Smithsonian Institution

Office of Engineering Design & Construction

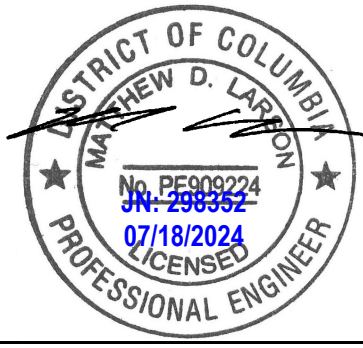
SPECIFICATIONS

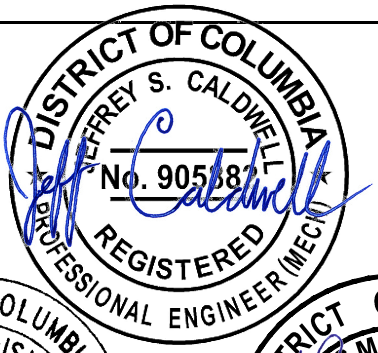
PROJECT NO.: **2209110**

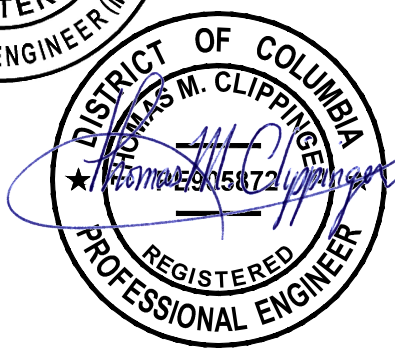
PROJECT TITLE: **Café at Sackler Pavilion**

FACILITY: **National Museum of Asian Art**

DATE: 07/18/2024
Final Construction Submission







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

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

600 Maryland Avenue, S.W.
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Washington, D.C. 20560
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MRC 511
P.O. Box 37012
Washington, D.C. 20013-7012

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SECTION 01000

SUPPLEMENTARY CONDITIONS FOR CONSTRUCTION

PROJECT SUMMARY AND INFORMATION

1. PROJECT INFORMATION

1.1. SF Project No. 2209110
Café at Sackler Pavilion
National Museum Asian Art
12th Street & Independence Ave. SW
Washington, DC 20560

1.2. Smithsonian Institution Contacts:

Contracting Officer (CO), address for Fed Ex and UPS delivery:
Smithsonian Institution
Office of Contracting
2011 Crystal Drive, Suite 350
Arlington, VA 22202-3709

Contracting Officer (CO), address for USPS delivery:
Smithsonian Institution
Office of Contracting
MRC 1200
P.O. Box 37012
Washington, DC 20013-7012

Contracting Officer's Technical Representative (COTR), address for Fed Ex and UPS, delivery:
Smithsonian Institution
Office of Planning, Design & Construction
600 Maryland Avenue, SW
Suite 690-E
Washington, DC 20024

Contracting Officer's Technical Representative (COTR), address for USPS delivery:
Smithsonian Institution
OPDC Capital Gallery
MRC 511
PO Box 37012
Washington, DC 20013-7012

2. SUMMARY OF WORK

2.1. The Contractor shall furnish all supervision, labor, materials and equipment needed to provide a café in the Sackler Pavilion at the Smithsonian Institution's National Museum of Asian Art, located at 12th Street & Independence Ave. SW, Washington, DC 20560, as set forth on the Drawings for SF Project No. 2209110, sheets l through 103 and in these specifications, both dated 18 July 2024.

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

Remove and salvage existing counter and equipment.

Provide food-equipment grade counters and equipment with designated penetrations to support the café menu.

Enclose Pantry 0015 to become a new back of house prep area for the café. Investigate existing structure beneath the carpet, provide flooring and a new ceiling.

Install a grease interceptor and associated plumbing in Mezzanine 0014.

Modify mechanical systems to support increased ventilation in Gallery 0012 and Kitchen 2020. Add exhaust to Mezzanine 0014 and Pantry 0015.

