agent (CxA).
5. The project will be LEED certified.

F. See Division 01 for requirements related to Owner’s occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 26 specifications.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in article “Substitutions” below for substitutions.

C. Products specified by reference standards or by description only: Any product meeting those standards or description.

D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance, and shall not be construed as limiting competition. Contractor may use products of any manufacturer, which meet the specifications.

E. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 26 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project, and of representative manufacturer. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install

E. Materials and equipment shall be installed and completed in a first class and professional manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or professional appearance shall be removed and replaced with satisfactory work when so directed in writing by the COTR.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall artisanry.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the COTR will determine sizes to be utilized.

H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the COTR of said uncertainty, doubt, or conflict and obtain a decision as to the intent prior to initiating any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the COTR and await a written decision.

B. Plan and coordinate work to proceed in an orderly and continuous manner without undue delay, and in conformance with the project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate electrical work so that work of each trade is completed before other construction begins which would obstruct it.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of all raceway, luminaires, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the COTR prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractors' assistants shall include a competent electrical supervisor, who shall be on the premises at all times to check, layout, coordinate and superintend the installation of work. The supervisor shall establish all basic requirements relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for all equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of Shop Drawings and Product Data for every item of equipment. Shop drawings or product data will not be considered until Manufacturers' Lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.
2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.
3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.

4. All exclusively electrical items furnished as items associated with mechanical items but not specifically described in the mechanical item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the mechanical item by identified specification paragraph.
5. Product data sheets shall be 8.5-inches by 11-inches cut sheets for operating and maintenance manual.

C. Submit at least three copies of the results of every test required under any section in this division.

D. Specialist shall submit a list of at least three projects similar to this project in type, size, and quality, which have been in place and operating satisfactorily for at least five years.

1. Include project name, address, name and phone number of owner's representative, and project type and size.

E. After the work is completed, submit all required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the COTR prior to final acceptance of the work.

1.10 SPECIALIST

A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.11 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

a. Contract Drawings.
b. Specifications.
c. Addenda.
d. Change Orders and other Modifications to the Contract.
e. Reviewed shop drawings, product data, and samples.

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

a. Manufacturer's name and product model and number.
b. Product options, substitutions, or alternates utilized.
c. Changes made by addenda and modifications.

5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

    a. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
    b. Field changes of dimension and detail.
    c. Details not on original Contract Drawings.

6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Binders: Three-ring binders with vinyl-covered hard covers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
3. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. Print on spine of binder "O & M INSTRUCTIONS." If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.
4. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
5. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
6. Part 1: Directory, listing names, addresses, and telephone numbers of electrical engineers; contractor; electrical subcontractors; and major electrical equipment suppliers.
7. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria.
    b. List of equipment.
    c. Parts list for each component, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

8. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data.
    b. Photocopies of certificates.
    c. Photocopies of warranties, guarantees, and bonds.
    d. Test reports: Copies of the results of all tests required under all sections of specifications.
    e. Photocopies of each panelboard circuit directory or directories for each panelboard provided, including panel name, panel location, panel ratings, spare circuit breakers and spaces for additional circuit breakers.

9. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
10. Submit final volumes revised, within ten days after final inspection.

1.12 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The electrical, building, fire, and safety codes of the Smithsonian Institution.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Codes (NFPA).
4. International Building Code (IBC).
5. International Energy Conservation, Fire, and Electrical Codes (ICC).

1.13 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply.

1. Factory Mutual (FM)
2. Federal Specifications (FS)
3. American National Standards Institute (ANSI)
4. American Society for Testing and Materials (ASTM)
5. International Code Council (ICC)
6. Institute of Electrical and Electronics Engineers (IEEE)
7. National Electrical Code (NEC) (NFPA 70)
8. National Electrical Manufacturer’s Association (NEMA)
9. National Fire Protection Association (NFPA)
10. The Occupational Safety and Health Act (OSHA)
11. Underwriters Laboratory Inc. (UL)
12. American Association of State Highway and Transportation Officials (AASHTO)
13. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
14. Illuminating Engineering Society of North America (IESNA)

1.14 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

B. Area shall be maintained and shall be returned to original condition at the completion of the project.

C. Store electrical construction materials such as wire, raceways and boxes, devices, and equipment in buildings, enclosed trailers, or portable enclosed warehouses.

1. Materials and products subject to damage from moisture: Store in dry locations. If necessary, protect with protective wraps or covers.
2. Plastics and other materials and products subject to damage from heat or cold: Store at manufacturer's recommended temperatures.
3. Plastics and other materials and products subject to damage from sunlight: Protect from sunlight.

D. Electrical equipment such as motor controllers, panelboards and circuit breakers stored before installation and installed during construction: Provide clean, dry locations at manufacturer's recommended temperatures, and cover or wrap if required to protect from incidental damage.

1.15 PROTECTION

A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.
4. Construct dust partitions, where indicated on the drawings or as required.
5. Protect areas occupied by Owner's personnel or equipment.
6. Seal off all return air registers and other mechanical systems to prevent dust from entering.

B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

C. Repair all damage or soiling to the complete satisfaction of the COTR; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract sum.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer's recommended temperatures.

E. Protect electrical materials and products from weather events and accidents of construction.

F. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.16 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.17 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the COTR in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.18 WARRANTY

A. All work and equipment provided as work of this division shall be fully warranted under the general project warranty. In addition, provide added special warranties as specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the Owner. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the Owner and revise schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is one year after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Service reports for warranty work shall be provided to the Owner.

C. When use of the permanent equipment has been permitted for temporary services during construction of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.19 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractor's and subcontractors' responsibilities are described in Divisions 01 and 23.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of raceways. Close superfluous openings and remove all debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the COTR.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or COTR finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, COTR shall be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

3.4 COMMISSIONING

A. Comply with requirements of ‘Commissioning” in Part 1 above.

END OF SECTION 260101

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to work of more than one section of Division 26.

B. Basic material and equipment required for electrical work.

C. Date sensitive equipment.

D. Operating instructions.

E. Testing wiring systems.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 260101.

B. Operation and Maintenance Manuals: Division 01 and Section 260101.

C. Painting: Division 09.

D. Commissioning requirements: Division 01 and Division 23.

1.3 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

1.4 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed on the basis of using the particular manufacturers' products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.

2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that make their use impractical or cause functional fit, access, or connection problems.

1.5 SUBMITTALS

A. Test reports: Show that tests specified in Part 3 below demonstrate the specified results.

1.6 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the electrical, building, fire, and safety codes and regulations of the Smithsonian Institution.

B. Electrical control panels, equipment, materials and devices provided or installed as work of Division 26 shall bear UL label, or, if UL label is not available, the item shall be tested and labeled by a qualified testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70. Provide testing, if required, without addition to the contract sum.

C. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

D. Products shall contain no urea-formaldehyde content.

1.7 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractors' and subcontractors' responsibilities are described in Division 01 and Division 23.

PART 2 - PRODUCTS

2.1 GENERAL

A. Techniques, testing, and operating instructions specified in this section apply to products specified in other sections of Division 26.

B. Equipment that uses or processes date and time data in order to perform its function shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

2.2 DATE-SENSITIVE EQUIPMENT

A. Date-sensitive equipment: Systems, equipment, or components which use or process date and time data in order to perform their functions.

B. Each item of date-sensitive equipment used in the project shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

PART 3 - EXECUTION

3.1 GENERAL

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify COTR if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. The contract drawings are diagrammatic, and do not indicate all fittings or offsets in raceway or all pull boxes, access panels, or other specialties required. Provide required fittings, offsets, access panels, and specialties to coordinate the work.

C. No raceway shall be run below the head of a window or door.

D. Mounting heights for devices are to the center of the device unless otherwise indicated.

E. Comply with the Americans With Disabilities Act for maximum mounting heights.

F. Mounting heights for luminaires are to the bottom of the luminaire.

G. Equipment and raceways installed in areas without a suspended ceiling shall be as tight to structure as possible, but at least above a height of 6'-8", unless otherwise noted.

H. Items which require access for operation or maintenance shall be easily accessible. Do not cut or form hand holes for operation or maintenance of appliances through walls or ceilings.

3.2 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Install raceway exposed to view parallel with the lines of the building and as close to walls, columns, and ceilings as may be practical, maintaining adequate clearance for access at parts requiring servicing.

B. Install raceway a sufficient distance from other work to permit a clearance of not less than 13 mm (0.5 inch) between its finished covering and adjacent work.

C. Pull boxes and other appurtenances which require operation or maintenance shall be easily accessible. Do not cut or form handholes for operation or maintenance of appliances through walls or ceilings.

3.3 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish the necessary technicians, skilled workers, and helpers to operate the electrical systems and equipment of the entire project for one 8-hour day.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of systems and equipment.

1. Instructions by manufacturer's technical representative for each type of equipment shall include the performance of the recommended preventive maintenance procedures for that equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions for use by instructors and Owner personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon with the COTR.

3.4 TESTS

A. During the progress of the work and after completion, test the branch circuits and distribution system, and the low-voltage alarm and signal systems.

B. Results of the tests shall show that the wiring meets the requirements of this specification. Should any test indicate defect in materials or installation, immediately repair, or replace with new, the faulty installation, and retest the affected portions of the work.

C. Furnish equipment and instruments necessary for testing.

D. Tests shall demonstrate the following:

1. Lighting, power, and control circuits are continuous and free from short circuits.
2. Circuits are free from unspecified grounds.
3. The resistance to ground of each non-grounded circuit is not less than one megohm.
4. Circuits are properly connected in accordance with the applicable wiring diagrams.
5. Circuits are operable. Demonstration shall include functioning of each control not less than ten times, and continuous operation of each lighting and power circuit for not less than 0.5 hour.

E. Test circuit breakers larger than 100 amps at full voltage.

F. Make voltage built-up tests with a voltage sufficient to determine that no short circuits exist.

G. Immediately repair defects and retest until systems are operating correctly.

H. Submit test reports.

END OF SECTION 260500

SECTION 260504 - ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Extent and location of demolition are shown on the drawings.

B. Removal and disposal of PCB-containing fluorescent light ballasts.

C. Removal of fluorescent lamps without breaking them, and disposal to a recycler.

1.2 RELATED SECTIONS

A. Demolition: Division 02.

1.3 SUBMITTALS

A. Shop drawings: Demolition and removal procedures and schedules.

1. PCB disposal plan.

B. Certifications showing compliance with EPA and District of Columbia regulations for removal and disposal of PCB-containing lamp ballasts, including but not limited to:

1. Contractor’s generator identification number.
2. Hazardous waste manifests.
3. Certification of licensed hazardous waste hauler.
4. Certification of disposal facility.

C. Qualifications of fluorescent lamp recycler as required in the article “Quality Assurance” below.

D. Project record documents:

1. Record drawings.
2. For PCB removal, copies of completed required forms showing compliance with EPA requirements. Forms include, but are not limited to, records showing that the correctly identified hazardous material from this project has been properly transported, delivered, and accepted at the certified disposal facility.
3. For fluorescent lamp disposal, records demonstrating that all the fluorescent lamps removed from the site have been received and accepted at the recycling facility. Receipt or bill of sale shall include the typewritten name and signature of the person responsible for receiving and logging in, and shall be dated.

1.4 QUALITY ASSURANCE

A. Demolition shall be carried out as expeditiously as possible, in accordance with accepted practice and applicable building code provisions.

B. For PCB removal:

1. Regulatory requirements: Comply with EPA requirements for removal, handling, and disposal of PCB-containing lamp ballasts.
2. Instruct employees on the dangers of PCB exposure; protective clothing; methods for identification, removal, and storage on site; and applicable EPA regulations.
3. Dispose of PCB-containing ballasts and PCB-contaminated materials by incineration at an EPA-approved rotary kiln incinerator.

C. Fluorescent lamp recycler shall be in compliance with federal and state regulations applicable at its location, including licenses if required, to commercially recycle lamps and mercury-containing materials.

1.5 HANDLING AND STORAGE

A. PCB-containing ballasts:

1. Store removed ballasts in lined steel drums or other approved leak-proof containers, labeled in accordance with EPA requirements, in a secured area.
2. Containers shall be removed from the site within 30 days.

B. Fluorescent lamps:

1. Handle lamps so as not to break them. Store and ship in containers which prevent breakage during storage and shipping.
2. Store lamps in secure location approved by the COTR, until they are shipped to the recycler.
3. The lamps are not defined as hazardous. If a few lamps should be broken accidentally, treat the debris as general construction debris.

1.6 PROJECT CONDITIONS

A. If, in the course of the work, workers unexpectedly encounter a material not identified for special removal but which they suspect to be asbestos, to contain lead or PCBs, or to present some other hazard:

1. Promptly notify the COTR in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

B. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.

C. Locate, identify, and protect mechanical and electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 PREPARATION

A. In areas where lamp ballasts are to be removed, protect floors and other surfaces with plastic sheeting.

B. Coordinate removal and storage of fluorescent lamps and ballasts. Protect lamps to prevent breaking them during removal.

C. Protect existing building and equipment that is to remain, particularly to prevent entry of either dust or water. Ensure weathertightness at all times. Keep materials on hand to patch and maintain protection.

3.2 DEMOLITION

A. Comply with demolition and disposal requirements of Division 02.

B. Perform removal work neatly with the least possible disturbance to the building.

C. Provide temporary barriers, danger signals, and appurtenances for protection of personnel and equipment during removal operations.

D. Demolish, remove, demount, and disconnect inactive and obsolete raceway, fittings and specialties, equipment, and fixtures.

1. Raceway and ducts embedded in floors, walls, and ceilings may be abandoned in place if they do not interfere with new installations. Cut back to at least 25 mm below finished surface.
2. Remove materials above accessible ceilings.
3. Disconnect and cap items to remain behind finished surfaces.
4. Patch and repair surface materials as required in Division 01 and Section 260101 article, “Cutting and Patching.”

E. Remove the anchors, bolts, and fasteners associated with raceway and equipment to be removed.

3.3 REMOVAL OF FLUORESCENT LAMP BALLASTS

A. Where fluorescent luminaires are shown on the drawings to be removed, remove ballasts.

B. If a ballast is stenciled “No PCBs”, dispose of it as general demolition debris. If ballast has no such identification, assume that it contains PCBs.

C. Workers removing ballasts shall be: informed as to the danger of skin contact with PCBs; informed that PCB-containing ballasts contain paper or cardboard impregnated with PCBs inside the casings; instructed to handle ballasts so as not to damage the casings; and shall wear protective gloves.

D. Examine ballasts for evidence of leaking PCBs. Black, tarry material may contain PCBs. Where leakage has contaminated materials outside the ballast itself, dispose of the contaminated materials by the same methods used to dispose of the ballasts, except that nonporous surfaces such as smooth metal or plastics may be properly decontaminated and then treated as clean material.

3.4 REMOVAL OF FLUORESCENT LAMPS

A. Remove lamps without breaking them and pack in protective containers for shipment to recycler.

B. Prepare a record of lamps removed and prepared for shipment. This record shall be used to account for disposal of lamps to qualified recycler.

3.5 DISPOSAL

A. Dispose of equipment and materials removed, and rubbish and waste material, as work progresses. Do not allow demolition debris to accumulate on site. Remove products of demolition from the building daily.

B. Transport and dispose of PCB-containing ballasts, discarded protective clothing, and other contaminated material in accordance with applicable EPA regulations. Maintain and submit records showing compliance with regulations, as specified in Part 1 above.

C. Transport fluorescent lamps without breaking them and deliver to the recycler. Submit records of disposal as required in Part 1 above.

END OF SECTION 260504

SECTION 260519 - WIRES AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wire and cable rated 600-volts and less.

B. Type MC, Type AC-HCF, and Type NM cables are not permitted.

1.2 RELATED SECTIONS

A. Raceways: Section 260533.

B. Lighting controls: Section 260926.

C. Lighting: Section 265100.

D. Voice and data communication cables: Division 27.

1.3 REFERENCES

A. ANSI/NEMA WC 70 – Power Cables rated 2000 Volts or Less for Distribution of Electrical Energy.

B. ASTM B3 – Standard Specification for Soft or Annealed Copper Wire.

C. ASTM B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors.

D. UL 44 – Standard for Thermoset-Insulated Wires and Cables.

E. UL 83 – Standard for Thermoplastic-Insulated Wires and Cables.

F. Additional UL Standards as indicated.

1.4 SUBMITTALS

A. Product data:

1. Each type of wire and cable, including accessories.
2. Include copies of UL certifications showing compliance with requirements in “Quality Assurance” below.

1.5 QUALITY ASSURANCE

A. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70 Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Products and installation shall comply with NFPA 70 and other applicable national, state, and local electrical codes.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General requirements: Deliver, store, and handle wire and cable in accordance with the manufacturer's instructions.

1. Wire and cable shall be packaged in a manner that protects them during ordinary handling and shipping. Ship from manufacturer with ends temporarily sealed against moisture.
2. Protect wire and cable during storage (both onsite and offsite).

a. Store in a clean and dry location. Elevate from surfaces where water can accumulate, and cover cable rolls to protect against weather.

3. Handle wire and cable as recommended by the manufacturer. Do not pull from the center or periphery of the cable reel.
4. Damaged wire and cable shall be removed from the project site.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE (600-Volts Max.)

A. Conductors: UL listed and NEMA WC 70 compliant; Copper, 98 percent conductivity, suitable for 600-volt duty; rated 90-degree Celsius temperature for wet/dry applications; solid bare annealed copper for No. 10 and smaller complying with ASTM B 3, and stranded for No. 8 and larger complying with ASTM B 8.

B. Conductor insulation:

1. Type THHN/THWN-2: Comply with UL 83; PVC insulation, nylon jacket.

C. Conductor identification: Markings along outer braid denoting conductor size, voltage classification, type of insulation, and manufacturer's trade name, and color code. Identification shall extend to branch circuits and outlets. Use the color coding system tabulated below throughout the building's network of feeders and circuits, unless otherwise required by the authority having jurisdiction.

1. Colors on conductors No. 10 and smaller, or No. 6 and smaller for grounded and grounding conductors: Solid colored insulation.
2. Colors on conductors No. 8 and larger, or No. 4 and larger grounded and grounding conductors: Colored tape wrapped a minimum of 150 mm (6 inches) on either end of conductor.

(see schedule next page)

COLOR CODE				
VOLTAGE	NEUTRAL	PHASE		
		A	B	C
120-V, 2-wire	White	Black, Red, or Blue, depending on phase		
208/120-V wye, 3-phase, 4-wire	White	Black	Red	Blue
277-V, 2-wire	Gray	Brown, Orange, or Yellow, depending on phase		
480/277-V wye, 3-phase, 4-wire	Gray	Brown	Orange	Yellow
480-V delta, 3-phase, 3-wire		Brown	Orange	Yellow

D. Wires used solely for grounding purposes shall be green, where insulated.

E. Control wiring shall be coded with colors different from those used to designate phase wires.

2.2 WIRING ACCESSORIES

A. Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service where installed.

B. Twist-on wire connectors (dry locations):

1. Color-keyed.
2. Basis of design: Ideal Industries, Inc., Wingnut®, 3M Company "Scotchlok", or King Innovation.

C. Twist-on wire connectors (damp and wet locations):

1. Connectors shall be listed under UL 486D.
2. Basis of design: Ideal Industries, Inc., UnderGround®, models 60, 64, or 66 as appropriate; King Innovation DryConn®; or 3M Company.

D. Compression connectors:

1. Color-keyed.
2. Basis of design: 3M Company "Scotchlok"™ compressor connectors, "10000" series for copper conductors, or Thomas & Betts (Blackburn) or Ilsco.

E. Compression connectors (damp and wet locations):

1. Protect the connectors with a waterproof system, UL-listed for direct burial and 600 volts.
2. Basis of design: 3M Company 8420 series, Thomas & Betts Model DBSK82, or IIsco.

F. Compression taps:

1. Series CT-2 tap with CT-2C cover, or Series 54710 color-keyed compression taps,
2. Basis of design: Burndy Corporation "Versitap" or OZ/Gedney.

G. Power distribution blocks:

1. Basis of design: Hubbell Burndy “U-Blok.”

H. Terminal strips for #8 conductors and smaller: Plastic housing with UL-94V2 flammability, 20 ampere, 300 volt, (or amperage and voltage ratings as appropriate), number of terminal pairs as indicated on drawings: Ideal 89-600 series or equal by Molex.