Provide finishes and furniture in the Sackler Pavilion, including chairs, tables, carpet, and signage.

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

Demolition, salvage and recycling in an active Museum.

Coordination and installation of specialty kitchen equipment and counters.

Stone cutting and patching and stone flooring.

Specialty finish for doors and stone floor patches.

Mechanical, electrical, and plumbing modifications.

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

- Cold Formed Metal Framing.
  - Including calculation of loads for the new ceiling of Pantry 0014.
- Gallery 0012 Wood Slat Wall Support
  - Calculate loads and design anchors to attach wood framing for the wood slat wall behind and above food service counter 1.12 to existing construction.
- 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 **342 calendar days**. All construction activity must be completed and work areas must be clean and clear of contractor's materials by COB April 30, 2025 for the Café Opening on June 20, 2025. Punch list must be completed at that time, excepting any outstanding work to install the permanent electrical panel and lighting. 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 – NOT USED

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. 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 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. Part of this project requires special arrangements for access to a non-public area. Access to the site may be restricted at times other than during the scheduled visit.

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. Units of measure on this project are imperial and metric units.

8.2. All Contractor and subcontractor personnel working on the site shall possess and use imperial and metric measuring equipment for all work shown in imperial and metric units.

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 in the Sackler Pavilion is a potentially contributing structure to an expanded National Mall Historic District 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 a structure that is expected to become a historic landmark structure in the future.

11.2. Without exception, all original building fabric of the National Museum of Asian Art 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 SF Codes, Standards and Guidelines document, dated February 15, 2012, to the maximum extent practical.

12.2. Refer to Construction and Demolition Waste Tracking Sheet attached at the end of the section.

13. COMMISSIONING

13.1 The Smithsonian requires Fundamental Commissioning of all eligible design and construction projects.

13.2 Refer to MasterSpec (AIA) Division 21 through 28 sections on Commissioning Requirements for those disciplines.

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.

14.1.1 After hours work with security escort is required for noise control, sprinkler, fire alarm, and electrical shut-offs.

14.3. 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.

14.4. 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.

14.5. 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. Also see the National Museum of Asian Art website https://asia.si.edu/ for a listing of special events. The Smithsonian Institution will notify the Contractor of any events that will limit their ability to work during the regularly scheduled hours.

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

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. Areas that will remain occupied include the whole building of the museum except the area within the Limits of Work shown on the Contract Documents. Several public spaces may need to be closed in order to access mechanical and plumbing systems above. Coordinate the timing of these closures in advance and limit Gallery closure to as tight a window as possible.

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 within the Limits of Work on the Contract Drawings. 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 shall be through the ramp on the west side of the building to the non-collections loading dock in the basement. Coordinate all deliveries with the COTR.

16.3. The Contractor may use the freight elevator located in the basement for movement of material, structures and equipment within acceptable loading limits.

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: from the gallery space directly into the freight elevator next to it to the basement, then out of the freight elevator to the non-collection loading dock, finally from there through the ramp out of the building. All hazardous materials shall be transported through the building in secondary containment and properly secured to transport carts to prevent breakage or spills.

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. Arrangements for Contractor's parking are the sole responsibility of the Contractor. Parking is not provided at the project site.

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 MasterSpec (AIA) Division 21 through 28 sections on Commissioning Requirements for those disciplines.

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 a superintendent to be on site at all times during work activities.

21.2. 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.

21.3. 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.

21.4. CQC Plan Requirements: The Contractor shall submit for review/approval a CQC Plan within thirty (10) 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. 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.

21.4.2. 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.

21.4.3. 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.

21.4.4. Daily Reports: The Contractor's Daily Report, as discussed in the section Contractor Correspondence and Daily Reports, shall be signed by the Superintendent. The superintendent'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.

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

21.5.1. Preparatory Inspection Meeting: Preparatory inspection meeting shall be performed before beginning work and before beginning each segment of work. All preparatory inspection meetings 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.