2.3 PLENUM CABLES

A. Plenum cable:

1. Insulated with material that is UL classified for low flame and smoke-spread characteristics, for use in plenum areas without raceway in accordance with the requirements of NFPA 70.
2. Communications cable: Type MPP or CMP in accordance with NFPA 70.
3. Insulator basis of design: Dupont “Teflon FEP”.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide wire and cable indicated in accordance with national and Smithsonian Institution electrical codes.

B. Conceal wire and cable in new construction and in locations with finished walls, ceilings, and floors unless otherwise noted on drawings.

C. Wire and cable serving systems over 100-volts shall be installed in raceways, except where otherwise noted on drawings.

D. Wire and cable serving systems rated below 100-volts shall be installed in raceways, except where otherwise noted in individual specification sections. Refer to paragraph “INSTALLING CABLE RATED BELOW 100-VOLTS” below for additional information.

3.2 INSTALLING INTERIOR WIRING

A. Sizes: Minimum sizes shall be as follows, unless a larger size is indicated on the drawings.

1. 120-volt branch circuits:

a. Homerun from first outlet to panel: No. 12 when run is 15 m (50 feet) or less; No. 10 when run is between 15 m (50 feet) and 30 m (100 feet); No. 8 when run is more than 30 m (100 feet).
b. First outlet to other outlets: No. 12.

2. Exit light and emergency lighting circuits: Do not install in raceways, outlet boxes, or other locations with non-emergency wiring systems.
3. Other systems (over 100-volts): Minimum No. 12 unless specified or shown on drawings to be smaller.

B. Wiring methods and locations: Wires and cables shall be installed based on the following requirements, unless otherwise noted.

1. Feeders: Type THHN/THWN-2, single conductors in raceway.
2. Branch circuits:

a. Unless otherwise indicated, utilize Type THHN/THWN-2, single conductors in raceway.

3. All other applications: Provide Type THHN/THWN-2, single conductors in raceway or wire and cable type as indicated.

C. Splicing shall be done in outlet boxes and junction boxes and not in raceway.

1. Conductors No. 8 and larger: Terminated, spliced and taped, wherever practical, with compression connectors or solderless connectors. Use tools recommended by the manufacturer.
2. Splices in conductors No. 10 and smaller, including luminaires: Made with wire connectors.
3. Taps in conductors No. 6 and larger: Made with compression taps or power distribution blocks.

D. Wiring in high ambient temperature areas shall be of types required by NFPA 70.

E. Neatly shape wires in panels, wireways, boxes, and appurtenances.

3.3 COORDINATION WITH DEVICES AND EQUIPMENT

A. Where conductor size or parallel conductors shown on drawings connect to terminals on devices or equipment which is not sized for the connection:

1. Provide a junction box as near the equipment as possible, but no more than 3 m (10 feet) away. Obtain approval of location before installing.
2. Provide conductor(s) sized to the ampacity of the equipment, from equipment to junction box.
3. In the junction box, splice the conductors from the equipment to the conductors of sizes, or parallel conductors, shown on the drawings.

3.4 INSTALLING CABLE RATED BELOW 100-VOLTS

A. Install in raceway, unless otherwise indicated in individual specification sections.

B. Where individual specification sections allow cable to be installed either in raceway, on cable trays, or on J-hooks, install as follows:

1. Wiring method:

a. Wiring in walls, above inaccessible ceilings, where exposed in finished spaces, exposed on walls, and wherever it may not be accessible or may be subject to physical damage: Install cables in raceway.
b. Wiring exposed in ceilings of unfinished spaces: Install cables in raceway, on existing cable trays where present, or on J-hooks.
c. Wiring concealed above accessible suspended ceilings: Install cables on existing cable trays where present and J-hooks elsewhere.

d. Wiring in ceiling spaces of communications equipment rooms: Install cables on existing cable trays where available and on J-hooks.
e. Wiring within enclosures, consoles, cabinets, desks, and counters: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and/or distribution spools.

2. Conceal raceway and cables, except in unfinished spaces, and in open ceiling spaces and raceways on existing walls.
3. Cable not in raceways or on cable tray:

a. Do not install in hangers used for pipes, electric raceways, or ceiling hangers, nor support it in any way by attachments to pipes, raceways, or ceiling hangers.
b. Install without damaging conductors, shield, or jacket. Cables shall not run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
c. Install away from potential EMI sources, including electrical power lines and equipment.
d. Install parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.

4. Cable support with J-hooks:

a. Install J-hooks at intervals not exceeding 1524 mm (60 inches).
b. Secure cables on J-hooks with cable ties. Avoid cinching cables.
c. Provide separate J-hooks for each low-voltage system.

5. Each cable run shall contain an ‘S’ loop or other means to accommodate expansion or contraction.
6. Where ceiling plenums are used for passage of air by heating and air conditioning system, install cable in raceway or use UL listed plenum cable.

C. For cable installed in raceway, comply with requirements for raceways and boxes specified in Section 260533, Raceways, and Section 260534, Boxes.

1. Provide separate raceway systems for each low-voltage system.
2. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

a. Pull cables simultaneously if more than one is being installed in same raceway.
b. Use pulling compound or lubricant, if necessary. Use compounds that will not damage conductor or insulation.
c. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage cables or raceway.

D. Avoid installing near hot utilities, which might adversely affect system performance or result in damage to the cable. If cable must be placed close to such utilities, keep it separate and protect with insulation.

E. Cable bends shall have a radius not less than the value recommended by the cable manufacturer.

F. Tag cables connected to electronic equipment, to show function and the location of other end. Securely fasten labels to the cable.

END OF SECTION 260519

SECTION 260521 - WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power and control wiring for equipment.

1.2 RELATED SECTIONS

A. Equipment: Installed items requiring electricity, specified in other sections or shown on drawings.

B. Motors:

1. Motors requirements for HVAC equipment: Section 230513.

C. Control systems wiring: Section 230923 Instrumentation and Controls for HVAC.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Raceways, wires and cables, devices, and accessories as specified in other sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide power wiring from the motor starters and drives to each motor and its manual controlling device. Interlock and control wiring related to the automatic temperature control system shall be provided under Section 230923, Instrumentation and Controls for HVAC.

1. Make flexible or liquid tight connections as specified in Section 260533, Conduits.

B. Except where provided with equipment, furnish and install manual pushbutton stations and pilot lights, with wiring. Where stations and pilot lights are grouped at central locations, mount them under a common faceplate.

C. Rough in and connect to shop equipment furnished under other sections and equipment furnished by Owner. Make connections as indicated on drawings with exact locations and details determined by approved shop drawings of the equipment.

1. Under equipment sections, equipment will be set in position and the electrical devices and components furnished loose. Assemble, install, and wire under this section.
2. Accomplish rough-in from walls with flush outlet boxes and from floors by means of conduit couplings finishing flush with finished floor.

D. Certain equipment, as indicated, will be furnished with control panels and auxiliary control components. Mount the panels, furnish and install source wiring and disconnects, and completely connect controls and motors.

E. Provide source wiring, connections, and disconnects for mechanical heating, ventilating, and air-conditioning (HVAC) equipment specified in Division 23. Refer to sections of Division 23 for equipment and controls.

1. Mount starters where required, and provide proper size overload protection.

F. Where a Division 23 section requires installation of equipment under supervision of equipment manufacturer's representative, coordinate electrical installation to cooperate with representative's requirements.

G. Provide power sources for Owner-furnished equipment.

END OF SECTION 260521

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding electrical systems and equipment.

1.2 REFERENCES

A. ANSI/TIA/EIA J-STD-607

B. IEEE STD 142

C. NFPA 70

D. ASTM F467 and F468

E. UL 467

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Ground conductor, unless specifically noted otherwise, shall be copper, 98 percent conductivity, solid for No. 10 AWG and smaller and stranded for No. 8 AWG and larger.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide the complete grounding of raceway systems, electrical equipment, conductor and equipment enclosures, motors, transformers, and neutral conductors in accordance with applicable codes. Grounded phase and neutral conductors shall be continuously identified. Continuity of metal raceways shall be insured by double locknuts.

B. Bonding interior metal ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.2 EQUIPMENT GROUNDING AND BONDING

A. Provide insulated equipment grounding conductors to all feeders and branch circuits.

B. Air-duct equipment circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

END OF SECTION 260526

SECTION 260533 - CONDUITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit, raceways, and accessories, aboveground.

B. Where the words “conduit” or “conduits” are used without referring to a specific type of conduit (e.g., flexible metal conduit), the words include conduit and electrical metallic tubing.

1.2 RELATED SECTIONS

A. Firestopping: Division 07.

B. Boxes: Section 260534.

C. Painting: Division 09.

1.3 DEFINITIONS

A. FMC: Flexible metal conduit.

B. LFMC: Liquid-tight flexible metal conduit.

1.4 SUBMITTALS

A. Product data:

1. Each type of raceway and raceway included in the work, and related fittings.
2. Accessory materials.
3. Hangers and fasteners.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

B. Steel tubing:

1. AFC Cable Systems, Inc. (FMC and LFMC)
2. Allied Tube & Conduit; a Tyco International Ltd-Co.
3. O-Z/Gedney, Unit of General Signal.
4. Wheatland Tube Co.

C. Steel raceway fittings:

1. Appleton Electric Co.
2. Cooper Crouse-Hinds.

3. Hubbell, Inc.; Killark Electric Manufacturing Co.
4. O-Z/Gedney; Unit of General Signal.
5. Spring City Electrical Manufacturing Co.
6. Thomas & Betts Corporation.
7. Wheatland Tube Co.

D. Wireways and fittings:

1. Hoffman Engineering Co.
2. Lamson & Sessions, Carlon Electrical Products.
3. Schneider Electric; Square D products.

E. Raceway hangers and supports:

1. Thomas & Betts “Kindorf”.
2. Tyco Power-Strut.
3. Unistrut Diversified Products.

F. Fasteners:

1. Caddy Fasteners by Erico Products Inc.
2. ITW Ramset “Red Head”.
3. Wej-It Fastening Systems.

2.2 RACEWAY AND FITTINGS

A. Electrical metallic tubing (EMT): Hot-dip galvanized or sherardized thin-wall steel raceway conforming to UL 797 and ANSI C80.3.

B. Connectors and couplings for EMT: Set screw type, made of zinc- or chromium-plated steel. Connectors shall have nylon insulating throats.

1. Set screw connector:

a. Basis of design: Steel City No. TC722A.

2. Set screw coupling:

a. Basis of design: Steel City No. TK122A.

C. Flexible metal conduit (Type FMC): Made of sheet metal strip, interlocked construction, conforming to UL 1.

D. Liquidtight flexible metal conduit (Type LFMC) shall conform to UL 360.

E. Connectors for flexible metal conduit:

1. Angle wedge with nylon insulated throat.
2. Basis of design: Thomas & Betts “Tite-Bite” connector Series 3110 and 3130.

F. Liquidtight type connectors:

1. UL 14814A. Fittings: With nylon insulated throat.
2. Basis of design: Thomas & Betts Series 5331.

G. Wireways: Steel wireway with hinged cover, UL listed as wireways and auxiliary gutters.

1. Cover: Opening complete width and length of wireway.
2. Finish: Baked enamel.
3. Basis of design: Square D “Square-Duct.”

H. Fittings for wireways: Made with removable covers to permit installation of a complete system with access to wires throughout the system, UL listed with wireways. Connections: Threaded screws at every connector.

I. Weatherproof expansion fittings:

1. With bonding jumpers.
2. Basis of design: O-Z/Gedney Types AX and TX.

2.3 ACCESSORY MATERIALS

A. Pull rope:

1. Polypropylene, minimum 5 mm (0.1875 inch) thick, tensile strength 3559 N (800 pounds), work load 578 N (130 pounds).
2. Basis of design: Ideal Industries., “Pro-Pull.”

B. Caps and plugs:

1. Basis of design: Thomas & Betts Series 1470.

C. Lubricant:

1. UL approved.
2. Basis of design: Ideal Industries, Inc. “Yellow 77”.

2.4 RACEWAY HANGERS

A. Adjustable hangers:

1. Basis of design: Kindorf C-711 lay-in hanger or C-710 Clevis hanger.

B. Trapeze hangers:

1. Constructed of channels with notched steel straps.
2. Steel strap basis of design: Kindorf C-105.

C. Channels:

1. Steel, 38 mm (1.5 inches) wide with 22-mm (7/8-inch) continuous slot, gauges and weights.
2. Basis of design: Kindorf B-900 series.

D. Beam clamps:

1. Adjustable type for connecting hanger rod to steel beam.
2. Basis of design: Kindorf E-160 or U-569

E. Hangers for raceway 27 mm (1.0 inch) and smaller, through or below bar joists: “Hang-on” hangers attached to joists with Minerallac scissor clips or two-piece stud clips.

F. Finish: For hangers, assemblies, plate washers, rods, locknuts, channels, bolts, and appurtenances:

1. Zinc plated.

2.5 FASTENERS

A. General: Select fasteners such that load applied does not exceed one-fourth of manufacturer’s load capacity in 24000 kPa (3500 psi) concrete.

B. Fasteners to concrete: Self-drilling type expansion anchors, or machine bolt drop in anchors for drilled holes. Fasteners to concrete ceilings shall be vibration- and shock-resistant.

C. Fasteners to drywall or cavity wall: Toggle bolts, hollow-wall drive anchors, or nylon anchors as required.

D. Powder-actuated or drive pin type fasteners are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide complete, separate and independent raceway system for each of the various wiring systems including, but not limited to, the following:

1. Lighting
2. Power
3. Exit Lighting*
4. Emergency Lighting System*
5. Fire Alarm System
6. Low Voltage Control System
7. Control Wiring
8. Voice and Data Systems
9. Sound System
10. Security Systems

*These wiring systems may be installed in common raceways.

B. Wire raceway systems completely, except where otherwise indicated, as shown on drawings and as required for satisfactory operation of each system.

C. Where wireways are required or used to facilitate the installation, size them to accommodate conductors, in accordance with NFPA 70.

D. Types and locations of raceways are scheduled at the end of the section.

E. Do not install conductors or pull rope during installation of raceway.

F. Where raceway is connected to a cabinet, junction box, pull box, or auxiliary gutter, protect the conductors with an insulating bushing. Provide locknuts both inside and outside the enclosure. Where raceway is stubbed up to above ceilings for future wiring, close ends with bushings.

G. Make turns in raceway runs with manufactured elbows or using machines or tools designed to bend raceway. Turns shall be not less than the various radii permitted by NFPA 70.

H. Sizes:

1. Do not use raceway smaller than 21 mm (0.75 inch).
2. Feeder raceways shall be as large as indicated, or as required by NFPA 70 (whichever is larger). Do not install more than one feeder in a single raceway.
3. Raceway sizes shown on drawings are based on Type THHN/THWN-2 wire.

I. Make vertical runs plumb and horizontal runs level and parallel with building walls and partitions.

J. Ground raceways as required by NFPA 70.

K. Where raceways pass through building expansion joints, and wherever relative movement could occur between adjacent slabs, equip with weatherproof expansion fittings and bonding jumpers.

L. Run raceways concealed in new construction except where connecting to surface-mounted cabinets and equipment, and in electrical and mechanical equipment spaces. Install raceway above suspended ceilings and within walls and partitions.

M. Immediately after each run of raceway is completed, test it for clearance, smooth the joints, and close at each end with caps or plugs to prevent entrance of moisture or debris.

N. Install no raceway in these locations:

1. Setting beds for terrazzo or tile.
2. Concrete toppings, unless specifically approved by Structural Engineer.

O. Raceway in concrete decks above grade: Permitted if all of the following conditions are met:

1. If acceptable to local authorities having jurisdiction, and
2. If to serve floor outlets, and
3. if in accordance with the following restrictions, unless otherwise restricted.

a. Diameter 27 mm (1 inch) or less, or less than 1/3 the concrete cover.

b. No crossovers.
c. Raceways no less than 457 mm (18 inches) apart.
d. Concrete cover no less than 19 mm (0.75 inch).

P. Where raceway is stubbed up through concrete slab, exterior walls, or bearing walls, provide galvanized steel raceway elbows.

Q. Install insulated bushings on ends of raceway stubs.

R. Paint exposed raceways and fittings flat black where being installed in an open ceiling in an area open to or visible by the public. Apply paint before installation.

3.2 INSTALLING PULL BOXES, JUNCTION BOXES, OUTLET BOXES

A. Install as specified in Section 260534, Boxes.

B. Install pull or junction boxes in long runs of raceways or where necessary to reduce the number of bends in a run.

1. Select inconspicuous locations. Do not install until locations have been approved by the COTR.
2. Install boxes flush with wall or ceiling surfaces, with flat covers. Where removable ceiling units are used, locate boxes above ceilings.

C. Verify door swings with door frame installed before locating switch outlets. Locate switch outlets on the side of the door opposite the hinges.

D. Paint exposed boxes flat black where being installed in an open ceiling in an area open to or visible by the public. Apply paint before installation.

3.3 INSTALLING FLEXIBLE CONDUIT

A. Installation shall comply with NFPA 70.

1. Minimum length: 610 mm (two feet).
2. Maximum length: 1830 mm (six feet).

B. Make immediate connections to transformers, recessed luminaires, speakers, and other equipment in suspended ceilings with flexible metal conduit. Include sufficient slack to permit removal of fixture or equipment.

C. Make immediate connections to motors with liquidtight flexible metal conduit. Include sufficient slack to reduce the effects of vibration.

D. In wet locations, install liquidtight type, in such a manner that liquid tends to run off the surface and not drain toward the fittings.

E. Where fittings are brought into an enclosure with a knockout, install a gasket assembly consisting of an O ring and retainer on the outside.

3.4 INSTALLING PULL ROPE AND CONDUCTORS

A. After raceway is installed, fish pull rope. After completion of the work of this project, pull rope shall remain in raceways identified as to be left empty.

B. Do not use a pull rope that has a tensile strength of more than one of the conductors of a two-wire circuit, more than two of the conductors of a three-wire circuit, or more than three of the conductors of a four-wire circuit.

C. Do not pull conductors into the raceways until the system is entirely completed and wet building materials are dry.

D. Use only a lubricant approved for use with conductor materials and pull rope materials.

3.5 INSTALLING RACEWAY HANGERS

A. Single runs of overhead raceways 35-mm (1.25-inch) size and larger shall be supported by adjustable hangers, using 10-mm (0.375-inch) rods for raceways up to 53-mm (2.0 inch) size and 13-mm (0.5-inch) rods for raceways larger than 53-mm (2.0 inch).

B. Support groups of raceways run in parallel on trapeze hangers suspended from 13-mm (0.5-inch) hanger rods.

C. Space hangers not over 3 m (10 feet apart). Support raceways within 914 mm (3 feet) of each outlet, junction or pull box.

D. Below bar joist construction, support hangers from a length of structural channel, welded to the top chords of at least two joists.

E. Where large numbers of raceways are grouped together, stagger individual hangers so as not to concentrate the load on a few joists.

F. Where hanger rods are attached to structural beams, use adjustable beam clamps.

G. Attach hanger rods to concrete with expansion bolts and anchors.

3.6 RACEWAY IN EXISTING BUILDING

A. Remove superfluous electrical equipment and cap outlets not being used, as specified in Section 260504, Electrical Demolition.

B. In existing areas that are being renovated it is the intent to show on the drawings what the finished areas will contain when completed. Except as specified otherwise, existing raceway, and outlet boxes may be reused where they meet specifications and code requirements. Replace existing products or materials which are not suitable for reuse as determined by the COTR.

C. Suitably cap superfluous concealed outlets, and remove unused wire. Remove superfluous raceways exposed in finished areas, and abandon superfluous raceways concealed in walls.

D. Install concealed raceway in existing building wherever possible above ceilings, in new walls, and in existing furred spaces. Install exposed raceway in secondary rooms, such as storage rooms.

E. Where existing raceway penetrates a fire-rated partition, and there is no firestopping, provide firestopping. Maintain indicated fire rating of walls, partitions, ceilings, and floors at existing raceway penetrations. Comply with Division 07.

3.7 SCHEDULE OF LOCATIONS

A. EMT:

1. Sizes 102 mm (4 inch) and smaller except as noted above.

B. FMC and LFMC:

1. Where noted elsewhere in this section.

END OF SECTION 260533

SECTION 260534 - BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Boxes with covers.

1.2 RELATED SECTIONS

A. Raceways: Section 260533.

B. Wiring devices: Section 262726.

C. Outlet boxes where required for special systems: Provided by the equipment manufacturers of the various systems.

1.3 SUBMITTALS

A. Product data: Each type of box included in the project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

B. Boxes:

1. Appleton/EGS Electrical Group
2. RACO/Hubbell Electrical Products
3. Steel City/Thomas & Betts

2.2 MATERIALS

A. Outlet, switch, and junction boxes:

1. Sheet metal: NEMA OS 1, sherardized or galvanized stamped.

2.3 BOXES FOR WALLS AND PARTITIONS

A. Switch and receptacle boxes in metal stud partitions: 100 mm (4 inches) square by 38 mm (1.5 inches) deep boxes with 19-mm (0.75-inch) raised tile wall device covers finishing flush with finished wall surface.

B. Wall- and partition-mounted outlets for low-voltage systems: Same as specified above for switches and receptacles.

2.4 JUNCTION AND PULL BOXES

A. Junction and pull boxes in feeder raceway runs: Galvanized, of size required for raceway arrangement and not less than the size required by NFPA 70, and furnished with screwed covers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide box at each outlet, switch, and appurtenance. Each box shall be of a type suitable for the duty intended and shall be installed in accordance with the manufacturer's instructions.

B. Coordinate locations of boxes with installation of raceway as specified in Section 260533.

C. Do not install boxes back-to-back (through the wall) in partitions.

D. Firmly secure the boxes in place, plumb, level, and with front of device cover even with finished wall surface.

E. Boxes in metal stud walls or partitions shall be securely supported by metal channels spanning between two studs and attached to same.

F. Outlet boxes used for supporting luminaires: Furnish with malleable iron fixture studs of "No-Bolt" type, secured by locknut. Provide structural channel supports for boxes occurring in ceilings. Outlets in ceilings directly on bottom of joists shall be supported independent of ceiling construction. Outlets in suspended ceilings shall not be supported from ceiling construction. Special supports for boxes shall be as directed and approved by the COTR.

G. Provide a single cover plate where two or more devices are grouped together in one box.

H. Verify door swings with door frame installed before locating switch outlets. Install switch outlets on the side of the door opposite the hinges.

I. Outlet boxes in fire-rated assembly:

1. Clearance between boxes and wallboard shall not exceed 3.2 mm (0.125 inch).
2. Surface area of individual outlet box does not exceed 103 sq cm (16 square inches).
3. Entire surface area of boxes shall not exceed 645 sq cm (100 square inches) per 9.3 sq m (100 square feet) of wall surface.

3.2 IDENTIFICATION

A. Identification on outside covers of pull and junction boxes in ceiling space or exposed on walls: Paint with colored enamel or mark with permanent waterproof black marker, or both, as specified.

1. Fire alarm system: Red.
2. Security: Blue.
3. Other special systems: Mark with system type, such as Data.
4. Power and lighting: Panelboard designation and circuit number(s).

B. Identification inside boxes for recess-mounted or concealed in walls and partitions: Plasticized card stock tags marked with permanent waterproof black markers.

1. Fire alarm system: Fire alarm.
2. Other special systems: Mark with system type, such as Data or Security.
3. Power and lighting: Panelboard designation and circuit number(s).

END OF SECTION 260534

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes electrical identification materials and devices required to comply with ANSI, NFPA, and OSHA standards.

B. This section addresses identification of electrical equipment, raceways, boxes, conductors, and other related electrical system components.

1.2 SECTION INCLUDES

A. Identification for raceways and cables.

B. Identification of power conductors and control cables.

C. Identification of equipment and instructions.

D. Miscellaneous identification products.

1.3 RELATED SECTIONS

A. Sections in Divisions 26, 27 and 28.

1.4 REFERENCES

A. ANSI A13.1: Scheme for the Identification of Piping Systems.

B. ANSI Z535.4: Standard for Product Safety Signs and Labels.

C. ANSI/IEEE C2: National Electrical Safety Code.

D. NFPA 70: National Electrical Code.

E. NFPA 70E: Standard for Electrical Safety in the Workplace.

F. OSHA 29 CFR 1910.144: Safety Color Code for Marking Physical Hazards.

G. OSHA 29 CFR 1910.145: Specifications for Accident Prevention Signs and Tags.

H. UL 969: Standard for Marking and Labeling Systems.

1.5 SUBMITTALS

A. Product data: For each type of electrical identification product.

1.6 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with OSHA standards.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.7 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other sections requiring identification applications, drawings, shop drawings, manufacturer's wiring diagrams, and the operation and maintenance manual; and with those required by codes, standards, and safety regulations. Use consistent designations throughout Project.

B. Coordinate installation of identification materials and devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identification materials and devices with location of access panels and doors.

D. Install identifying materials and devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following manufacturers, or approved equal:

1. Brady USA, Inc.
2. Carlton Industries
3. Graphic Products, Inc.
4. Ideal Industries, Inc.
5. Panduit Corporation
6. Presco
7. Seton Identification Products
8. Thomas & Betts Company
9. Utility Safeguard

2.2 GENERAL PRODUCT REQUIREMENTS

A. Except where otherwise indicated, provide manufacturer's standard identification products of category and type suitable for each application. Where more than one identification method is specified for an application, the Installer shall select and utilize each material in a consistent manner.

2.3 RACEWAY IDENTIFICATION

A. Comply with ANSI A13.1 for minimum lettering size, length of color field, and coloring schemes for each raceway size, type, and location.

1. Colors: Black letters on Orange field.
2. Legend: Raceways carrying the following:

a. Power circuits less than 600V: Indicate system voltage.
b. Low-voltage systems less than 50V: Indicate system type (Example – "TELECOMMUNICATIONS").

B. Adhesive labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear weather- and chemical-resistant coating.

C. Color-coded, adhesive tape: Self-adhesive vinyl tape, in appropriate colors for system voltage and phase.

D. Marker tapes: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters. Diameter sized to suit raceway or cable it identifies.

E. Wrap-around marker bands: Diameter sized to suit raceway or cable it identifies.

1. Plastic color-coded, pretensioned, grip-type, flexible, acrylic sleeve.

2.4 CONDUCTOR AND CABLING IDENTIFICATION

A. Adhesive labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

B. Color-coded, adhesive tape: Self-adhesive, vinyl tape, in appropriate colors for system voltage and phase.

C. Marker tapes: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

D. Wrap-around marker bands: Diameter sized to suit conductor or cable it identifies.

1. Plastic, color-coded, pretensioned, grip-type, flexible, acrylic sleeve.

2.5 EQUIPMENT IDENTIFICATION

A. Engraved plastic nameplates: Laminated plastic, engraved, white letters on black background, except where other color schemes are noted or specified.

1. Size: Minimum 19 mm (0.75-inch) by 64 mm (2.5-inches).
2. Letter size: Minimum height of 10 mm (0.375-inch).
3. Mechanically fastened, except adhesive mounted where necessary due to substrate.

a. Mechanical fastener: Punched or drilled, with vandalproof stainless steel or brass screws or rivets.

B. Adhesive film label: Machine-printed, black letters on white background, through thermal transfer or equivalent process, with clear weatherproof and UV-resistant covering. Minimum letter size height of 0.375-inch (10 mm).

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Wiring device tape labels:

1. Adhesive film label: Machine-printed, black letters on clear background, through thermal transfer or equivalent process. Minimum letter size height of 6 mm (0.25-inch).

a. Labeling for electrical devices and components such as receptacles, switches, control device stations, manual motor starters, network and phone jacks, junction and pull boxes, etc.

B. Warning labels and signs:

1. Self-adhesive warning labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configures for display on front cover, door, or other access to equipment unless otherwise noted.
2. Fasteners: Self-tapping, stainless-steel screws or, stainless-steel machine screws with nuts, flat and lock washers.

C. Cable ties: Fungus-inert, self-extinguishing, one-piece, self-locking, color-coded, nylon cable ties suitable for the application (general purpose, UV-stabilized outdoor, or plenum rated).

D. Adhesive: Heavy-duty, thermo-resistant, industrial grade adhesive, for adhesion to any surface without identification curling, peeling, or falling off.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification products at locations for most convenient viewing without interference with operation and maintenance of equipment.

1. For finished public spaces, coordinate identification product mounting locations with COTR.

C. Existing equipment: Apply identification products to unmarked existing equipment where work is being performed.

D. Apply identification products to surfaces after equipment finish work has been completed.

E. Clean surfaces before applying identification products, using materials and methods recommended by manufacturer of identification device.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. System identification labeling for raceways and cables: Each label shall be installed on sidewall of conduit and easily placed for proper identification. Locate labels at changes in direction, at penetrations of walls and floors, at 15 m (50-foot) maximum intervals in straight runs, and at 7.6 m (25-foot) maximum intervals in congested areas.

H. System identification color-coding bands for raceways and cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 15 m (50-foot) maximum intervals in straight runs, and at 7.6 m (25-foot) maximum intervals in congested areas.

I. Cable ties: For attaching tags, use general-purpose type, except as listed below:

1. In spaces handling environmental air: Plenum rated.

3.2 APPLICATION

A. Miscellaneous:

1. Access doors and panels: Apply engraved nameplate labels at access doors identifying concealed electrical item. Do not locate labels in finished, public spaces.

B. Junction and pull boxes:

1. Label each junction and pull box, identifying circuit designation or type of system.

a. Exposed boxes: Place label on coverplate, externally visible.
b. Concealed boxes: Place label or tag on inside cover of box.
c. Junction boxes concealed above suspended ceilings or exposed in non-occupied spaces may be marked with permanent ink marker in lieu of printed labels.

2. Fire alarm system boxes shall have red finish. Boxes shall be prefinished prior to installation.

C. Raceway identification: Apply identification products for each raceway.

1. Apply color-coded identification products to raceways as follows:

a. Normal power system: None.
b. Standby/emergency power system: Orange.

c. Fire alarm system: Red, solid colored.
d. Telecommunications system: None.
e. Security System: Blue, color banded.

2. Apply labels identifying nominal system voltage for the raceways containing feeders. Labeling of raceways with branch circuit conductors is not required.
3. Apply system identification labels identifying type of system for low-voltage system raceways.
4. Apply circuit designation markings on each feeder and branch circuit raceway entering and leaving each panelboard and switchboard. Mark raceway clearly with permanent ink marker or printed labels.
5. Empty raceways: Apply labels indicating description of empty raceways (i.e., spare, future use) and identifying the beginning and end locations. Mark raceway clearly with permanent ink marker or printed labels.
6. Abandoned raceways: Apply labeling indicating raceway has been abandoned.

D. Wiring and cabling identification:

1. Power circuit conductor identification, 600 V or less: Apply color-coded identification for cables, feeders, and power circuit conductors exposed in accessible vaults, junction and pull boxes, utility structures, and equipment enclosures. Apply color-coding scheme as indicated below throughout the building's network of feeders and circuits, unless otherwise required by the authority having jurisdiction.

a. Colors on conductors No. 10 and smaller, or No. 6 and smaller for grounded and grounding conductors: Solid colored insulation.
b. Colors on conductors No. 8 and larger, or No. 4 and larger for grounded and grounding conductors: Apply colored tape wrapped a minimum of 6 inches (150 mm) on either end of conductor and in boxes where splices or taps are made.
c. Conductors used solely for grounding purposes shall be green, if insulated.
d. Where multi-conductor cables are used, use same color coding system for identification of wiring.

COLOR CODE (600 V Max.)				
VOLTAGE	NEUTRAL	PHASE		
		A	B	C
120-V, 2-wire	White	Black, Red, or Blue depending on phase		
277-V, 2-wire	Gray	Brown, Orange, or Yellow depending on phase		
208/120-V wye, 3-phase, 4-wire	White	Black	Red	Blue
480/277-V wye, 3-phase, 4-wire	Gray	Brown	Orange	Yellow
480-V delta, 3-phase, 3-wire		Brown	Orange	Yellow

2. Conductors for future use: Attach tags with circuit designation for conductors to be extended for future use.
3. Control and low-voltage system wiring shall be coded with colors and markings different from those used to designate phase wires.

E. Wiring device labels: For wiring devices such as receptacles, devices installed in surface raceway assemblies, and other wiring devices operating at or greater than 120V.

1. Apply adhesive film labels on outside of wiring device coverplates identifying circuit designation serving device, except apply on the inside cover for the following locations.

    a. Public lobbies, corridors, and vestibules.
    b. Galleries accessible to the general public.

2. For special receptacle configurations, apply label identifying applicable device NEMA configuration designation in location not concealed by plug.
3. Apply labels to device coverplates serving low-voltage system devices including the following:

    a. Fire alarm devices and test stations: Circuit designation and (for addressable devices and equipment associated with a specific addressable device) device address.
    b. Telecommunications device stations: Work area outlet designation.
    c. Audio-visual device stations: Device designation.
    d. Security device stations: Device designation.

F. Equipment Identification: Install unique designation label consistent with contract documents and shop drawings.

1. Labeling instructions:

    a. Engraved plastic laminate nameplates, unless otherwise indicated.
    b. Unless otherwise required, provide a single line of text with 13 mm (0.5-inch) high lettering on 38 mm (1.5-inch) high label. Where two or more lines are required, use single label with increased height.
    c. For multi-section or multi-compartment equipment, apply labels identifying each compartment or section.
    d. For fusible equipment, identify fuse type and size on the front cover.
    e. For enclosed circuit breaker equipment, identify device trip rating where rating is not visible.
    f. Where equipment has more than one source of power (i.e., separate control power source), the location and circuit designation of each power source shall be clearly identified at the equipment location.

2. Apply nameplates and labels to equipment according to the below identification schemes:

    a. Identify equipment designation; voltage rating; phase and number of wires; and designation and location of load served. Apply products to the following equipment:

        (1) Panelboards
        (2) Dimming system equipment

    b. Identify equipment designation; primary and secondary voltage ratings; phase and number of wires; circuit designation and location of primary source; and designation and location of load served. Apply products to the following equipment:

        (1) Disconnect switches

(2) Enclosed circuit breakers
(3) Contactors
(4) Motor starters and combination motor starter-disconnects
(5) Variable frequency drives
(6) Transformers

c. Identify equipment designation; and circuit designation and location of primary source. Apply products to the following equipment:

(1) Monitoring and control equipment
(2) Control stations
(3) Fire alarm control panels and auxiliary equipment
(4) Security panels and auxiliary equipment

3. Nameplates shall incorporate white lettering on colored backgrounds based on the following color-coding scheme:

a. Normal power system: Black background.
b. Emergency or standby power systems: Red background.

G. Warning and caution labels and signs:

1. Apply warning and caution labels on equipment in accordance with NFPA 70 and 70E, ANSI, and OSHA requirements including arc flash hazard warning labels and special clearance requirements.
2. Apply warning and caution labels and signs at locations where safe operation and maintenance of electrical system equipment is of concern.

3.3 FIELD QUALITY CONTROL

A. Coordinate names, abbreviations, colors, and other designations with construction documents, submittals, and applicable code and standards requirements. Utilize consistent designations and identification techniques throughout project.

B. Install identification products at locations that are clearly visible at normal viewing angles and without interference with operation and maintenance of the equipment.

C. Install identification products in a neat and clean, professional manner where products are securely attached and oriented parallel to equipment edges.

END OF SECTION 260553

SECTION 260926 - LIGHTING CONTROL PANELBOARD

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Section includes manually operated, PC-based, digital lighting controls with external signal source, electrically operated circuit breakers, and control module.

B. Lighting controls narrative.

1.2 RELATED SECTIONS

A. Interior Lighting: Section 265100.

B. Panelboards: Section 262416.

C. Commissioning: Division 01.

1.3 DEFINITIONS

A. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

B. PC: Personal computer; sometimes plural as “PCs.”

C. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

D. UTP: Unshielded twisted pair.

1.4 SYSTEM DESCRIPTION

A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.

B. Performance requirements: An internal timing and control unit, and other control signal sources send a signal to a PC-based network-system control module that processes the signal according to its programming and routes an open or close command to one or more electrically operated circuit breakers in the power-supply circuits for groups of luminaires or other loads.

1.5 SUBMITTALS

A. Shop drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Outline drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.

3. Block diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
4. Wiring diagrams: For power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.

B. Product data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, and conductors and cables.

C. Coordination drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other sections.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

D. Software and firmware operational documentation:

1. Software operating and upgrade manuals.
2. Program software backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

E. Field quality-control reports.

F. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

G. Operation and maintenance data: For lighting controls to include in emergency, operation, and maintenance manuals.

H. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Source limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

E. All devices shall be UL listed for their intended application.

1.7 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of lighting control functions.
2. Coordinate lighting controls with that in sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

B. Coordinate lighting control components specified in this section with components specified in Section 262416, Panelboards.

1.8 WARRANTY

A. Special warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of software input/output to execute switching or dimming commands.
b. Failure of modular relays to operate under manual or software commands.
c. Damage of electronic components due to transient voltage surges.

B. Warranty period: Two years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Electrically operated, molded-case circuit breakers: Equal to ten percent of amount installed, but no fewer than ten circuit breakers.

1.10 SOFTWARE SERVICE AGREEMENT

A. Technical support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade service: Update software to latest version at project completion. Install and program software upgrades that become available within two years from date of substantial completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of the software.

1. Provide 30 days' notice to Smithsonian to allow scheduling and access to system and to allow Smithsonian to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide products by Electronic Theater Controls, Inc. (ETC) where available.

2.2 CIRCUIT BREAKER / RELAY PANELS

A. General

1. The wall mount relay panel shall be the Echo Relay Panel as manufactured by ETC, Inc., or equal.
2. Relay panels shall be UL508, UL67, and UL924 Listed, and shall be so labeled when delivered
3. Relay panels shall consist of a main enclosure with 30 pole breaker subpanel, relay/dimmer sub panel, integral control electronics, and a low voltage subpanel for data terminations and provision for accessory cards.

    a. Up to two accessory cards shall be supported per relay panel.

B. Mechanical

1. The panel shall be constructed of 16-gauge steel. Panel components shall be properly treated and finished in fine-textured, scratch resistant paint.
2. Relay panels shall be available in 120 volt AC configuration.

    a. 120V enclosures shall be 1715 mm (67.5”) high by 365 mm (14.36”) wide and 109 mm (4”) deep.

3. The panel shall be capable of being mounted on the surface of a wall or recessed mounted
4. Choice of panel covers shall be available for surface or recess mount applications. This outer panel shall ship complete with a locking door to limit access to electronics and breakers, breakers. Optional center-pin reject security screws shall be available for all accessible screws.
5. The unit shall provide interior cover over breaker panel to allow access only to class 2 wiring and prevent direct access to class 1 line voltage components.
6. The relay panel shall support up to twenty-four 20-amp single pole circuits made up of relays or 300W dimmers.

    a. Two and three-pole relay circuits shall be supported at decreased density where each pole constitutes one of the available single-pole circuits. Mixing of circuits in any combination shall be supported.
    b. Panels that do not support an integral dimmer module shall not be acceptable.

7. Breaker subpanel may include up to twenty-nine 20-amp single pole, up to fourteen 20 amp double pole, or nine three pole breakers as required in any combination up to capacity.
8. Control wiring for DMX, station bus, and emergency input terminations shall land on removable headers for installation.

C. User Interface

1. The user interface shall contain a graphical display with button pad to include 0-9 number entry, up, down back arrow navigation and enter.
2. Test shortcut button shall be available for local activation of preset, sequence and set level overrides.
3. The user interface shall have a power status LED indicator (Blue), a DMX status LED indicator (Green), a network status LED indicator (Green) and an LED indicator (red) for errors.
4. Interface shall allow the backlight to timeout and shall provide user editable options to shut off backlight completely as well as adjust screen contrast.
5. Ethernet interface shall default to automatic IP through link local and DHCP. Upon receiving IP address, the address of the Network Interface Card (NIC) shall display in the about menu. Static address and settings shall also be possible.
6. The control interface shall support a USB memory stick interface for uploads of configurations and software updates.

D. Functional

1. Panel setup shall be user programmable. The control interface shall provide the following relay setup features (per circuit):

    a. Type (1 pole, 2 pole, or 3 pole)
    b. Name
    c. Circuit Number
    d. DMX address
    e. sACN address
    f. Space Number
    g. Circuit Modes

        (1) Normal (priority and HTP based activation and dimming)
        (2) Latch-lock
        (3) Fluorescent
        (4) DALI

    h. On threshold level
    i. Off threshold level
    j. Include in UL924 emergency activation
    k. Allow Manual

2. Relay panels shall support discrete addressing of each relay. Panels that are restricted to use of start address with sequential addressing and cannot assign each 0-10V output control to any internal relay shall not be acceptable.
3. The panel shall be capable of switching all relays on or off at once, or in a user-selectable delay per relay using a period of 0.1 to 60 seconds, in 0.1 second increments.
4. An Ethernet connection shall provide advanced control of relays over streaming ACN (sACN) and transmit status, control override, and measured energy usage per branch circuit via an internal Web UI or central monitoring interface.

    a. Control electronics shall report the following information per branch circuit:

(1) Breaker state (On/Off)
(2) Breaker state (Open/Closed)
(3) Current draw (In Amps)
(4) Voltage
(5) Energy usage

b. Panels that do not report this information shall not be acceptable.