21.5.2. 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. Notify the COTR once the contractor initial inspection is complete.

21.5.3. 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.

21.5.4. Non-Compliance Check-Off List: The Contractor 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 Contractor shall not 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 Contractor 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.

21.5.5. Completion and Inspection of Work: The Contractor shall sign the written request for Substantial Completion Inspection (discussed in the Project Closeout 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.

22.5. 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.

- 22.6 Food Service Facilities: The Contractor shall comply with health and sanitation requirements for new construction of food service facilities as cited in the District of Columbia Municipal Regulations, "DCMR 23 -Alcoholic Beverages and Food," available from:
  Government of the District of Columbia
  Municipal Building
  Documents Section
  1350 E Street NW
  Washington, DC 20001

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 five (5) 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. In case of special events the Smithsonian Institution will notify the Contractor of certain utilities that should not be interrupted.

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.

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. Erosion and Sedimentation Control (ESC) Plan – NOT USED

27.4. 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.

27.5. 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.

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 out of public viewing.

29.4. Refer to Construction and Demolition Waste Tracking Sheet 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.

31.3. 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.

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 48 to 72 hours in advance, including for days following holidays, Mondays and off-hours (night) work. Hot Work Permit form and General Instructions for required permit process are available from the COTR. 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. Fire System Impairment Permit form and General Instructions are available from COTR.

33.1.1: Welding will not be permitted during the hours the museum is open to the public.

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 within the Limits of Work. The Contractor shall provide information about proposed locations of any temporary office, 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. No on-site trailer available.

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 or 1/4”=1’-0”) 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 utility extensions, temporary interior walls and barriers to limit unauthorized intrusion and to control noise and dust, 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

37.1. Existing electrical and water utilities are available for the Contractor's use as designated by the COTR.

37.1. Where work is required to interrupt utility services to the facility, continue working until service is restored or temporary or bypass systems are put in place to maintain facility service until work is complete.

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.

38.4 The Contractor is required to provide his own lifts for work in NMAA. Submit information on site access and floor protection, weight on structure, and procedures and requirements for Jobsite Safety.

39. PROJECT SIGNS - NOT USED

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. Building Systems Commissioning;

40.1.15. 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.

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 metric and imperial units for this project. 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 of 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 SF 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 four (4) samples, minimum size 600 mm by 600 mm, unless otherwise specified. After submittal review, two (2) sample may be retained by the Smithsonian, which includes one copy for NMAA and one for Smithsonian Enterprises.

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. The Contractor shall provide digital photographs of the project and construction activities throughout the progress of the Work. The COTR shall determine the vantage points from which photographs will be taken.

46.2. Take at least 24 digital color progress photographs 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, the Contractor shall submit to the COTR, via email or other electronic means, JPEG files for all photographs taken. The COTR will select twelve (12) images for electronic "prints" to be made. Prints may be in JPEG or PDF format.

46.4. On each print provide, an information box (40 mm by 90 mm) in the lower right-hand corner. and arranged as follows:

Smithsonian Institution
Title: _____
SF Project No.: _____Contract No.: _____
Contractor: _____
Photo No.: _____ Date:_____Time: _____
Description/View: _____

46.5. Submit all original images, select labeled images and typed index to COTR via email.

46.6. 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.

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. Safety Plan must include specific exposure control methods used to comply with the respirable crystalline silica standard, 29 CFR 1926.1153, during disturbance of concrete.

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. The Contractor shall submit to the COTR for approval, at least ten (10) working days prior to their intended use, a written list of toxic and hazardous substances that will be used on the project. The Contractor shall submit a "Material Safety Data Sheet" similar to OSHA Form No. 20 for these substances to identify the following information:

49.1.1. Product Identification;

49.1.2. Hazardous Ingredients;

49.1.3. Physical Data;

49.1.4. Fire and Explosion Hazard Data;

49.1.5. Health Hazard Data;

49.1.6. Emergency and First Aid Procedures;

49.1.7. Reactivity Data;

49.1.8. Spill or Leak Procedures;

49.1.9. Special Protection Information;

49.1.10. Special Precautions;

49.1.11. Volatile Organic Compound (VOC) Content.

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, or

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 shall be constructed of pressure-impregnated fire-retardant treated wood, with fire-retardant 6-mil polyethylene as necessary. 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.