5. Built-in Control shall include:

a. Ability to record up to 16 presets in each space from the control panel, connected control stations, or timed events.
b. Presets shall be programmable by recording current levels (as set by DMX or connected control stations), by entering levels on the control panel directly, manually selecting relay state on each relay or a combination of these methods. From the control panel, stations, or timed events it shall be possible to record values for up to 16 zones per space.
c. Up to 8 spaces in a single rack for total of up to 16 spaces shall be supported per system or system subnet.
d. Indication of an active preset shall be visible on the control panel display.
e. One 16-step sequence per space for power up and power down routines.
f. The panel shall have a UL924-listed contact input for use in Emergency Lighting systems. The panel shall respond to the contact input by setting included relays to “on”, while setting non-emergency relays “off”. Each relay can be selected for activation upon contact input.
g. Upon Data loss the system shall provide options to hold last look infinitely or hold for a configured time period set by the installing technician then fade/switch to the input of the next available priority.
h. Control electronics shall respond directly to control stations for zone, preset, and sequence control. Systems that require secondary control systems for this functionality are not acceptable.
i. After power loss, electronics shall be capable of holding the system in its previous state until new level data (DMX, architectural presets, sequences and zones, or local overrides) is received to make each relay change state.

6. The control of lighting and associated systems via real time and Astronomical clock controls:

a. The relay panel shall allow the activation of presets, sequence, and zone programming of up to 50 time clock events via a built in real and astronomical timeclock.
b. System time events shall be programmable via the control panel.

(1) Time clock events shall be assigned to system day types. Standard day types include: everyday, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday.
(2) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event.
(3) System shall automatically compensate for regions using a fully configurable daylight saving time.
(4) Presets shall be assigned to events at the time clock.

c. The time clock shall support event override. It shall be possible to override the timed event schedule from the face panel of the time clock.

d. The time clock shall support timed event hold. It shall be possible to hold a timed event from the face panel of the processor.

7. The panel shall receive ESTA DMX512-A control protocol. Addressing shall be set via the user interface button keypad with any relay being patched to any DMX control address.

   a. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components.
   b. The relays shall respond to control changes (DMX or Stations) in less than 25 milliseconds. DMX512 update speed shall be 40Hz.
   c. Setting changes shall be able to be made across all, some, or just one selected relay in a single action from the face panel.
   d. DMX data loss shall allow for levels/relays to be held for ever or for a specified time before switching to a lower priority source.
   e. Initial Panel setup:

      (1) The relay panel shall automatically detect the type of relay or dimmer installed in each location without need for manual configuration of the physical arrangement.
      (2) Quick rack setup shall be available to apply address settings across all circuits for rack number, DMX Start Address, sACN universe, and sACN start address.
      (3) Emergency Setup Menu shall provide optional delays when emergency is activated or deactivated, and option to turn off non-emergency circuits shall be available. Record function shall allow circuits that are turned on to be added to the emergency setting.

E. Electrical

1. Relay Panels shall be available to support power input from:

   a. 120/208V three phase 4-wire plus ground
   b. 120/240V single phase 3-wire plus ground

2. Raceway Entry:

   a. Feeders:

      (1) Top or top-side (upper 152.4 mm (6”) of either side)
      (2) Bottom or bottom-side 152.4 mm (6”) of either side
      (3) Feeders shall enter through the top or bottom according to the orientation of the enclosure.
      (4) Feeder entry shall be nearest to the location of the feeder lugs or main breaker.

   b. Load:

      (1) Load wiring shall enter through the top or bottom of the enclosure.
      (2) Load wiring shall enter through the top/bottom surface nearest to the breaker sub panel.
      (3) Load wiring may also enter through left and/or right side provided a low voltage chase is not required through the same area. Provide a class 2 chase via a field-installable barrier. When installed, the left or right side of the panel, where the barrier has been installed, shall not permit load wiring.

c. Low Voltage:

(1) Top or top-side (upper 152.4 mm (6”) of either side)
(2) Bottom or bottom-side (bottom 152.4 mm (6”) of either side)
(3) For low voltage raceway entry at the relay end of the cabinet, raceways shall be located at the outer 76.2 mm (3”) of the top/bottom panel.
(4) Field installed low voltage channel shall be provided separately for installation on the left or right side of the panel to allow class 2 wiring to traverse the panel from top to bottom or bottom to top.

3. All relays shall be mechanically latching.
4. The relay shall be capable of switching 20A at up to 300V.
5. The relay panel shall support a maximum feed size of 200 Amps.
6. Relay panels shall support main circuit breaker options:

a. Main breaker options shall be available.
b. Main breakers shall be field installable.
c. Main breakers shall be available in 100 and 200 Amps.
d. Series rated SCCR ratings apply as follows with appropriate main breaker:

(1) 22,000A at 120/240V
(2) 10,000A at 100A; 120/208V
(3) 10,000A, 22,000 or 42,000 at 200A; 120/208V

e. Main breakers shall allow the following range of wire sizes:
(1) 1AWG-300kcmil at 120/240V
(2) 3/0 to 300kcmil at 120/208V

F. Relay

1. Each relay shall have a manual override switch with on/off status indication.
2. Relays shall be rated for use with:

a. 16A Electronic Ballast loads @ 120 and 240V.
b. 20A Tungsten loads at 120 and 240V.
c. Motor loads with ratings of 20 FLA @ 120V and 17 FLA @ 240V 100,000A symmetrical SCCR.

3. Isolation shall be 4000V RMS.
4. Relays shall be latching state.
5. Rated Life:

a. 1,000,000 mechanical activations
b. 100,000 cycles at full resistive load
c. 30,000 cycles full motor, inductive, tungsten, and electronic (LED).
d. Decreasing loading shall increase the rated life of the relay inversely proportional the square of the load.

6. Relays shall support reporting of current usage with an accuracy of five percent of the connected load.

G. Dimmer Modules

1. Dimmer modules shall be available as either forward-phase or phase-adaptive.
2. Dimmer modules shall be fully rated for loads up to 300W.
3. By default, phase-adaptive dimmers shall automatically detect the required dimming mode based on connected loads and lock the mode in at power-up.
4. The forward-phase dimmer shall support tungsten/incandescent, 2-wire fluorescent, and magnetic transformer loads.
5. The phase-adaptive dimmer shall support tungsten/incandescent, line-drive LED, and electronic transformer loads.
6. Panels without available dimmers that support magnetic loads shall not be acceptable
7. The panel shall support a maximum phase dimming load of 7,200W if populated fully with (24) 300W dimmer modules. Panels that do not support phase dimmers and relays combined in a single panel shall not be acceptable.

H. Relay Panel Accessories

1. A low voltage 0-10V dimming option shall provide up to 24 0-10v control outputs that are linked to relay circuits within the panel. Each output shall support up to 400mA of current sink per output.
2. A contact input option shall provide 24 dry contact inputs to be linked for direct or group relay control, to activate a preset, or to activate a sequence. Controller software shall allow for normally open maintained, normally closed maintained, or momentary toggle.
3. A DALI control option shall provide 24 control loops of broadcast DALI control, with each loop controlling up to 64 DALI devices.
4. A ride-through option shall provide short-term power backup of control electronics by automatically engaging when power is lost, and recharging when normal power is present.
5. A tamperproof hardware kit shall be available that provides center reject Torx head screws to prevent access to panel interior by unqualified individuals
6. Main Breaker options shall be available as specified in Section E.

I. Environmental

1. The panel shall be convection cooled. Panels that require the use of cooling fans shall not be acceptable.
2. The panel shall operate safely in an environment having an ambient temperature between 0ºC (32ºF) and 40°C (104ºF), and humidity between 5-95% non-condensing

2.3 POWER-OVER-ETHERNET SWITCH

A. General

1. Acceptable manufacturers: Provide switch approved by manufacturer of lighting control panel.
2. Basis of design is the Cisco Model SG350-10P 10-Port Gigabit PoE Managed Switch and power supply.
3. Switch shall be UL or ETL listed.
4. Enclosure: Rack-mounted in existing lighting control network rack.

    a. Rack-mounted:

(1) One rack unit (U) of rack space per EIA-310.

B. Electrical

1. 120-volt input.
2. 8-port minimum Power over Ethernet (PoE) switch.
3. Ports shall be RJ45 type.
4. Minimum 512 megabytes random access memory.
5. Minimum 16,000 media access control (MAC) address table size.
6. Minimum 14.88 millions of packets per second
7. UTP termination panel.
8. Surface-mounted box shall include patch panel with patch cables. Patch panel with cables not required for rack-mount switch.
9. Power output minimum 125% of PoE required to operate PoE devices provided under this project.

2.4 PUSHBUTTON WALL STATIONS

A. Low-voltage, programmable wall station device with button configurations and functions as shown in details on the drawings, compatible with building's existing lighting control system. Basis of design is ETC Paradigm Inspire stations.

B. Device functionality: Wall station(s) shall provide an immediate local LED illumination response upon button activation to indicate that a system command has been requested. LED will remain lit contingent upon receiving system confirmation of the successful completion of the command.

1. Each button shall be capable of performing an 'On' or 'Off' operation of the programmed zone.
2. Buttons shall be capable of modifying the state of multiple zones to create a scene.
3. Override of programmable time clock function.

C. Wall stations shall have control over programmed scenes, stored in the master control panel memory.

D. Wall stations shall be engraved with appropriate zone and scene descriptions, furnished to the manufacturer prior to fabrication. Size and style of engraving type shall be determined by the Architect during submittal stage. Any silk-screened borders, logos, graduations, etc. shall use a graphic process that chemically bonds the graphics to the metal faceplate, resisting removal by scratching, cleaning, etc. Use zone designations indicated on drawings.

E. Wall station functions shall be configured through software.

F. Finish: White.

1. Faceplate shall match wiring device finish.

2.5 TOUCHSCREEN CONTROL WALL STATIONS

A. Touchscreen Control Stations shall be the Unison Paradigm Touchscreen P-TS7 Series Control Stations as manufactured by ETC, Inc., or equal.

B. General

1. Touchscreen stations shall support default and fully graphical control pages.
2. The Touchscreen station shall operate using graphic buttons, faders and other images on at least 30 separate programmable control pages.
3. Touchscreen stations shall also allow programming of page pass-code, lock out and visibility levels.

C. Mechanical

1. Touchscreen stations shall consist of a seven inch, backlit liquid crystal display (LCD) with a minimum resolution of 800 by 400 pixels and 24-bit color depth with a capacitive touch interface.
2. Touchscreen bezels shall be constructed of cast aluminum finished in a fine texture powder coat.

    a. Touchscreen shall be available in five standard colors:

        (1) Cream (RAL 9001)
        (2) Ivory (RAL 1015)
        (3) Gray (RAL 7001)
        (4) Black (RAL 9004)
        (5) Signal White (RAL 9003)

    b. The bezel shall have no visible means of attachment.
    c. The bezel shall allow the touchscreen to be installed and removed without the use of tools.
    d. The bezel shall provide two working positions for the Touchscreen: service and normal operation.

3. Touchscreen shall have hinged locking covers.

    a. Locking covers shall be made from cast aluminum and be painted to match touchscreen.
    b. Locking covers shall allow for viewing of system status on the touchscreen though a smoked Lexan window.

4. The manufacturer shall furnish back boxes for all LCD stations.

D. Electrical

1. Touchscreens shall be powered entirely by the system network.
2. Touchscreens shall connect to the system using an Ethernet network with Power over Ethernet (PoE).

    a. Ethernet network shall be 10/100BaseTX, auto MDI/MDIX, 802.3af (PoE) compliant.
    b. Network shall utilize Unshielded Twisted Pair (UTP) Category 5, or better wiring.
    c. PoE power consumption shall be PoE class 2, consuming no more than 6 watts.

E. Functional

1. System

a. The Touchscreen shall support configuration firmware upload from a Paradigm Processor as proxy
b. The Touchscreen shall support configuration or firmware upload from local removable media

2. Setup Mode

a. There shall be a setup display that is separate from any user-defined configuration.
b. It shall be possible to view and modify connectivity settings.
c. It shall be possible to view status information.
d. It shall be possible to view and modify LCD screen settings.
e. It shall be possible to perform touchscreen calibration.
f. It shall be possible to view and modify audio settings.
g. The appearance of the setup display shall be standard and not editable.
h. The setup display may be invoked from within the user-defined configuration and/or physical button on the touchscreen.
i. There shall be a default protected method to invoke the setup display.

3. Configurations

a. It shall be possible to have multiple configurations stored within an LCD station.
b. Where multiple configurations are stored, there shall be a boot menu to allow selection of a configuration.

4. Operation

a. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via touchscreen controls. System shall allow the control of presets, sequences, macros and time clock events.

(1) System presets shall be programmable via button, button/fader, touchscreen, or LightDesigner software.

(a) Presets shall have a discrete fade time, programmable from zero to 84,600 seconds with a resolution of one hundred milliseconds.
(b) Presets shall be selectable via touchscreen stations.

(2) System macros and sequences shall be programmable via LightDesigner system software.

(a) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
(b) Macro and sequences shall be activated by button, time clock event or LightDesigner software.

(3) System time clock events shall be programmable via the touchscreen, LightDesigner system software, the processor user interface, or the internal web server.

(a) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
(b) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.

(4) A color selector, supporting hue, saturation, and brightness (HSB) color selection shall be available for color selection of color changing luminaires and provide visual feedback of the current color produced by the associated luminaire.

(a) The color selector shall be provided with a default layout that requires no user configuration.
(b) The color selector shall provide RGB faders in addition to the default HSB color wheel for color selection.
(c) Color selector values shall allow for numerical value input in addition to color wheel and fader control.
(d) The color selector shall be compatible with color mixing systems that use up to seven discrete color control channels.

b. Touchscreen stations shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.

(1) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, and cue light, or room join/separate.
(2) Optional fader functions include master control, individual channel control, fade rate control or preset master control.

c. Touchscreen stations shall allow programming of station and component electronic lockout levels via LightDesigner.
d. It shall be possible to adjust LCD contrast and brightness.
e. It shall be possible to program the station to dim during periods of inactivity.

2.6 BRANCH CIRCUIT EMERGENCY LIGHTING TRANSFER SWITCH

A. General

1. The Branch Circuit Emergency Lighting Transfer Switch (BCELTS) shall be the SC1008 as manufactured by ETC, Inc., or equal.
2. The BCELTS shall provide automatic transfer of a single branch circuit from normal to emergency power source, when normal power fails.
3. The BCELTS shall transfer a lighting load branch circuit from a dimmer/ relay or secondary control output to a second power source in the event of a loss of power to the primary power source, a normal system failure, or activation of a fire alarm.

4. The system shall be listed under ANSI / UL1008 Transfer Switch Equipment and comply with ANSI / NFPA 110 Standard for Emergency and Standby Power Systems, and ANSI / NFPA 70 (NEC), including Article 700, 701 and 702 safety standards. Emergency transfer systems that do not comply with the below stated NEC articles and sections shall not be permitted.

    f. Satisfies requirements of the National Electrical Code (NFPA 70).

        (1) Article 700 – Emergency Systems
        (2) Article 701 – Legally Required Standby Systems
        (3) Article 702 – Optional Standby Systems
        (4) Section 518.3(C) – Assembly Occupancies
        (5) Section 520.7 – Theatres and Similar Locations
        (6) Section 540.11(C) – Motion Picture Projection Rooms

5. The BCELTS shall transfer a single circuit at 120V or 277V up to 20 Amperes in capacity.

B. Transfer Switch

1. The BCELTS shall be a UL1008 transfer switch listed for Emergency Systems (NEC Articles 700 and 701; UL CCN WPWR).

    a. Transfer switches not listed under UL1008 shall not be acceptable
    b. Transfer switches listed under UL1008 for Optional Standby (NEC Article 702; UL CCN WPXT) applications only shall not be acceptable
    c. Automatic Load Control Relays (ALCR) listed under UL924 shall not be acceptable.

2. The switch shall be positively latched and unaffected by voltage variations or momentary outages so that constant contact pressure is maintained and temperature rise at the contacts is minimized.
3. The switch shall be electrically interlocked to ensure only one position, either Normal or Emergency, is engaged at any time.
4. The switch shall be break-before-make to ensure that normal and emergency sources are never interconnected within the unit.
5. Built-in fuses shall provide 10,000 Ampere Short Circuit Current Rating (SCCR) on the connected emergency circuit.
6. Switch contacts shall withstand transfer without welding, with 180º phase displacement between normal and emergency power sources if both sources are energized.
7. Transfer switch contacts shall be rated for mixed loads, including electric discharge lamps and tungsten filament lamps.
8. Transfer switch shall be rated for a minimum of 6,000 cycles at full tungsten load.

C. Control Circuitry

1. The control circuitry shall direct the operation of the transfer switch.
2. A field-configurable normally closed (NC) or normally open (NO) dry contact closure input shall be provided.

    a. Up to (10) BCELTS devices may be connected to a single remote loop.

3. The BCELTS shall support transfer of a 0-10V or DALI controlled circuit.

a. Upon activation of emergency transfer the BCELTS shall break the 0-10V or DALI control circuit, driving connected 0-10V circuits to full output and DALI circuits to their default level.

D. Operation

1. Transfer to alternate emergency supply will occur when normal supply sense voltage drops below 80V when used at 120V or 277V.

E. Enclosure

1. The BCELTS shall be mounted in a NEMA 1 interior type enclosure finished in fine-textured epoxy paint.
2. The system shall be provided with an approved overlay mounted on the front of the enclosure, stating, “BRANCH CIRCUIT EMERGENCY LIGHTING TRANSFER SWITCH”.
3. The enclosure shall be provided with an approved label indicating that the system is UL1008 LISTED for Emergency Systems.

2.7 CONFIGURATION SOFTWARE

A. Provide configuration software to be installed on Smithsonian-provided PC.

1. Software shall support system configuration, printing of configuration records, and monitoring and control functions.
2. Software shall serve as a configuration utility for basic setup and control.

B. Basic features:

1. Support for configuring inputs, zones, circuit breaker actions, and time schedules.
2. Monitor the status of the system and provide visual indication of input status, circuit breaker status, and operational parameters.
3. Establish connections to lighting control panelboard through a control unit front port.

2.8 CONDUCTORS AND CABLES

A. Power wiring to supply side of Class 2 power source: Not smaller than No. 12 AWG, complying with Section 260519, Wires and Cables.

B. Classes 2 and 3 control cables: Stranded copper, complying with UL 83, multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519, Wires and Cables.

C. Class 1 control cables: Stranded copper, complying with UL 83, multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519, Wires and Cables.

D. Structured network digital and multiplexed signal cables: UTP cable with copper conductors, complying with TIA/EIA-568-B.2, Category 6 for horizontal copper cable.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring method:

1. For power wiring comply with Section 260519, Wires and Cables.
2. For digital data transmission cables, comply with Division 27.
3. Wiring within enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

C. Install field-mounted surge protective devices for lighting control panelboards within 12 inches (305 mm) of panelboard enclosure.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, taps, and terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

F. Provide control wiring as needed to tie new lighting control panels to the building's existing ETC lighting control network.

3.2 SOFTWARE INSTALLATION

A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

B. Provide PC user interface custom screens.

3.3 REQUIREMENTS OF THE SMITHSONIAN OFFICE OF THE CHIEF INFORMATION OFFICER

A. The ETC network shall be completely independent from the Smithsonian data network, both physically and logically.

B. Network switches required for the ETC system shall be provided by the integrator and shall be completely independent from existing Smithsonian network switches, other than existing Smithsonian ETC switches.

C. Backbone cabling (copper and/or fiber) shall be completely independent of the Smithsonian data backbone. Do not share pairs or strands within the same cable sheath.

D. Termination hardware required for ETC system shall be completely independent of the Smithsonian data network infrastructure. Do not share copper or fiber patch panels with the Smithsonian data network.

E. At no point shall the ETC network interface with Smithsonian data network.

F. No virtual private network shall be allowed or created on the Smithsonian data network for the ETC network.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's field service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and inspections:

1. Test for circuit continuity.
2. Verify that the control module features are operational.
3. Check operation of local override controls.
4. Test system diagnostics by simulating improper operation of several components.

C. Lighting controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to project during other-than-normal occupancy hours for this purpose.

3.6 OPERATING INSTRUCTIONS

A. As required in Section 260500, provide operating instructions.

B. Engage a factory-authorized service representative to train Smithsonian's maintenance personnel to adjust, operate, and maintain lighting controls.

1. Provide minimum two 8-hour days of on-site training.

3.7 COMMISSIONING

A. Provide system functional performance testing. Comply with the requirements of Commissioning Plan. Coordinate commissioning activities with Commissioning Agent (CxA).

3.8 LIGHTING CONTROLS NARRATIVE

A. The narrative at the end of this section provides a written description of lighting control and programming requirements for each building space type:

END OF SECTION 260926

Narrative Follows Section

LIGHTING CONTROLS NARRATIVE

A. Room 3204 Gunboat Philadelphia Conservation Space

1. Lighting will be controlled by the museum's lighting control network.
2. When the space is unoccupied, the pendant-mounted luminaires will dim or go out, depending on time of day.
3. When called for by the conservators, the room will go into "blackout mode". All lighting except for exit signs will be turned off.
4. In event of a fire alarm, all lighting comes on at 100%, even if in "blackout mode".
5. In event of a power outage, all emergency lighting comes on at 100%, even if in "blackout mode".

END OF NARRATIVE 260926

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Circuit breaker panelboards, lighting and appliance branch-circuit types.

B. Circuit breakers for existing panelboards.

1.2 RELATED SECTIONS

A. Identification for electrical systems: Section 260553.
B. Lighting control panelboard: Section 260926.

1.3 REFERENCES

A. ANSI/NECA 407: Recommended Practice for Installing and Maintaining Panelboards.

B. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NEMA PB 1: Panelboards.

D. NEMA PB 1.1: Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

E. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

F. UL 50: Enclosures for Electrical Equipment.

G. UL 67: Panelboards.

1.4 DEFINITIONS

A. Lighting and appliance panelboard: Maximum branch breaker amperage 100 A.

1.5 SUBMITTALS

A. Product data: For each type of panelboard, overcurrent protective device, accessory, and component indicated.

B. Bill of materials: Provide detailed list of components.

C. Shop drawings: For each type of panelboard, include the following details:

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings in panel schedule format.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.

4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

D. Operation and Maintenance Data: For panelboard components to include in operation and maintenance manuals. In addition to items specified in Division 01 and Section 260101, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Copy of each printed panelboard schedule representing final version following installation.

1.6 QUALITY ASSURANCE

A. Source limitations:

1. Obtain new panelboards, with their associated overcurrent protective devices, components, and accessories through one source from a single manufacturer.
2. For each existing panelboard to receive new components, obtain overcurrent protective devices, components, and accessories through one source from the panelboard’s original manufacturer.

B. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency accepted by the authority having jurisdiction, and marked for intended location and application; listed as a complete assembly.

1. UL label and local testing (where required): As specified in Section 260500, Common Work Results for Electrical.

C. Comply with referenced standards and listings previously identified including NEMA PB 1, NFPA 70, and UL 67.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.9 PROJECT CONDITIONS

A. Interruption of existing electrical service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify COTR no fewer than fourteen days in advance of proposed interruption of electrical service. Provide applicable details of proposed outage including sequence of work and methods of providing temporary electrical service.
2. Do not proceed with interruption of electrical service without written permission.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Furnish spare breakers for panelboards as indicated in schedule on drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Circuit breaker panelboards: the only new panelboard provided under this project is a lighting control panelboard. See Section 290926.

B. Circuit breakers for panelboards: Subject to compliance with requirements, provide components from the original panelboard manufacturer.

2.2 PANELBOARDS, GENERAL

A. UL listing: UL 67, listed and labeled.

B. Integrated equipment short-circuit rating: Each panelboard, as a complete unit, shall have a short-circuit rating equal to or greater than the integrated equipment rating shown or scheduled on the drawings.

1. Rating shall be established by testing in accordance with UL 67, with the overcurrent devices mounted in the panelboard. Make short-circuit tests on the overcurrent devices and on the panelboard structure simultaneously, by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. The source shall be capable of supplying specified panelboard short-circuit current or greater.
2. Testing of overcurrent devices only while individually mounted is not acceptable. Testing the bus structure by applying a fixed fault to the bus structure alone is not acceptable.
3. Mark each panelboard with its maximum short-circuit current rating at the supply voltage.
4. Series rating of panelboards with devices outside of the panelboard enclosure are not permitted.

C. Enclosures: Flush- or surface-mounted as indicated, NEMA PB 1, Type 1, UL 50, galvanized steel.

1. Size: Where multiple-width or multiple-section panelboards are indicated or required, each cabinet shall be the same width and height.
2. Provide enclosure type as indicated below or listed on drawings:

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

D. Directory card: Inside panelboard door, mounted in transparent card holder with information as indicated in Part 3, Identification.

E. Provisions for future devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Furnish each unit with a master nameplate, listing standard manufacturer information including voltage, ampacity, frequency, and short-circuit ratings; manufacturer's model and project designations.

2.3 CIRCUIT-BREAKER PANELBOARDS

A. Factory-assembled complete with breakers.

B. Cabinets and fronts: Minimum 508 millimeters (20 inches) wide, wiring gutter space in accordance with UL 67, with minimum 102-millimeter (four-inch) width on every side.

1. Cabinet front: Door-in-door construction, one or more latches as required for size, with outer door covering the gutter.
2. Door: Required for sizes up to and including 600 amps.

a. Lock: Flush, cylinder tumbler type, with catch and spring-loaded stainless-steel door pull. All panelboards shall be keyed alike. Provide two keys per lock. Provide extra keys as required in "Extra Materials" in Part 1 above.
b. Hinges: Steel, completely concealed.

C. Circuit breakers: UL 489; voltage, continuous-current rating, and interrupting rating as indicated on the drawings.

1. Breakers shall be 1-, 2- or 3-pole, with an integral crossbar to ensure simultaneous opening of all poles in multipole circuit breakers.
2. Operating mechanism: Over center, trip-free, toggle-type with quick-make, quick-break action. Handles shall have on, off, and tripped positions.
3. Circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware or disturbing adjacent units, bars, or branch circuit connections.
4. Where indicated on the drawings, provide shunt-trip main breakers, standard main breakers, or lugs.
5. Main and branch circuit breakers shall have device ampacity rating engraved on the front or side of each breaker handle. The breaker rating shall be clearly visible without removing panelboard cover.
6. Circuit breakers shall be rated for use with 75 deg C wire (conductor temperature rating).
7. Thermal-magnetic circuit breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 amps and larger.
8. Ground-fault circuit interrupter (GFCI) type circuit breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
9. Tandem breakers are not permitted.

D. Bussing assembly and temperature rise: Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule, established by heat rise tests conducted in accordance with UL 67.

1. Conductor dimensions shall not be accepted in lieu of actual heat tests.
2. Current-carrying parts of the bus structure shall tin-plated aluminum.
3. Provide a separate copper ground bus with screw terminals for branch wiring and feed-through lugs.

E. Branch circuit panelboards: Panelboard shall be capable of accepting up to 100-amp branch breakers.

1. Single-pole, 15 and 20 A circuit breakers intended to switch lighting loads on a regular basis shall carry the SWD marking.
2. Branch breakers serving exit lights, fire alarm, and emergency lighting shall be provided with handle-blocking devices which shall prevent accidental operation but not prevent tripping.

2.4 NEW COMPONENTS FOR EXISTING PANELBOARDS, GENERAL

A. UL listing: UL 67, listed and labeled.

B. Integrated equipment short-circuit rating: Components installed in an existing panelboard shall have a short-circuit rating equal to or greater than the existing panelboard.

C. Updated directory card: Inside panelboard door, mounted in transparent card holder or metal frame with transparent protective cover with information as indicated in Part 3, Identification.

2.5 NEW CIRCUIT BREAKERS FOR EXISTING PANELBOARDS

A. Circuit breakers: UL 489; voltage, continuous-current rating, and interrupting rating as indicated on the drawings or equal to the highest-rated existing component in the panelboard in which they are installed.

1. Breakers shall be 1-, 2- or 3-pole, with an integral crossbar to ensure simultaneous opening of all poles in multipole circuit breakers.
2. Operating mechanism: Over center, trip-free, toggle-type with quick-make, quick-break action. Handles shall have on, off, and tripped positions.
3. Circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware or disturbing adjacent units, bars, or branch circuit connections.
4. Circuit breakers shall have device ampacity rating engraved on the front or side of each breaker handle. The breaker rating shall be clearly visible without removing panelboard cover.
5. Circuit breakers shall be rated for use with 75 deg C wire (conductor temperature rating).
6. Thermal-magnetic circuit breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits
7. Tandem breakers are not permitted.
8. Single-pole, 15 and 20 A circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.
9. Branch breakers serving exit lights shall be provided with handle-blocking devices which shall prevent accidental operation but not prevent tripping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely attach panelboards to the wall where indicated on the drawings. Install in accordance with NEMA PB 1.1 and manufacturer's written installation instructions.

1. Mounting height:

a. 1829 mm (72 inches) to top of panelboard.
b. Panelboards taller than 1829 mm (72 inches): Bottom edge no more than 102 mm (4 inches) above floor.
c. Top breaker maximum height: No more than 2.0 meters (6 feet, 7 inches) above the floor or working platform.

B. Comply with applicable portions of NECA 407.

C. Frame and mount printed circuit directory indicating type and location of equipment on each circuit.

D. Wiring in gutters: Arrange conductors into groups, and bundle and wrap with wire ties .

E. Install filler plates in unused spaces.

3.2 CONNECTIONS

A. Connect panelboard components to wiring and to ground as indicated.

B. Shared neutral conductors shall not be permitted.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

A. Materials: Refer to Division 26 Section "Identification for Electrical Systems." Identify units, auxiliary devices, controls, and wiring. Identify equipment ratings.

B. Nameplates: Refer to Division 26 Section "Identification for Electrical Systems" for additional requirements. Provide identification nameplate for each panelboard and associated components located on front of assembly.

C. Identify field-installed wiring and components. Refer to Division 26 Section "Identification for Electrical Systems" for additional requirements.

D. Provide printed directory for each panelboard. Handwritten directories are not acceptable. Copying of panel schedules and descriptions on drawings is not acceptable. Circuit directory card shall be 6 mm (¼ inch) narrower than the interior width of the directory card holder or holder metal frame. Circuit directory shall reflect final circuit installation. Include the following information:

1. Panelboard designation and room location.
2. Circuit breakers, size and number of poles.
3. Circuit or feeder description including destination room name(s) and number(s).
4. Clear description of type of load circuit serves.
5. Panelboard ratings: Main bus ampacity, main circuit breaker or main lug ampacity, AIC rating.
6. Incoming primary feeder size and source panelboard circuit designation.

E. Room names and numbers on the panelboard circuit directories shall match names and numbers used by the Owner. Note that room names and numbers on the drawings may not match the Owner's final room name and numbering scheme.

3.4 FIELD QUALITY CONTROL

A. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuit

B. Make continuity tests of each circuit installed under this project.

C. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. Clean interior and exterior of any panelboard, new or existing, modified by the work of this project.

B. Refinish painted surfaces damaged during construction to match the rest of the panelboard.

END OF SECTION 262416

SECTION 262716 - CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Indoor enclosures.

1.2 SUBMITTALS

A. Product data: Each type of enclosure required for the project.

PART 2 - PRODUCTS

2.1 INDOOR ENCLOSURES

A. Type 1 in accordance with NEMA 250 and conforming to UL 57, of size required by NEC to fit equipment or as shown on the drawings.

B. Construction: Code grade galvanized steel.

2.2 FINISHES

A. Satin gray enamel, inside and out.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely attach enclosure to wall or hang on frame, as indicated.

3.2 LOCATIONS

A. Provide indoor type inside building.

END OF SECTION 262716

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Switches and receptacles.

1.2 RELATED SECTIONS

A. Nameplates: Section 260553.

1.3 SUBMITTALS

A. Product data: Each type of device used in the project.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. Acceptable manufacturers:

1. Pass & Seymour, Inc.
2. Leviton Manufacturing Co.
3. Hubbell/Bryant Electric
4. Cooper Industries/Cooper Wiring Devices.

B. Receptacles: Heavy-duty specification grade receptacle conforming to UL 498:

1. Convenience receptacles: Duplex, brass mounting strap, NEMA 5-20R.

a. Basis of design: Pass & Seymour PS5362.

C. GFCI receptacles: Specification grade receptacle conforming to UL 498:

1. Convenience receptacles: Duplex GFCI, NEMA 5-20R.

a. Basis of design: Pass & Seymour 2097.

D. Device color:

1. General-purpose receptacles: Black

E. Device plates: Type 302 stainless steel.

1. Basis of design: Pass & Seymour:

a. Type 302 stainless steel, SS Series.

2.2 TERMINAL BLOCKS

A. Terminal blocks: Screw-terminal type, size as required by NFPA 70, NEMA 250 Type 1 enclosure with hinged cover.

B. Basis of design: Square D.

2.3 CORD REELS

A. Standard duty retractable cord reel with power accessories. Provide enclosed drum, rigid mount unit with minimum 35 feet cord (12/3 STJOW) and ball stop. Provide 2 NEMA 5-20 duplex ground-fault circuit interrupter receptacles in cast outlet box.

B. Basis of design: Woodhead Model 998-3070G20.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices in complete compliance with the manufacturer’s recommendations.

B. Receptacle orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

C. Device plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

D. Arrangement of devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent devices under single multi-gang wall plates.

3.2 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face or back of plate, and durable wire markers or tags inside outlet boxes.

C. Attach nameplates securely to receptacle cover plates. Provide nameplates for all devices except 120-volt receptacles, identifying equipment and use.

END OF SECTION 262726

SECTION 262800 - ENCLOSED CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Enclosed switches (disconnects/safety switches).

1.2 RELATED SECTIONS

A. Motors:

1. Motor requirements for HVAC equipment: Section 230513.

B. Fuses: Section 262813.

1.3 REFERENCES

A. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. UL 98: Enclosed and Dead-Front Switches.

1.4 SUBMITTALS

A. Product data: Each type of enclosed switch.

1.5 QUALITY ASSURANCE

A. Comply with the following standards:

1. NEMA KS 1 for enclosed switches.
2. UL 98.

B. UL label and local testing (if required): As specified in Section 260500, Common Work Results for Electrical.

PART 2 - PRODUCTS

2.1 ENCLOSED SWITCHES (DISCONNECTS/SAFETY SWITCHES)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation.
2. ABB; General Electric products.
3. Schneider Electric; Square D products.
4. Siemens Industry, Inc.

B. Properly size switches for number of poles and provide fused or non-fused as required for project conditions and to meet NFPA 70 requirements.

C. Fuse contacts and quick-make/quick-break jaws shall ensure positive contacts with reinforcing spring clips or other approved means.

D. Switches shall be front-operated.

E. Current-carrying parts: plated copper.

F. Hinges: Noncurrent-carrying.

G. Switches shall be lockable in either open or closed position.

H. Type:

1. Nonfused switches: General-duty type on 120/208 V or 120/240 V systems, and heavy-duty type on 277/480 V or 240/480 V systems.
2. Fused switches: Heavy-duty type on all voltages.

I. Enclosures: Indoors NEMA 250 Type 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches where indicated and as required for motor outlets, transformers, and other equipment.

B. Securely attach and properly connect enclosed switches.

C. Provide an enclosed switch for each motor, as required by NFPA 70, except where it is provided in a panelboard within sight and easy reach of the motor, and provide wiring and connections from source. Enclosed switches shall be fused where protection is required or indicated on drawings and unfused elsewhere.

END OF SECTION 262800

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 RELATED SECTIONS

A. Enclosed switches: Section 262800.

1.3 REFERENCES

A. UL 198E: Class R fuses.

B. UL 198C: High-Interrupting-Capacity Fuses, Current Limiting Types.

1.4 SUBMITTALS

A. Product data: Each type of fuse.

B. Published data on fuses shall include time/current curves, peak-let-through curves and I^2t melting and clearing curves.

1.5 QUALITY ASSURANCE

A. Comply with UL 198C, Class L fuses, also Classes G and J.

B. UL label and local testing (if required): As specified in Section 260500, Common Work Results for Electrical.

1.6 EXTRA MATERIALS

A. Provide three spare fuses for each type and size of fuse in the work.

PART 2 - PRODUCTS

2.1 FUSES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation; Bussmann
2. Littelfuse, Inc.
3. Mersen

B. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

C. Fuses 0-600 amps for 600 V or 250 V, UL labeled Class RK5 with time delay, with a minimum short-circuit interrupting capacity of 200,000 rms symmetrical amperes, and shall carry 500 percent of rating for a minimum of 10 seconds.

1. Fuses for disconnecting switches for HVAC equipment: Size and type recommended by the equipment manufacturer and as required for equipment to meet UL rating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses where indicated and as required for motor outlets or other equipment.

END OF SECTION 262813

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Luminaires, including lamps, drivers, and accessories.

1.2 RELATED SECTIONS

A. Commissioning requirements: Divisions 01 and 23.

B. Dimming control:

1. Lighting control panelboards: Section 260926.

1.3 SUBMITTALS

A. Product data: For each type of luminaire indicated, arranged in order of luminaire designation. Include data on features, accessories, and the following:

1. Dimensions of luminaires, photometrics and efficiency, wattage, reflectors, glassware, voltage, suspension, and appurtenances.
2. Certified results of laboratory tests for luminaires and lamps for photometric performance.
3. LED drivers
4. Lumen output, rated color temperature, and manufacturer’s LED binning procedures.
5. Types of lamps.

B. Shop drawings: Show details of nonstandard or custom luminaires. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

1. Wiring diagrams: Detail wiring for luminaires and differentiate between manufacturer-installed and field-installed wiring.

C. Samples: If contractor has selected luminaires not identical to scheduled luminaires, as permitted in Part 2 below as an option, COTR may require submittal of samples.

1. One complete luminaire of each approved type, except as otherwise instructed by the COTR.
2. Install approved samples as work of the project, in locations as directed, as standards for all luminaires of the same type.
3. Ascertain that the luminaire will fit in the available space and is coordinated with adjacent and connected products.

D. Maintenance data: For luminaires to include in maintenance manuals specified in Division 01.

1.4 QUALITY ASSURANCE

A. UL label and local testing (if required): As specified in Section 260500, Common Work Results for Electrical.

B. Luminaires, and accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

C. Comply with NFPA 70.

D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Luminaires, mounting hardware, and trim: Coordinate layout and installation of luminaires with ceiling system and other construction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver glassware and lamps in their original cartons, clearly labeled.

1.7 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractor's and subcontractors' responsibilities are described in Divisions 01 and 23 for Commissioning Requirements.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-design products: Luminaires indicated in the Luminaire Schedule on the drawings are the basis of design of the project.

1. Subject to compliance with requirements, provide the scheduled products. Unnamed products will only be considered and approved according to Bidding and Contracting requirements and Division 01 requirements for substitutions.

B. Subject to compliance with requirements, provide products by one of the following:

1. Drivers:

a. Philips/Advance
b. Osram Sylvania
c. Universal Lighting Technologies
d. Lutron
e. EldoLED

C. Subject to compliance with requirements, provide products by one of the following:

1. Lamps:

a. General Electric

b. Osram Sylvania
c. Philips
d. Venture

2.2 LUMINAIRES, GENERAL

A. Luminaires shall comply with UL 1598 and be complete with sockets, casings, fittings, holders, shades, glassware, lamps, and appurtenances, wired and completely assembled.

B. Metal parts: Free from burrs, sharp corners, and edges.

C. Sheet metal components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, frames, and other internal access: Smoothly operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

E. Metal finishes: Painted after luminaire fabrication.

F. Reflecting surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White surfaces: 85 percent.
2. Specular surfaces: 83 percent.
3. Diffusing specular surfaces: 75 percent.
4. Laminated silver metalized film: 90 percent.

G. Lenses, diffusers, covers, and globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated, exactly as scheduled or specified in optical details and lighting characteristics.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens thickness: 4 mm (0.156 inch) minimum, unless greater thickness is indicated.