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 Subcontractors' 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 Identification Badge or Day Pass in plain view for inspection. Photo identification badges with serial numbers and information about allowed access may be issued by the Smithsonian to some Contractor employees.

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

54.2.1. ID badges will be provided by the Smithsonian at no cost to the Contractor. Smithsonian reserves the right to not issue ID badges 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: Contractors 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 an identification badge or 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 ID badge or day pass upon leaving the premises shall be reported to the COTR.

54.5. Lost ID: If a Contractor or Subcontractors employee loses an ID badge or 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 badge or pass.

54.6. Ownership of ID: The Contractor Identification Badge or Day Pass shall remain the property of the Smithsonian and it shall not be taken off the premises. The badge 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 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.

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.

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, the Contractor shall submit, to the COTR, three (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 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 sub-Contractor 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.

64.4.8. 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.

64.7. 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. Joint occupancy and/or turnover of the space between Contractor and Food Service Operator is prohibited until final punch list is completed.

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.. 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 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. Final clean up, including:

1. Sweep and dust all surfaces and wash all finished surfaces to appear new and free of all stains, soil marks, dirt and other forms of defacement.

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-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.

9. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.

10. Clean project site (yard and grounds) of litter and foreign substances. Sweep exterior paved areas to a broom-clean condition; remove stains, petro-chemical spills and other foreign deposits. Rake grounds, which are neither planted nor paved, to a smooth, even textured surface.

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:

65.5.1. 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.

65.5.2. 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 ID badges and parking permits 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 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: electronic copies of as-built record drawings in PDF and AutoCad DWG formats.

f. As-Built Record Survey of Underground Utilities Submitted: NOT USED

g. 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.

h. 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.

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						
Non-Window Glass						
Glazing						
Acoustical Tile						

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)
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 Panel boards						
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%*

END OF SUPPLEMENTARY CONDITIONS FOR CONSTRUCTION

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.

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

Photo 01: Sackler Gallery Pavilion. SW corner of Quadrangle Building

Photo 02 Main entrance from Haupt Garden.

Photo 03: Gallery 0012, counter from temporary café at far end.

Photo 04: Close up of temporary café – new café will be in similar location and have back bar.

Photo 05: docent desk at east end of Gallery 0012.

Photo 06: temp counter at west end of Gallery 0012. Circulation to exhibits is along wall, through archway.

Photo 07: through archway, Pantry 0015 is straight ahead

Photo 08: electric panels in Coatroom 0015, to be reconfigured.

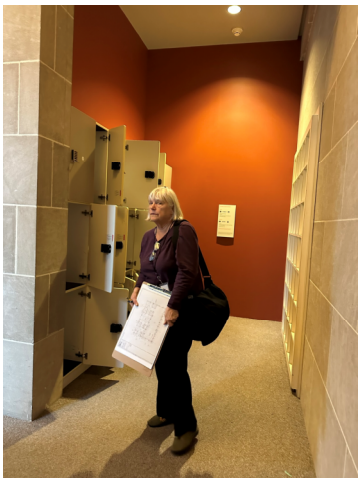

Photo 09: Pantry 0015 alcove. Floor originally was open for revolving coat rack but is now infilled with steel deck and framing below a carpet. We do not have records for the structure between the carpet and the

steel deck below.

Photo 10: spiral stair to Mezzanine 0014. Mezzanine 0014 is above the Level B1 toilet rooms. Space will be sprinklered.

Photo 11: in Mezzanine, concrete beams & deck above; sloped concrete below stairs; GWB ceiling area at steel deck infill.

Photo 12: Gallery 1075, showing ceiling type and devices to be removed and reinstalled. Piping will run above this ceiling between Gallery 0012 and Mezzanine 0014.

Photo 13: Corridor to Men's room. Ceiling is wood and GWB. Piping may cross above to Men's room.

Photo 14: Above ceiling to Men's room,

Photo 15: Men's room in front of chase will that will hold new piping to riser. Wall is 4x4 ceramic tile on GWB and steel studs. Access panel pictured.

Photo 16: Kitchen 2020: ETR 3-compartment sink; range has been removed and gas capped; see new layout for new equipment.

Photo 17: Kitchen 2020, looking in opposite direction.

Photo 18: Janitor's Closet 3023. This room will include a 36 x 36" slab removal to access to a sanitary line below the slab.

END OF SECTION 02 2000 – PHOTOGRAPHIC DOCUMENTATION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
2. Removal and salvage of existing items for delivery to Government and removal of existing items for reinstallation.
3. Investigation of Flooring at Pantry 0015.

B. Related Requirements:

1. Section 011000 "Supplementary Conditions for Construction" for restrictions on use of the premises, Government-occupancy requirements, and phasing requirements.
2. Section 024296 "Historic Removal and Dismantling" for general protection and work procedures for alteration projects.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Government as indicated.

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: Existing items of construction that are not to be removed.

1.3 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Government that may be uncovered during demolition remain the property of Government.

1. Carefully salvage in a manner to prevent damage and promptly return to Government.

1.4 COORDINATION

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

1.5 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 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.
6. Review and finalize protection requirements.
7. Review procedures for noise control and dust control.
8. Review storage, protection, and accounting for items to be removed for salvage or reinstallation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For refrigerant recovery technician.

B. Survey of Existing Conditions: Submit survey.

C. 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.

D. 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 Government's on-site operations are uninterrupted.
2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Government's continuing occupancy of portions of existing building and of Government's partial occupancy of completed Work.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.

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

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

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

1.9 FIELD CONDITIONS

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

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

1. Before selective demolition, Government will remove the items identified on AD101:

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

D. Historic Areas: Demolition and hauling equipment and other materials to be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more. All materials original to the public spaces of the building shall be treated as historic, including but not limited to: Granite flooring, Limestone wall panels, wood wall and ceiling paneling.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

C. Investigate Pantry 0015 Floor Structure
1. Investigate floor structure between the existing level floor and the concrete ramp and sloped metal infill framing below.
2. Remove finish flooring and subfloor to allow COTR to review framing beneath subfloor.
3. Contractor shall report any field condition (including unforeseen condition) to COTR.
4. Contractor then shall submit any field change request (per their survey) with their proposed alternative solution via RFI to COTR, which may cause COTR to make design changes based on the impact from field survey.

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

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video. Comply with Section 013233 "Photographic Documentation."

1. Inventory and record the condition of items to be removed for salvage or reinstallation. Photograph or video conditions that might be misconstrued as damage caused by removal.
2. Photograph or video existing conditions of adjoining construction including finish surfaces, that might be misconstrued as damage caused by selective demolition operations or removal of items for salvage or reinstallation.

3.2 PREPARATION

A. 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.

B. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
3. Cover and protect furniture, furnishings, and equipment that have not been removed.
4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

C. 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 and reinstalled in their original locations after selective demolition operations are complete.

D. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment in accordance with 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND BUILDING SYSTEMS

A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.

1. Government will arrange to shut off indicated utilities when requested by Contractor.
2. If disconnection of utilities and building systems will affect adjacent occupied parts of the building, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to those parts of the building.
3. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment and components.

4. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.

    a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    b. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

5. Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:

    a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.
    b. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Government.

3.4 SALVAGE/REINSTALL

A. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Government.
4. Transport items to Government's storage area designated by Government.
5. Protect items from damage during transport and storage.