2.3 LED DRIVERS

A. Driver shall operate from a 120-volt or 277-volt, 60-Hz input power source and be suitable for outputting power to 12-volt or 24-volt LED lamp sources, as required.

B. Drivers, where specified, shall be capable of being dimmed. Dimmable drivers shall be controlled by a Class 2 low-voltage 0-10VDC controller.

C. Performance Criteria:

1. Driver shall have a Class A sound rating.
2. Driver shall have a power factor (PF) greater than 0.90.
3. Driver shall have Total Harmonic Distortion (THD) of input current equal to or less than 20 percent.

D. Driver shall meet FCC and Title 47 CFR regulations for EMI/RFI.

E. Driver shall comply with ANSI C62.41 Class A requirements for transient protection.

2.4 EXIT SIGNS

A. General requirements: Exit signs shall meet the Energy Star Program requirements to operate on 5 W or less input power per face. Comply with UL 924 and the following:

1. Sign colors and lettering size: Comply with authorities having jurisdiction.

B. Internally lighted signs: As follows:

1. Lamps for ac operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

2.5 LAMPS

A. Lamps, LED:

1. The LED manufacturer shall provide the quantity and wattage of LEDs required to achieve the defined lighting output set forth by the luminaire manufacturer.
2. LED lamps shall be integrated into an engineered package for the specific luminaire application, including heat dissipation components.
3. Color temperature: As specified in luminaire schedule, with a tolerance of plus or minus 100K and within a range of three macadam ellipses. Noticeable color temperature variation between adjacent luminaires shall be considered a failure to meet these specifications and shall be replaced at no cost to the owner.
4. Minimum performance characteristics:

a. Life: Minimum lumen maintenance of L70 at 50,000 hours, as defined by IES LM-80.
b. Lumen Output: Based on absolute photometry, lumens (total luminous flux exiting the physical luminaire), as specified on contract drawings and schedules.
c. Color Rendering Index: Rated at 85 or higher.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with Section 260500, Common Work Results for Electrical, for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-stem hangers: 12-mm (1/2-inch) steel tubing with swivel ball fitting and ceiling canopy. Finish same as luminaire.

C. Twin-stem hangers: Two, 12-mm (1/2-inch) steel tubes with single canopy arranged to mount a single luminaire. Finish same as luminaire.

D. Rod hangers: 5-mm- (3/16-inch-) minimum diameter, cadmium-plated, threaded steel rod.

2.7 FINISHES

A. Luminaires: Manufacturer’s standard, unless otherwise indicated.

1. Paint finish: Applied after fabrication over corrosion-resistant treatment or primer, free of defects.
2. Metallic finish: Corrosion-resistant.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before ordering the luminaires, consult with the installer of the ceilings to ensure that the correct luminaire trim is supplied and installed. Provide the supports and accessories required for installation in each ceiling system.

B. Before ordering the luminaires, verify the specified voltage with the voltage shown on the drawings to ensure the correct voltage is supplied.

3.2 INSTALLATION

A. Furnish and install a complete luminaire for every outlet indicated on the drawings so that every outlet shall be properly provided with a suitable luminaire of type specified, of wattage indicated.

B. Luminaire wire shall bear UL label. Luminaire wiring for luminaires and branch circuit wiring in luminaire channels shall be type THHN.

C. Each luminaire shall be completely equipped with lamps of the size, type, wattage and shape indicated and specified. Lamps and drivers shall be of the proper voltage for the building.

D. Furnish luminaires in the quantities, sizes, and types indicated on drawings.

3.3 LUMINAIRE SUPPORT

A. Support from building structure: Provide fasteners appropriate to the supporting substrate, and wire, jack chain, or rods as specified for particular luminaire types below.

1. Provide channels bolted or welded between joists where required to obtain proper spacing for lighting supports.
2. Connections to joists or beams: Beam clamps. For wire supports, wrap wire securely around structural member.
3. Connections to concrete: Embedded, as specified in Section 260533, Conduits.

B. In suspended plaster and drywall ceilings, luminaires may be supported from the suspended ceiling construction. Fasten box and luminaire supports securely to suspension system. Where luminaires are surface-mounted, cut neat holes in the plaster as required for supports.

C. Recessed luminaires in suspended acoustical ceilings: Coordinate luminaire installation with ceiling installer. Ensure that ceiling supports are located to clear luminaires.

1. Support from building structure: Use fasteners specified in Section 260533, Raceways, and 6-mm (0.25-inch) rods , jack chains, or No. 10 wire.

a. Provide 4 supports for each individual luminaire, one at each corner of luminaire. In continuous rows, install additional supports at each joint.

2. Provide double nuts on rods.

D. Surface-mounted and stem-suspended luminaires on or below suspended acoustical ceilings: Supported from the building structure above with 6-mm (0.25-inch) rods.

1. Install double nuts on rods.
2. Provide 4 supports for each individual luminaire, 2 at each end of luminaire. In continuous rows, install an additional support at each joint.
3. Surface-mounted luminaires mounted on low-density ceilings shall be provided with spacers where required.

E. Where it is necessary for a luminaire to be installed directly below an air duct, install two hanger rods, one on each side of the duct, bolted to a channel or angle suspended from the hangers under the duct, and support the luminaires from the suspended channel or angle.

3.4 CLEANING

A. Luminaires, used for temporary lighting during construction, shall be cleaned free of construction dirt to like-new condition.

END OF SECTION 265100

SECTION 270101 - COMMUNICATIONS GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for communications work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

B. Division 01 includes sections specifying requirements for commissioning and construction waste management.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 27.

B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for, all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Owner.

E. Communications work of this project includes, as a brief general description, the following:

1. Providing local area network outlets in the project area, with cabling back to the local telecommunications closet.
2. The project includes commissioning under the direction of a Commissioning Agent (CxA).

F. See Division 01 for requirements related to, commissioning, Owner's occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 27 specifications.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in article "Substitutions" below for substitutions.

C. Products specified by reference standards or by description only: Any product meeting those standards or description.

D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance.

1. Where other acceptable manufacturers are named, Contractor may provide products of those named manufacturers only, which meet the specifications.
2. Where specification permits "equal" products, without naming other acceptable manufacturers, Contractor may use products of any manufacturer, which meet the specifications.

E. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance, and shall not be construed as limiting competition. Contractor may use products of any manufacturer, which meet the specifications.

F. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 27 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.

5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project and of representative manufacturer. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. Equipment, construction and installation must meet requirements of Smithsonian Institution and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install

E. All materials and equipment shall be installed and completed in a first class and professional manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or professional appearance shall be removed and replaced with satisfactory work when so directed in writing by the COTR.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall artisanry.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the COTR will determine sizes to be utilized.

H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the COTR of said uncertainty, doubt, or conflict and obtain a decision as to the intent prior to initiating any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the COTR and await a written decision.

B. Plan and coordinate all work to proceed in an orderly and continuous manner without undue delay, and in conformance with the project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate communications work so that work of each trade is completed before other construction begins which would obstruct it.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of all raceway, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the COTR prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractors' assistants shall include a competent communications supervisor, who shall be on the premises at all times to check, layout, coordinate and superintend the installation of work. The supervisor shall establish all basic requirements relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for all equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of Shop Drawings and Product Data for every item of equipment. Shop drawings or product data will not be considered until Manufacturers' Lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.
2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.

3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
4. All exclusively communications items furnished as items associated with mechanical items but not specifically described in the mechanical item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the mechanical item by identified specification paragraph.
5. Product data sheets shall be 8.5-inches by 11-inches cut sheets for operating and maintenance manual.

C. Submit at least three copies of the results of every test required under any section in this division.

D. Specialist shall submit a list of at least three projects similar to this project in type, size, and quality, which have been in place and operating satisfactorily for at least five years.

1. Include project name, address, name and phone number of owner's representative, and project type and size.

E. After the work is completed, submit all required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the COTR prior to final acceptance of the work.

1.10 SPECIALIST

A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.11 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

a. Contract Drawings.
b. Specifications.
c. Addenda.
d. Change Orders and other Modifications to the Contract.
e. Reviewed shop drawings, product data, and samples.

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.

4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

    a. Manufacturer's name and product model and number.
    b. Product options, substitutions, or alternates utilized.
    c. Changes made by addenda and modifications.

5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

    a. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
    b. Field changes of dimension and detail.
    c. Details not on original Contract Drawings.

6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Binders: Three-ring binders with vinyl-covered hard covers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
3. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. Print on spine of binder "O & M INSTRUCTIONS." If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.
4. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
5. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
6. Part 1: Directory, listing names, addresses, and telephone numbers of communications engineers; contractor; communications subcontractors; and major communications equipment suppliers.
7. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria.
    b. List of equipment.
    c. Parts list for each component, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

8. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data.
    b. Photocopies of certificates.
    c. Photocopies of warranties, guarantees, and bonds.
    d. Test reports: Copies of the results of all tests required under all sections of specifications.

9. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
10. Submit final volumes revised, within ten days after final inspection.

1.12 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

    1. The communications, building, fire, and safety codes of Smithsonian Institution.
    2. The National Electric Code, NFPA 70 (NEC).
    3. The National Fire Protection Association Code. (NFPA).
    4. International Building Code (IBC).
    5. International Energy Conservation, Fire, and Communications Codes (ICC).

1.13 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply.

    1. Factory Mutual (FM)
    2. Federal Specifications (FS)
    3. American National Standards Institute (ANSI)
    4. American Society for Testing and Materials (ASTM)
    5. International Code Council (ICC)
    6. Institute of Communications and Electronics Engineers (IEEE)
    7. National Communications Code (NEC) (NFPA 70)
    8. National Communications Manufacturer's Association (NEMA)
    9. National Fire Protection Association (NFPA)
    10. The Occupational Safety and Health Act (OSHA)
    11. Underwriters Laboratory Inc. (UL)

1.14 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

B. Area shall be maintained and shall be returned to original condition at the completion of the project.

C. Store communications construction materials such as cable, raceways and boxes, devices, and equipment in buildings, enclosed trailers, or portable enclosed warehouses.

1. Materials and products subject to damage from moisture: Store in dry locations. If necessary, protect with protective wraps or covers.
2. Plastics and other materials and products subject to damage from heat or cold: Store at manufacturer's recommended temperatures.
3. Plastics and other materials and products subject to damage from sunlight: Protect from sunlight.

D. Communications equipment stored before installation and installed during construction: Provide clean, dry locations at manufacturer's recommended temperatures, and cover or wrap if required to protect from incidental damage.

1.15 PROTECTION

A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.
4. Construct dust partitions, where indicated on the drawings or as required.
5. Protect areas occupied by Owner's personnel or equipment.
6. Seal off all return air registers and other mechanical systems to prevent dust from entering.

B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

C. Repair all damage or soiling to the complete satisfaction of the COTR; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract sum.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer's recommended temperatures.

E. Protect communications materials and products from weather events and accidents of construction.

F. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.16 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.17 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes cutting, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the COTR in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.18 WARRANTY

A. Work and equipment provided as work of this division shall be fully warranted under the general project warranty. In addition, provide added special warranties as specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the Owner. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the Owner and revise schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is one year after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Service reports for warranty work shall be provided to the Owner.

C. When use of the permanent equipment has been permitted for temporary services during construction of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.19 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractor's and subcontractors' responsibilities are described in Division 01.

B. Cooperate with the CxA to accomplish the requirements of the Commissioning Plan during the construction and correction periods.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of raceways. Close superfluous openings and remove all debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the COTR.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or COTR finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, COTR and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

3.4 COMMISSIONING

A. Comply with requirements of 'Commissioning" in Part 1 above.

END OF SECTION 270101

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to work of more than one section of Division 27.

B. Communications identification.

C. Testing wiring systems.

1.2 RELATED SECTIONS

A. Division 01 includes sections specifying requirements for commissioning and construction waste management.

B. Operation and Maintenance Manuals: Division 01 and Section 270101.

C. Painting: Division 09.

1.3 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A national recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

1.4 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed on the basis of using the particular manufacturers' products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that make their use impractical or cause functional fit, access, or connection problems.

D. The contract drawings are generally diagrammatic, and do not indicate all fittings or offsets in raceway or all pull boxes, access panels, or other specialties required.

1. Install raceway exposed to view parallel with the lines of the building and as close to walls, columns, and ceilings as may be practical, maintaining adequate clearance for access at parts requiring servicing.
2. Install raceway a sufficient distance from other work to permit a clearance of not less than 15 mm (0.5 inch) between its finished covering and adjacent work.
3. No raceway shall be run below the head of a window or door.
4. Pull boxes and other appurtenances which require operation or maintenance shall be easily accessible. Do not cut or form handholes for operation or maintenance of appliances through walls or ceilings.

1.5 SUBMITTALS

A. Test reports: Show that tests specified in Part 3 below demonstrate the specified results.

1.6 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the electrical, building, fire, and safety codes and regulations of the Smithsonian Institution.

B. Communications equipment, materials and devices provided or installed as work of Division 27 shall bear UL label, or, if UL label is not available, the item shall be tested and labeled by a qualified testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70. Provide testing, if required, without addition to the contract sum.

C. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

D. Products shall contain no urea-formaldehyde content.

1.7 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractors' and subcontractors' responsibilities are described in Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Nameplates: Laminated plastic, engraved, white letters on black background, except where other colors are noted or specified.

1. Size: Minimum 0.75 inch (19 mm) by 2.5 inches (64 mm).
2. Letter size: Minimum height 0.1875 inch (5 mm).
3. Fasteners: Vandalproof brass screws or rivets.

2.2 DATE-SENSITIVE EQUIPMENT

A. Date-sensitive equipment: Systems, equipment, or components which use or process date and time data in order to perform their functions.

B. Each item of date-sensitive equipment used in the project shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify COTR if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

3.2 IDENTIFICATION

A. Items to be identified include, but are not limited to:

1. Voice and data communications systems and devices.
2. Wire management equipment.

B. Identify function, equipment services, and area served.

3.3 TESTS

A. During the progress of the work and after completion, test the communications cabling and wiring systems.

B. Results of the tests shall show that the wiring meets the requirements of this specification. Should any test indicate defect in materials or workmanship, immediately repair, or replace with new, the faulty installation, and retest the affected portions of the work.

C. Furnish equipment and instruments necessary for testing.

D. Tests shall demonstrate the following:

1. Circuits are continuous and free from short circuits.
2. Circuits are free from unspecified grounds.
3. Circuits are properly connected in accordance with the applicable wiring diagrams.
4. Circuits are operable.

E. Immediately repair defects and retest until systems are operating correctly.

F. Submit test reports.

3.4 OPERATING INSTRUCTIONS

A. Furnish the necessary technicians, skilled workers, and helpers to operate the communications systems and equipment of the entire project for one 8-hour day.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of systems and equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions for use by instructors and Owner personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon by the COTR.

END OF SECTION 270500

SECTION 282000 – VIDEO

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. The Video Assessment and Surveillance System (VASS) is an enterprise class system. Integrate with the PACS so the PACS provides a single unified control and management platform. Link video to events and alarms on all other systems (intrusion detection, intercommunications, and PACS) with the PACS.

B. This is an extension of the Owner's existing American Dynamics Victor system.

C. The existing system head-end in NMAH Server Room has expansion capacity to accommodate the new cameras. The Contractor is responsible for licenses.

1.2 SUMMARY

A. This Section includes the following:

1. Cameras
2. PoE Ethernet Over Fiber Converter

1.3 REFER TO 280500.10 FOR ALL OTHER PART I REQUIREMENTS

PART 2 - PRODUCTS

2.1 MULTI-LENS DOME CAMERA, 12MP

A. Acceptable Manufacturers

1. Arecont Vision
2. Approved Equivalent

B. Arecont Vision AV12275DN-28 or approved equivalent

C. Minimum Features and Specifications

1. Multiple Lens Options in a single camera housing
2. 3 axis gimbal; up to 4 individual camera gimbals can be independently placed in any orientation around a 360 degree track with extra positions for looking straight down
3. Image Sensor: 4 x 3MP CMOS
4. Resolution
   a. Total: 8192 H x 1536 V
   b. Per Sensor: 2048 H x 1536 V
5. Dynamic Range: 69.5dB
6. Frame Rates:
   a. 10 FPS at maximum resolution
   b. 14 FPS at 1/4 resolution
   c. 29 FPS in Binning Mode
7. Remote Focus
8. True day/night functionality with mechanical IR cut filter
9. Binning Mode
10. PoE 802.3af, class 3
11. Outdoor rated IP66 and IK-10 Impact-Resistant Housing
12. Motion Detection
13. H.264 (MPEG-4, Part 10)/Motion JPEG and multi-streaming
14. Minimum Illumination:
    a. Color: 0.2 Lux
    b. Color Binning: 0.1 Lux
    c. B/W (Night Mode): 0.2 Lux, IR sensitive
15. Operating Temperature: -40 to 122 deg F (-40 to 50 deg C)
16. Humidity: 0% to 90% (non-condensing)
17. Total dimensions: 7.7 x 3.1 in (196 x 78.5 mm)
18. Made in USA

2.2 FIXED DOME CAMERA, 3MP

A. Acceptable Manufacturers

1. Arecont Vision
2. Approved Equivalent

B. Arecont Vision AV3255PMIR-SH and AV3255PMTIR-SH or approved equivalent

C. Minimum Features and specifications

1. Image Sensor: 3 MP
2. Resolution: 2048 H x 1536 V
3. Minimum Illumination:
   a. Color (Day Mode): 0.3 Lux
   b. Color Binning (Day Mode): 015 Lux
   c. B/W (Night Mode): 0 Lux, IR sensitive
   d. IR Illuminator: 850 nm LEDs / 50 ft (15 m) IR distance (max) / 40 degree IR angle (PMIR model)
   e. IR Illuminator: 850 nm LEDs / 120 ft (36 m) IR distance (max) / 30 degree IR angle (PMTIR model)
4. Wide Angle lens with remote focus/zoom, P-Iris, Day/Night (PM model)
5. Telephoto lens with remote focus/zoom, P-Iris, Day/Night (PMT model)
6. Power: Power over Ethernet (PoE) IEEE 802.3af, Type 1 Class 3
7. Allows 90 degree image rotation for better coverage in hallways and corridors
8. Non-integer Scaling
9. 3 axis gimbal
10. True day/night functionality with IR LEDs
11. 21 frames per second
12. SDHC Card Slot
13. Binning Mode
14. Outdoor rated IP66 and IK-10 Impact-Resistant Housing
15. Bit rate control and multi-streaming
16. Operating Temperature: -40 to 122 deg F (-40 to 50 deg C)
17. Total dimensions: 5.5 x 4.9 in (140 x 125 mm)
18. Made in USA

2.3 MULTI-IMAGER CAMERA, RECESSED CEILING MOUNT

A. Minimum Features

1. Video
   a. Video frame rate (up to): 10FPS @ 8192x1536

2. Video frame rate in binning mode up to: 10FPS @ 4096x768

B. Protocols

1. The camera shall have Real Time Streaming Protocol (RTSP) support allowing for compatibility with media players such as Apple QuickTime, VLC Player and others.
2. The camera shall support both unicast and multicast communication protocol.
3. The camera shall support RTSP, RTP over TCP, RTP over UDP (Unicast/Multicast), HTTP1.0, HTTP1.1, TFTP, DHCP, 802.1x, and IPv4.
4. 100 Base-T Ethernet Network Interface.
5. Multi-streaming: 8 non-identical streams(2 active connections to each sensor).

C. Electrical

1. General purpose opto-coupled 1 input and 1 output

2. Power over Ethernet (PoE): PoE 802.3af
3. Auxiliary Power 12-24VDC, 24VAC
4. Power consumption: PoE – Class 3; auxiliary- 12W max

D. Networking

1. The camera shall be equipped with a 100 Mbps LAN connector.

E. Environmental

1. Operating temperature -40˚C (-40 °F) to +50˚C (122 °F)
2. Storage temperature -40˚C (-40 °F) to +60˚C (140 °F)
3. Humidity 0% to 90% (non-condensing)

F. Illumination

1. Color (Day Mode): 0.2 Lux
2. B/W (Night Mode): 0.02 Lux, IR sensitive

G. Compatible Accessories

1. AV-WMJB Wall Mount w/ Junction Box
2. AV-PMJB Pendant Mount w/ Junction Box
3. AV-CRMA Corner Mount Adapter
4. AV-PMA Pole Mount Adapter
5. AV-JBA Junction Box
6. AV-EBAS Electrical Box Adapter Square
7. AV-EBAR Electrical Box Adapter Round
8. SO3-FMA Flush Mount Adapter
9. SO3-CAP Mount Cap

H. 2.14 Warranty

1. Limited 3-Year Parts and Labor

PART 3 - EXECUTION

3.1 GROUNDING

A. Comply with requirements in Section 270526.10 "Grounding and Bonding for Security Systems" for grounding conductors and connectors.

3.2 GENERAL

A. Install all system components and appurtenances in accordance with the manufacturer's instructions, ANSI C2, and furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified. Control signals, communications, and data transmission lines grounding shall be installed as necessary to preclude ground loops, noise, and surges from affecting system operation. Equipment, materials, installation, workmanship, inspection, and testing shall be in accordance with manufacturers' recommendations and as modified herein.

B. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the Riser/Connection diagram for all schematic system installation/termination/wiring data.

C. Attach equipment to walls and ceiling/floor assemblies and be held firmly in place (e.g., sensors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

D. Current Site Conditions: Visit the site and verify site conditions are in agreement with the design package. Report all changes to the site or conditions that will affect performance of the system to the Owner. Do not take any corrective action without written permission from the Owner.

E. Cameras

1. Install cameras with the proper focal length lens as indicated for each zone
2. Set cameras with fixed iris lenses to the proper f-stop to give full video level
3. Aim camera to give field of view as needed to cover the alarm zone / intended field of view
4. Aim fixed mount cameras installed outdoors facing the rising or setting sun sufficiently below the horizon to preclude the camera looking directly at the sun
5. Focus the lens to give a sharp picture over the entire field of view.
6. Use a fine focus target for final focus adjustments.

F. Camera Pole and Mounts: The Contractor shall install the camera mount as specified by the manufacturer and as shown; provide mounting hardware sized appropriately to secure the mount, camera and housing with maximum wind and ice loading encountered at the site; provide a foundation for each camera pole as specified and shown; provide a ground rod for each camera pole of correct length as dictated by soil conductivity and connect the camera pole to the ground rod; provide electrical and signal transmission cabling to the mount location; connect signal lines and AC power to mount interfaces; connect pole wiring harness to camera.

3.3 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video surveillance system components, including camera-housing windows, lenses, and monitor screens.

3.4 REFER TO 280500.10 FOR ALL OTHER PART III REQUIREMENTS

END OF SECTION 282000

SECTION 283100 – INTRUSION DETECTION

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. The Intrusion Detection System is an inherent part of the PACS system. Link alarms to video system for event driven camera call-up and recording.

1.2 SUMMARY

A. This Section includes the following:

1. Door contacts
2. Motion sensors

1.3 REFER TO 280500.10 FOR ALL OTHER PART I REQUIREMENTS

PART 2 - PRODUCTS

2.1 CARD READER, ARM/DISARM

A. Refer to 281000 – Access Control for specifications

2.2 360 DEGREE DUAL-TECH MOTION SENSOR

A. Acceptable Manufacturers

1. Bosch
2. Approved Equivalent

B. Bosch DS9370 and DS9371 or approved equivalent.

C. Minimum Features and Specifications

1. Up to 25 ft (7.6 m) mounting height
2. 360 degrees x 70 ft (20 m) diameter pattern
3. Fully-adjustable optical arrays for coverage customization
4. Rated for use in difficult environment to reduce false alarms from background disturbances such as air movement and hanging signs.
5. Combination of passive infrared (PIR) detection, microwave detection, and advanced signal processing technology.
6. Built-in tamper switch
7. Operating Temperature: -40 to 120 deg F (-40 to 49 deg C)
8. Dimensions: 3.5 x 7 in (8.9 x 17.8 cm)
9. Voltage: 9 to 15 VDC
10. UL Listed

2.3 DOOR POSITION SWITCH; RECESSED

A. Acceptable Manufacturers

1. Magnasphere
2. Approved Equivalent

B. Magnasphere MSS-20 Series, MSS-26 Series for Normally Closed Loop or approved equivalent

C. Minimum Features and Specifications

1. UL 634 Listed
2. Recessed
3. Magnetic tamper
4. 0.75 in (19 mm) or 1 in (25.4 mm) diameter
5. Capable of operating with a 0.5 in (13 mm) gap
6. Screw Terminals or 12 in (305 mm) wire leads, #22 AWG, solid

2.4 DOOR POSITION SWITCH; HIGH SECURITY, RECESSED (COLLECTIONS STORAGE AREA)

A. Acceptable Manufacturers

1. Magnasphere
2. Approved Equivalent

B. Magnasphere HSS-L2C or HSS-L2C-A or approved equivalent

C. Minimum Features and Specifications

1. UL 634 Level 2 High Security Listed
2. Recessed
3. Integrated Removal Tamper Circuit and hardware, to actuate on removal of
4. switch from mounting surface
5. Used with, or contain embedded End of Line (EOL) resistors compatible with Software House control panels
6. Rated for both indoor and outdoor use
7. Qualify as an Intrinsically Safe - Simple Apparatus.
8. Installable in either a 1 in (25.4 mm) diameter hole or standard ANSI door cutout
9. Capable of operating with a 0.0625 in (1.5875 mm) gap
10. Wire leads, #22 AWG, solid, 12 in (305 mm) length
11. Brass magnet housing, ABS switch housing

PART 3 - EXECUTION

3.1 GROUNDING

A. Comply with requirements in Section 270526.10 "Grounding and Bonding for Security Systems" for grounding conductors and connectors.

3.2 SYSTEM INTEGRATION

A. Integrate intrusion detection system with the following systems and equipment:

1. Electronic door hardware – locking/unlocking, request-to-exit
2. Elevators – none
3. Network lighting controls – none
4. Intercommunications and program systems – none
5. Public address and mass notification systems – none
6. Access control – door contacts and IDS zones
7. Fire-alarm system – none
8. Perimeter security system – none
9. Video surveillance – video call-up of appropriate camera(s) for each alarm activation

3.3 SYSTEM INSTALLATION

A. Comply with UL 681 and NFPA 731.

3.4 GENERAL

A. Supervision

1. Configure system components to continuously monitor for normal, alarm, line supervision, tamper, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.
2. Trouble Condition Signal: Indicates the system is not fully functional (e.g. sensor battery failure, open or shorted/grounded transmission line conductors, or device cover removed).

3.5 REFER TO 280500.10 FOR ALL OTHER PART III REQUIREMENTS

END OF SECTION 283100

SECTION 283111 - ADDRESSABLE FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and General Provision of Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this Section.

B. Related Sections:

1) General and Special conditions
2) Division 1: Submittals
3) Division 7: Firestopping
4) Division 9: Painting
5) Division 23:

a. Air Handling Systems

6) Division 26:

a. Basic Electrical Requirements
b. Wires and Cables
c. Raceways
d. Identification for Electrical Systems

1.02 SUMMARY

A. Scope: This work includes designing and providing modifications to the existing addressable fire alarm system as described herein and on the contract drawings for renovations to the Gunboat Philadelphia facility at the Smithsonian Institution, National Museum of American History. The system shall include all wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm and supervisory signals, initiating devices, alarm notification appliances, interfaced equipment, and all other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described.

B. Existing Equipment: If possible, existing fire alarm equipment shall be maintained fully operational until the new equipment has been tested and accepted by the Smithsonian Institution. s new equipment is installed, it shall be labeled "NOT IN SERVICE" until the new equipment is accepted. Once the new system is installed, tested, and accepted by the Smithsonian, the labels on the new equipment shall be removed and the existing equipment shall be labeled "NOT IN SERVICE" until removed from the building. Just prior to demolition and construction activities (dust producing activities), dust covers should be installed over spot type smoke detectors and the duct detector for the air handling unit serving the area. The dust covers are to be removed at the end of the work day.

C. Equipment Removal: After acceptance of the new system by the Smithsonian, all existing equipment not connected to the new system shall be removed and all damaged surfaces shall be restored to finishes similar to surrounding walls/ceiling/floor. Smoke detectors shall remain covered during removal and while in storage. Operational equipment which was removed shall be carefully packaged, labeled, and turned over to the COTR. Other material, such as raceway and electrical boxes, shall be removed from the site and disposed of by the Contractor.

D. Repair/Service Replacement Parts: Repair services and replacement parts for the system shall be furnished under this contract after the date of final acceptance of work by the Smithsonian Institution. On-site service during the warranty period shall be provided within 24 hours after notification. All repairs shall be completed within 48 hours after notification.

E. All required testing of the fire alarm system, to include all connected devices as outlined in this Section. Testing shall also include intelligibility of the fire alarm system as outlined in Article 3.6. E.14 of this Section.

1.03 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. FM: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NFPA: National Fire Protection Association

G. NICET: National Institute for Certification in Engineering Technologies

H. OSHEM: Office of Safety Health and Environmental Management

I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

1.04 SYSTEM DESCRIPTION

A. The existing System is a complete, supervised, noncoded, addressable multiplex fire alarm system with voice/strobe evacuation, intelligent analog alarm initiation, conventional smoke detection initiation, and complying with all aspects of the applicable documents listed herein. Modifications of the system shall not diminish its capabilities.

1.05 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 72 and all contract documents and specification requirements.

B. The system is and shall remain classified as a proprietary protective signaling system.

C. Control features:

1) The system fire alarm control panel is tied-to the central monitoring system. The Keltron monitoring system uses the existing SI network to communicate fire alarm conditions. A compatible fire alarm system, the appropriate Keltron LS Net transceiver and associated network connections must be installed. The final connections and programming will be performed by SI staff.
2) Any intelligent analog smoke detector or conventional smoke detector zone shall include a selectable alarm confirmation capability. Alarm conditions on these devices are processed through a confirmation period of 45 seconds. Over the next 300 seconds, a signal justification period is initiated where any subsequent alarms are reported immediately.
3) A subprogram shall be provided to allow environmental compensating for smoke detector sensitivity. Each smoke detector shall be programmed with this capability.
4) The system shall provide a field test function where one person can test the complete system or a specified area at the fire alarm control panel while maintaining full operational function of other areas not under test. Alarms, troubles, device types, and the initiation device addresses shall be logged to the system printer and historical memory.
5) If one does not exist, provide a manual pull station attached to the fire alarm control panel that activates the general alarm. Resetting the manual pull station (and all other activated alarms) will cause the general alarm to cease operating. OSHEM must approve the final sequence of operation.
6) Provide program capability via switches or buttons in a locked portion of the fire alarm control panel to bypass the notification appliance circuits, air handler shutdown, smoke control operation, elevator recall, fire door release, and door unlocking features. Operation of these switches or buttons shall indicate this action as a supervisory signal on the FACP display and printer output.
7) History Logging - recirculating last 500 events, minimum. History shall be downloadable by classification for selective event reports.

D. Supervision

1) Class B initiating device circuits.
2) Class B signaling line circuits for each floor.
3) Class X signaling line circuits for the network.
4) Class B notification appliance circuits.
5) Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.
6) Provide electrical supervision of the circuits leading to interfacing modules for the monitoring of contact type initiation devices, the control of electrical devices, fire pump controllers, load control relays (controlling elevators and HVAC equipment), and each independent smoke detection, kitchen, and gaseous fire suppression systems.

E. Alarm Functions: Fire alarm system functions and operations shall be as indicated on the Alarm Function Matrix included at the end of this part. Operation of an alarm initiating device shall cause the functions indicated on the matrix to occur as described below:

1) Initiate Pre-signal Alarm: This function shall cause an audible and visual alarm and indication to be provided at the FACP. Activation of an initiation device will be annunciated at the FACP only, without activation of the General Evacuation Alarm.
2) Shutdown Supply Fan Served: This function shall cause the air handling system supply fan to shut down.

3) Initiate Smoke Management Sequence of Operation: The building HVAC system is arranged to exhaust smoke from a fire area. The sequence of operation is described in Division 23. The fire alarm system shall provide any and all such interfaces/control points as required to properly activate smoke management systems. Only the first fire alarm system initiating device to go into alarm condition will activate the smoke control functions. Any subsequent devices will have no effect on the smoke control mode. The exact quantities and locations of all such interface points shall be coordinated with the automatic control systems supplier.
4) Close Smoke Damper: This function shall cause smoke dampers installed in HVAC systems to shut-down.
5) Initiate Stairwell Pressurization: This function shall initiate the stairwell pressurization systems in each building stairwell. Each stairwell has a separate pressurization system which will be independently activated. The full extent and requirements of this system are described under Division 23. The fire alarm system shall provide any and all such interfaces/control points as required to properly activate this smoke management system.
6) Illuminate LED on Device in Alarm: This function shall cause an LED, integral to a device, to illuminate, indicating that the device is in alarm. For contact devices, such as sprinkler valve tamper switches, the LED shall be built into the intelligent system interface module monitoring the device.
7) Activate audio/visual signals and display address on the FACP: This function shall illuminate an alarm indicating LED, sound an audible alarm, and display a device address at the FACP when the system is in an alarm condition. Signals shall also be transmitted to a computer control display system.
8) Transmit Event to Central Monitoring Station: This function shall cause the event to be transmitted to the central monitoring station at the Smithsonian Institution SIPPS Control Center. The message sent shall include the building of origin and the identical message displayed on the fire alarm control panel LCD display board.
9) Print Address, Date, Time, and Type of Alarm: This function shall cause the fire alarm system printer to print a message identical to that shown on the FACP LCD display board.
10) Activate Audio/Visual Signals and Address Display on Remote Panel or Graphic Annunciator Panel: This function shall cause the event to be transmitted to a remote panel, whose location is shown on the drawings. The message sent shall be the same message displayed on the FACP LCD display board.
11) Signal Confirmation: This function shall cause the fire alarm control panel to reset the activated device and wait for a second alarm activation. Alarm conditions are processed through a confirmation period of 45 seconds. Over the next 300 seconds, a signal justification period is initiated where any subsequent alarms are reported immediately.

F. Trouble Functions: Provide the following actions and indications at the FACP upon a single break, open condition, or ground fault on all supervised circuits which may prevent the required operation of the system:

1) Annunciate at the FACP: A yellow visual signal, audible alarm, and alphanumeric LCD display of type of trouble, and device address.
2) The fire alarm system printer shall print a message identical to that shown on the LCD display on the FACP. In addition, the printed hard copy of the event shall indicate the date and time at which it occurred.
3) Send a signal to the existing central monitoring system. This message shall include the building of origin as well as all information indicated to be displayed on the FACP.

4) Send a signal to the remote panel shown on the drawings. This message shall include the building of origin as well as all information indicated to be displayed on the FACP. The message sent shall be the same message displayed on the FACP LCD display board.
5) Each independent fire detection, kitchen, and fire suppression system shall be monitored for trouble conditions. Each monitored condition shall be provided with a separate address.

G. Fire alarm signal initiation shall be by one or more of the following devices installed under this project:

1) Addressable area smoke detector

H. System trouble signal initiation shall be by one or more of the following devices or actions:

1) Loss of primary power at the FACP.
2) Ground or a single break in FACP internal circuits.
3) Abnormal ac voltage at the FACP.
4) A break in standby battery circuitry.
5) Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
6) Failure of battery charging.
7) Abnormal position of any switch at the FACP or annunciator.
8) Amplifier failure
9) Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.

1.06 SUBMITTALS

A. General: Refer to Section "SUBMITTALS" for basic information relating to submittal requirements. Submit 6 complete sets of submittals. Partial submittals will not be acceptable and will be returned without review. Before any work is commenced, the submittal must be approved by the Office of Safety, Health and Environmental Management (OSHEM). Any work performed by the contractor prior to their approval will be at the contractor’s own risk. If such work is contrary to applicable codes and contract documents, the contractor shall bear all costs including, but not limited to, demolition, reconstruction, and all costs and expenses associated with revising the fire alarm system to meet all applicable codes and contract document requirements.

B. System Description: Submit a detailed description of the control panel as it shall operate for this specific installation. General system descriptions from the catalog cuts and copies of the Systems Design Operation portion of this specification will not be acceptable.

C. Equipment: Include annotated catalog data showing manufacturer's name, model, voltage, and catalog numbers (for all equipment and components provided or modified under this project) of the following:

1) Fire Alarm Control Panel (FACP) components added to an existing FACP under this project
2) Strobe Power Extender Panel components added to an existing Strobe Power Extender Panel under this project
3) Storage Batteries added under this project.

4) Cabinet
5) Addressable Interface Devices
6) Terminal Cabinets/Assemblies
7) Addressable Relays and Interface Modules
8) Graphic Annunciator Panel components added to an existing FACP under this project
9) Annunciation devices (speakers, strobes, bells, etc.)
10) Fire Detector (smoke, heat, flame, etc.)
11) Amplifiers
12) Electromagnetic Door Holder
13) Remote Fire Alarm Control Unit
14) Wire
15) Boxes
16) Terminal strips
17) Relays
18) Transient Voltage Surge Suppressors
19) Raceway
20) Support

D. Shop Drawings: Provide 5 sets of working drawings and 1 set of reproducible mylar sepia on sheets not smaller than 609 mm by 914 mm (24 inches by 36 inches). Shop drawings shall be prepared on a Computer Aided Drafting (CAD) System. As a minimum, the shop drawing submittal shall include the following:

1) Interior wiring diagram for FACP if relevant to the work of this project.
2) Provide point-to-point wiring diagrams on floor plans at a scale of not less than 1:100 (1/8" = 1'-0"), showing all field devices installed or modified under this project (indicating and initiating devices, relays, switches, etc.), field interconnections installed or modified under this project, the routing of raceway and circuits installed or modified under this project between devices, electrical boxes, terminal cabinets, risers, and the FACP. All device circuit numbers and addresses shall be indicated.
3) Field wiring color code scheme.
4) Locations for all ceiling mounted equipment shall be coordinated with luminaires, air outlets, ductwork and other fixtures. All detectors shall be centered and aligned with ceiling tiles and/or other ceiling mounted devices.
5) Provide complete riser diagrams indicating the wiring sequence of all devices installed or modified under this project and their connections to the control equipment. Provide a color code schedule for the wiring. Provide floor plans showing the location of all devices and equipment installed or modified under this project.
6) Detailed sequence of operations and matrix.

E. As-Built (Record) Working Drawings: On a daily basis the contractor's superintendent shall record as-built conditions on a set of Shop Drawings maintained at the job site. Two sets of Shop Drawings reflecting as-built conditions shall be available prior to and for use in the final acceptance test. Two weeks after the acceptance test and before final acceptance of the work, furnish four complete sets of as-built drawings. The drawings shall be prepared on uniform sized sheets not less than 609 mm by 914 mm 24 inches by 36 inches). The drawings shall include:

1) As-built location of all devices and equipment installed or modified under this project. Device addresses shall be listed next to each device

2) Complete wiring diagrams showing connections between all devices and equipment installed or modified under this project. Each conductor shall be numbered at every junction point with indication of origination and termination points.
3) Riser diagram for all work installed or modified under this project.
4) All deviations from the project drawings and approved shop drawings.

F. Record Drawing Software: Provide three (3) compact discs containing CAD based drawings in DXF format of all as-built drawings and schematics.

G. Device Addresses: Prior to fire system installation, for all devices installed or modified under this project, provide for approval a complete list of device addresses with corresponding commands, controls, and sequence of operation.

H. Qualification Data: For Designer and Installer.

I. Strobe and Voice Evacuation Circuit Labels: Prior to fire system installation provide for approval an updated list of area descriptions for strobe and voice evacuation circuits to be labeled on the fire alarm panel.

J. Descriptions on Graphic Annunciators: Prior to fire system installation, provide updated descriptive labels (if necessary) for graphic annunciator labeling which will include strobe and voice evacuation zones, sprinkler zones, sprinkler valve locations, HVAC zones, fire walls, stairwells, and elevators.

K. Service Manuals and Equipment Descriptions: Thirty days prior to the final acceptance test and after the preliminary testing has been completed submit the following:

1) Furnish four (4) bound copies of complete service manuals to include: device and board specifications, operation, installation, and maintenance manual; manufacturers installation instructions for all aspects of the installation; Walktest Operating Instructions; manufacturer's wiring specifications for the system; and training manual.
2) Maintenance checklists for equipment installed or modified under this project.
3) As-built circuit diagrams, complete with color-code scheme, and device descriptions for work installed or modified under this project.
4) Complete parts list for parts installed or modified under this project by make model number and manufacturer.
5) List of smoke detector addresses and corresponding sensitivity readings for smoke detectors installed or modified under this project.
6) Copies of approved submittal materials.

L. Calculations: Submit substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component shall be submitted with the calculations. Calculations shall include:

1) Battery capacity calculations.
2) Supervisory power requirements for all equipment.
3) Alarm power requirements for all equipment.
4) Power supply rating justification showing power requirements for each of the system power supplies.

5) Justification showing power requirements of the system amplifiers. Amplifiers shall be sized for a minimum of 1 watt per connected speaker in common areas and 0.5 watt per speaker in all other locations.
6) Voltage drop calculations for NAC wiring runs demonstrating worst-case condition. Show capability of 25 or 70.7 vrms circuits for wire runs.
7) Provide complete battery calculations for both the alarm and supervisory power requirements. Ampere-hour requirements for each system component shall be submitted with the calculations.

M. FACP Wire Chart: Prepare a system wire chart. Chart every wire installed or modified under this project showing the wire number, color, size, type of circuit, designation, origination point and termination point. The chart shall be typewritten with minimum 12-point lettering on paper that is 215.9 mm by 279.4 mm (8.5 inches by 11 inches). The format of the wire chart shall be as shown on the contract drawings. Provide one copy of the wire chart in a sealed plastic envelope inside the fire alarm control panel.

N. Terminal Cabinet Wire Chart: Prepare a wire chart of the wires in each terminal cabinet installed or modified under this project. Chart every wire installed or modified under this project showing the wire number, color, size, type of circuit, designation, origination point and termination point. The chart shall be typewritten with minimum 12-point lettering. The format of the wire chart shall be as shown on the contract drawings. The chart must be protected with a clear laminate and mounted in each cabinet so that it does not interfere with the wiring or terminals.

O. Work Schedule: All work must be coordinated with facility operations. Museum operations may require limited access to areas, arranging for museum security personnel to accompany contractors in non-public areas, and working during off-hours. Prior to initial work, meet with museum staff to establish a work schedule. A work schedule must be submitted for approval prior to initial work.

P. Certificate of Compliance: Within two weeks after passing the acceptance test submit a certificate of code and contract compliance to the COTR in accordance with NFPA 72, Paragraph 1-7.2.1.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications

1) Testing Services or Laboratories: Construct all fire alarm and fire detection equipment in accordance with the latest edition of the following publications from Underwriters Laboratories (UL) and Factory Mutual Engineering Corporation (FM):

a. UL Fire Protection Equipment Directory
b. UL Electrical Construction Materials Directory
c. UL 38 – Manually Actuated Signaling Boxes for Use With Fire Protection Signaling Systems
d. UL 228 – Door Holding Devices
e. UL 268 - Smoke Detectors for Fire Protective Signaling Systems
f. UL 268A - Smoke Detectors for Duct Application
g. UL 464 - Audible Signal Appliances
h. UL 497A – Secondary Protectors for Communications Circuits

i. UL 521 - Heat Detectors for Fire Protective Signaling Systems
j. UL 864 - Control Units for Fire Protective Signaling Systems
k. UL 1283 – Electromagnetic Interference Filters
l. UL 1449 - Transient Voltage Surge Suppressors
m. UL 1480 - Speakers for Fire Protective Signaling Systems
n. UL 1971 - Signaling Devices for the Hearing Impaired
o. FM Approval Guide

2) Codes and Standards

a. International Building Code, Latest Edition
b. Life Safety Code, Latest Edition
c. NFPA 70, National Electrical Code
d. NFPA 72, National Fire Alarm Code, 2002 Edition
e. Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
f. ASME/ANSI A 17.1, Safety Code for Elevators and Escalators

B. Qualifications of Installer: Design shall be by a NICET Level III or IV Technician or a Registered Fire Protection Engineer. Installer shall have an office, which has been in existence for at least 3 years, within a 75-mile radius of the U.S. Capitol. Installation shall be accomplished by an electrical contractor with a minimum of five years' experience in the installation of fire alarm systems of similar size and capacity. The services of a technician provided by the control equipment manufacturer shall be provided to supervise installation, adjustments, and tests of the system.

C. Distributor/ Service Organization/ Designer Qualifications: Design Personnel certified by NICET as Fire Alarm Level III or IV. The manufacturer's equipment distributor shall show evidence of certification by the manufacturer in the technical support of the system installed under this contract.

1) The distributor shall show evidence of certification of at least one employee by the National Institute for Certification in Engineering Technologies (NICET) at Level III or IV in the Fire Alarm Systems subfield of Fire Protection Engineering Technology. If such a certified individual is not employed, adequate documentation shall be provided to show comparable training and experience of an existing employee. At a minimum, comparable training and experience shall consist of ten years of progressive experience in the installation and design of fire alarm systems of similar size and complexity to that specified herein.
2) In lieu of an employee with NICET Level III or IV certification, the distributor shall show evidence of at least one employee with a minimum of ten years of progressive experience in the design of fire alarm systems and, in addition, the distributor shall show evidence of technical support in the design, installation, and testing of the systems from a manufacturer-affiliated company, which shall show evidence of certification of at least one employee by the National Institute for Certification in Engineering Technologies (NICET) at level III or IV in the Fire Alarm Systems subfield of Fire Protection Engineering Technology.

3) The contractor shall furnish evidence that the fire alarm equipment supplier has an experienced and effective service organization, which carries a stock of repair parts for the system being furnished. Should the Contractor fail to comply with the service requirements of this section, the Smithsonian will then have the option to make the necessary repairs and back-charge contractor without any loss of warranty as provided by the contract documents.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.08 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.09 PROJECT CONDITIONS

A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by The Smithsonian Institution or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1) Notify COTR no fewer than two days in advance of proposed interruption of fire alarm service.
2) Do not proceed with interruption of fire alarm service without The Smithsonian Institution's written permission.

1.10 COORDINATION

A. Coordinate sprinkler head layout with reflected ceiling plan and all ceiling – mounted equipment, including diffusers, luminaires, security cameras, fire alarm devices, exit signs, and other devices.

B. Coordinate major equipment and piping layouts with other trades to avoid obstructions and excessive changes in direction for piping.

1.11 WARRANTY

A. The contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the Smithsonian and after the receipt of as-built drawings and schematics of all equipment.

1.12 SERVICE AGREEMENT

List requirements, if part of the contract. Confirm with OSHEM and COTR.

1.13 EXTRA MATERIALS

A. Spare parts shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, stamping or tagging.

B. Furnish the following spare parts. Quantity shall be two percent of the installed number of devices, but not less than the quantities listed:

1) Smoke Detectors of each type installed: five
2) Audio/visual devices of each type provided under this project: five
3) Fuses for each fused circuit installed or modified under this project: five
4) Lamps for each lamp type furnished: five

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) FACP components, cabinets, and peripheral devices: use only products from Siemens, the manufacturer of the existing fire alarm system.
2) Wire and Cable: Comtran Corporation.

a. Helix/HiTemp Cables, Inc.; a Draka USA Company.
b. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
c. West Penn Wire/CDT; a division of Cable Design Technologies.
d. Approved equal.

3) Raceway:

a. Allied
b. Approved equal

4) Boxes, supports, terminal blocks, and appurtenances:

a. As per Section Division 26

2.02 EXISTING FIRE ALARM CONTROL PANEL (FACP)

A. Use the existing fire alarm control panels.

B. Circuits

1) Existing circuits may be used to connect new devices to the FACP. Each circuit shall, after installation of the new devices, have at least a 20% spare capacity.
2) If the capacity of existing circuits is insufficient to meet the spare capacity requirement above, provide new circuits originating in the same FACP that serves fire alarm devices in the project vicinity.

2.03 FIRE DETECTORS

A. Photoelectric light scattering type smoke detectors shall be provided as follows:

1) The detector shall be suitable for two wire 24VDC operation and two-way communications on the intelligent analog signaling circuit. Smoke detectors shall be U.L. listed for use with the FACP and environmental conditions
2) Detectors shall be self-compensating for ambient temperature and humidity
3) Detector bases shall be installed on an industry standard, 101 mm (4 inch) square or octagonal electrical outlet box. Bases shall be universal for ionization, heat, and photoelectric (light scattering type) detectors.
4) Detectors shall be twist lock type on to the base with self-wiping contacts.
5) Screw clamp terminals shall be provided for all conductor terminations
6) The detector shall be addressed, tested and programmed prior to installation. The detector readout shall yield a discreet electrical value for status tracking and logging for determining maintenance and cleaning requirements. An address to identify each detector, type, its location within the system, and its sensitivity setting. The control panel shall provide a sensitivity readout from the detector without removal from the pluggable base.
7) Provide self-restoring type detectors which do not require any readjustment after actuation to restore them to normal operation.
8) All components shall be rust and corrosion resistant. Vibration shall have no effect on the detector's operation. Protect the detection chamber with a fine mesh metallic screen which prevents the entrance of insects or air born materials. The screen shall not inhibit the movement of smoke particles into the chamber.
9) The detector shall display a steady LED when in the alarm state when the system is operating from normal or standby power.
10) Where selective localized control of electrical devices is required for interfaced equipment operation, furnish and install a base with software programmed addressable relay integral to the base.

B. Photoelectric - Beam Type:

1) Detectors shall be U.L. listed for use with the fire alarm control panel and environmental conditions.
2) Field programmable sensitivity settings of 20%, 35%, and 60% beam obscuration.
3) Latching alarm LED is built into the cover of the receiver or transmitter.
4) Compensation circuit for environmental variations.
5) Tied directly into an FACP control board. A remote panel will not be allowed.

2.04 NOTIFICATION APPLIANCES

A. Speakers and strobes shall be 24 or 70 VDC and shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Devices shall be mounted to a 4 inch (101 mm) square outlet boxes.

B. Speakers: Provide fire alarm speakers conforming to U.L. 464.

1) Speakers shall be provided with at least the following four tap settings: 2-watt, 1 watt, 1/2 watt, and 1/4 watt.

2) The audible signal shall have two alternate and distinct audible patterns; horn tone and recorded voice message; each field switchable for peak output levels of 100db or 106db measured at 3048mm (10 feet). When multiple tones are activated simultaneously, the tones shall be prioritized to avoid interference.
3) System shall meet intelligibility requirements of NFPA 72 and this Section.
4) Finish: White.

C. Strobe lights

1) Provide with red finish plate and with the word "ALERT" horizontally printed for ceiling mounting.
2) Xenon strobe with a minimum repetition rate of 1 HZ, not exceeding 3 HZ and a maximum duty cycle of 40% with a pulse duration of 0.2 seconds.
3) Visual alarm signals shall be furnished with minimum light intensity of 75 candela and meet the requirements of ADA and UL 1971. In large rooms with ceilings over 10 feet, 110 candela models shall be provided. Any device up to 110 cd shall have adjustable candela ratings.
4) Provide strobe light visual alarm signals which operate on 24 VDC.
5) Synchronization shall be provided as required in NFPA 72.

D. Audio-Visual Combination Assemblies shall be provided where strobes and speakers are identified at the same locations.

2.05 INTERFACE MODULES:

A. Furnish intelligent analog signaling circuit interface modules for the monitoring of contact type initiation devices, and the control of electrical devices. The modules shall be capable of monitoring three separate functions: alarm, trouble and supervisory conditions.

B. The module shall be addressed, tested and programmed prior to installation using a U.L. listed programmer/ tester.

C. The module shall display a steady LED for each circuit, in the normal power or standby power condition, when in the alarm state or during control circuit is activation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment, materials, installation, artisanry, examination, inspection, and testing shall be in accordance with NFPA 72, except as modified herein.

3.02 SYSTEM FIELD WIRING AND RACEWAY

A. Wiring Within Cabinets and Junction Boxes: Provide wiring installed in a neat and professional manner and installed parallel with or at right angles to the sides and back of any box or cabinet.

B. Conductor Type and Size: Wire size shall be sufficient to prevent voltage drop problems. Wire type and sizing of conductors shall be in accordance with the manufacturers wiring specifications for the system, except for minimum wire size shall be as follows:

1) Signaling Line Circuits: 16AWG, Type FPLR, solid copper, shielded
2) Notification Appliance Circuits: 14AWG, Type FPLR, solid copper, twisted pair, shielded
3) Interfaced Circuits: 16AWG, Type FPLR, solid copper, shielded
4) Speaker Circuits: 16 AWG, Type FPLR, solid copper, twisted pair, unshielded

C. Connectors: All conductors shall be terminated at a screwed connector on a securely mounted approved pressure type terminal block. The use of twist-on wire connectors or similar devices shall be prohibited.

D. Terminal Cabinets: Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Cabinet size shall be appropriate for the size of the wiring to be connected.

E. Conductor Numbering: All conductors installed or modified under this project in the system shall be numbered at every junction point. Use a numbered shrink-wrap label designed specifically for this purpose. Wire numbers shall be the same as those designated on the as-built drawings. Mark each terminal in accordance with the wiring chart and diagrams of the system.

F. Conductor Color Coding: Color coded conductors shall be consistent for each type of circuit. When renovating or adding to an existing system, color coding shall match the existing system.

G. Junction Boxes: Any junction box used in a circuit shall be dedicated to that circuit. A common junction box is not permitted for routing multiple circuits.

H. Signaling Line and Notification Appliance Circuits

1) Signaling Line, notification appliance, and power circuits shall each be in separate raceway.
2) Strobes are to be connected to circuits separate from speakers. This includes strobes and speakers that are mounted as a unit.
3) Provisions for tying-in signaling line and notification appliance circuits directly to the FACP mother board (board containing CPU) shall not be used. Initiation and indicating circuits shall be tied to a separate electronic board before connection to the mother board.

I. Circuit Loading:

1) Circuits operating at 24VDC shall not operate at less than 21.6 volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10% of nominal voltage.

J. Raceway:

1) All conductors shall be in grounded metal raceway. Raceway shall be rigid metal or EMT. Flexible metal raceway not exceeding 1830 mm (six-foot) lengths shall be permitted from junction box to initiating device. On flexible metal conduit, use only insulated throat connectors.
2) Run raceway concealed unless specifically shown otherwise on the drawings.
3) Minimum raceway size shall be 21 mm (3/4-inch).

K. Circuits to Interfaced Equipment:

1) Circuits to smoke management systems, fan shutdown systems, door locking systems, A/V shutdown, lighting controllers, fire door release, and firefighter telephones in elevator cabs shall terminate in terminal cabinets within 914mm (3 feet) of the controllers for those systems. The completion of those circuits from the terminal cabinets to the appropriate system shall be provided under the appropriate division specification.

3.03 FIRESTOPPING:

A. Seal all holes caused by penetrating raceway, piping, or other penetrations which pass through floors, walls or ceilings. Firestop penetrations through floor slabs, fire-rated walls, shafts, or any fire-rated assembly in accordance with Section 078413, Penetration Firestopping.

3.04 MARKING:

A. All metal surfaces installed or modified under this project shall be painted. Metal raceway in finished areas shall be painted the color to match adjacent surfaces. Junction boxes in unfinished areas shall be painted a full gloss enamel red. Painting shall be in accordance with Division Nine.

B. Red bands shall be applied every 3.05 m (10 fee) when not using red-colored raceway.

C. Prior to acceptance testing each fire alarm initiating device installed or modified under this project must be labeled with the device address.

3.05 DEVICE INSTALLATION:

A. Wall mount strobes installed or modified under this project shall be a minimum of 2032 mm (80 inches) above the finished floor or 152 mm (6 inches) below the ceiling whichever is lower.

B. Speakers: Speakers installed or modified under this project should typically be set on the 1/2-watt tap. Speakers in areas with ceilings above 3048 mm (10 feet) shall be set on the 3/4-watt tap.

C. Smoke Detectors:

1) Install smoke detectors a minimum of 3 feet (914 mm) away from supply air vents.
2) New smoke detectors shall be installed with dust covers. The dust covers shall be removed just prior to acceptance testing.
3) The indicating LED on the smoke detector shall be visible from the floor. Where ceiling conditions prevent easy viewing of the LED from the floor, a remote indicating lamp must be installed.

D. Lighting Control Interfaces:

1) Control modules shall be provided adjacent to lighting control panels. Activation of the fire alarm system shall cause all lighting (controlled by a lighting control panel) to come on at full brightness.

3.06 TESTS

A. Prior to starting work, perform load tests on circuits affected by the work of this project and document the results.

B. Test Equipment: Supply personnel, communication devices, and all equipment necessary for performance of the final test.

C. Megger Tests: After all wiring has been installed, and prior to making any connections to panels or devices, all wiring modified or installed under this project shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by OSHEM and the Contracting Officer and test results recorded for use at the final acceptance test.

D. Loop Resistance Tests: Measure and record the resistance of each circuit installed or modified under this project with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer and OSHEM and test results recorded for use at the final acceptance test.

E. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits installed or modified under this project are functioning properly. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that all panel functions installed or modified under this project were tested and operated properly. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

F. Final Acceptance Test: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 14 calendar days prior to the test date. A final acceptance test will not be scheduled until megger test results, the loop resistance test results, and the submittals required in Part 1 are provided to the Contracting Officer. Test the system in accordance with the procedures outlined in NFPA 72. The required tests on all circuits and components installed or modified under this project are as follows:

1) Verify the absence of unwanted voltages between circuit conductors and ground.
2) Verify that the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
3) Complete operational tests under emergency generator power
4) Complete operational tests under battery power and as described above under battery power. Test the battery charger.
5) Test each initiating and indicating device and circuit for proper operation and response. Disconnect the confirmation feature for smoke detectors during tests to minimize the amount of smoke or test gas needed to activate the detector.
6) Test the system for all specified functions in accordance with the contract drawings and specifications and the manufacturer's operating and maintenance manual.
7) Verify several of the audibility and intelligibility results that were recorded on the as-built drawings as part of the preliminary testing above.
8) Visually inspect all wiring.

9) Verify that all software control and data files have been entered or programmed into the FACP.
10) Verify that Shop Drawings reflecting as-built conditions are accurate.
11) Measure the current in circuits to assure that there is the calculated spare capacity for the circuits.
12) Measure voltage readings for circuits to assure that voltage drop is not excessive.
13) Measure the voltage drop at the most remote appliance on each notification appliance circuit.
14) Conduct Intelligibility Testing

    a. Test intelligibility in identified Acoustically Distinguishable Spaces (ADS) in accordance with NFPA 72. Commercially available test equipment shall be provided by the installing contractor. The mean value of at least three readings shall be used to compute the intelligibility score at each test location. Each ADS shall be tested in at least one location.
    b. The following areas are not required to meet a minimum intelligibility score:

        1) Mechanical/Electrical/Plumbing Rooms
        2) Closets
        3) Rooms identified during design where intelligibility cannot be reasonably predicted.

    c. Ensure that the minimum required Common Intelligibility Scale (CIS) value of 0.7 (Speech Transmission Index (STI) 0.5) is obtained in normally occupied areas such as galleries, lobbies, offices, conference rooms, etc. Measurements should be taken near the head level applicable for the space under normal conditions (e.g., standing, sitting, as appropriate).
    d. Areas of the building identified during design and provided with hard wall and ceiling surfaces (such as metal, concrete, terrazzo, or glass) that are found to cause excessive sound reflections may be permitted to have a CIS score less than the minimum required value if approved by OSHEM. Building occupants in these areas must be able to determine that a voice signal is being broadcast by walking no more than 33 feet to find a location with at least the minimum required CIS score.
    e. Areas of the building identified during design where occupants are not normally expected to be present are permitted to have a CIS score less than the minimum required value if personnel can determine that a voice signal is being broadcast by walking no more than 50 feet to a location with at least the minimum required CIS score.
    f. Occasionally, large cavernous-type open areas are present in SI buildings. In such buildings, hard wall/ceiling surfaces and building geometry may cause excessive sound reflections. Areas identified during design are permitted to have locations with a CIS value lower than the normal, minimum required CIS value when the following conditions are met:

        1) The CIS value is not less than 0.6 (STI 0.4) at any location within the cavernous area.
        2) Occupants in the cavernous area must walk no more than 98 feet to find another location having at least the normal, minimum required CIS value.
        3) Occupants located in the cavernous area can adequately understand the message content in the voice signal being broadcast. Whether the voice message is adequately understood shall be determined by OSHEM.

4) Justification for the deviation from the normal, minimum CIS criteria must be provided to and approved by OSHEM. The justification shall address all factors relevant to the request and deviation from the normal, minimum CIS criteria, including but not limited to: the operational requirements that restrict the installation of acoustical wall and ceiling treatments; the potential use of special speaker technologies such as directional speakers or stacked speaker systems; and the availability of physically larger or higher-fidelity speakers even though such speakers might not be Listed for fire alarm use.

END OF SECTION 283111