B. 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.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to 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 exhibitry from the work area.
2. Proceed with selective demolition systematically, minimizing the impact to museum public spaces.
3. 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.
4. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
5. 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.
6. Maintain fire watch during and for at least one hour after flame-cutting operations.
7. Maintain adequate ventilation when using cutting torches.
8. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
9. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
10. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

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.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Government and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.

C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" to mean historic "removal" or "dismantling" as specified in Section 024296 "Historic Removal and Dismantling."

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete:

1. Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

D. Resilient and Carpet Floor Coverings: Remove floor coverings and adhesive in accordance with recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them in accordance with Section 017419 "Construction Waste Management and Disposal."

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. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.8 CLEANING

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

END OF SECTION 024119

SECTION 024296 - HISTORIC REMOVAL AND DISMANTLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Historic treatment procedures for removal and dismantling work for designated historic spaces, areas, rooms, and surfaces and the following specific work:

    a. Removal and dismantling of indicated portions of building or structure and debris hauling.
    b. Removal and dismantling of indicated site elements and debris hauling.
    c. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

A. Dismantle: To disassemble or detach a historic item from a surface, or a nonhistoric item from a historic surface, using gentle methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

B. Existing to Remain: Existing items that are not to be removed or dismantled, except to the degree indicated for performing required Work.

C. Remove: To take down or detach a nonhistoric item located within a historic space, area, or room, using methods and equipment to prevent damage to historic items and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

D. Retain: To keep an element or detail secure and intact.

E. Salvage: To protect removed or dismantled items and deliver them to Government.

1.3 PRECONSTRUCTION MEETINGS

A. Preconstruction 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 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.
6. Review and finalize protection requirements.
7. Review procedures for noise control and dust control.

8. Review storage, protection, and accounting for items to be removed for salvage or reinstallation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For historic removal and dismantling specialist.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by Contractor's removal and dismantling operations.

C. 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.

D. Removal and Dismantling Historic Treatment Program: Submit 30 days before work begins.

E. List of Items Indicated To Be Salvaged: Prepare a list of items indicated on Drawings to be salvaged for Government's use or for reinstallation. Submit 15 days before preconstruction conference.

F. Inventory of Salvaged Items: After removal or dismantling Work is complete, submit a list of items that have been salvaged.

1. Include item description, item condition, number of items if more than one of a type, and tag number.
2. As work proceeds, include on the inventory items that were indicated to be salvaged and items of historic importance discovered during the work. Document reasons, if any, why an item indicated to be salvaged was not salvaged.

1.5 QUALITY ASSURANCE

A. Historic Removal and Dismantling Specialist Qualifications: A qualified historic treatment specialist. General selective demolition experience is insufficient experience for historic removal and dismantling work.

B. Removal and Dismantling Historic Treatment Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of removal and dismantling work, including protection of surrounding and substrate materials and Project site.

1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris-hauling routes, turning radii, and locations and details of temporary protective barriers.

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

1.6 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purposes will be maintained by Government as long as practicable.

1. Before removal and dismantling, Government will remove the following items:

a. All plants and planters in Gallery 0012

b. Movable bar in Gallery 0012

c. Furniture and carpet in Gallery 0012

d. Banners on west wall of Gallery 0012

B. Notify COTR of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Hazardous Materials:

1. It is unknown whether hazardous materials will be encountered in the Work.

a. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify COTR and Government. Government will remove hazardous materials under a separate contract.

1) In the case of asbestos, stop work in the area of potential hazard, shut off fans and other air handlers ventilating the area, and rope off area until the questionable material is identified. Resume work in the area of concern after safe working conditions are verified.

D. Storage or sale of removed or dismantled items on-site is not permitted unless otherwise indicated.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 HISTORIC REMOVAL AND DISMANTLING EQUIPMENT

A. Removal Equipment: Use manual, handheld tools. Handheld power tools may be permitted on a case-by-case basis with approval by COTR.

B. Dismantling Equipment: Use manual, handheld tools, except as follows or otherwise approved by COTR on a case-by-case basis:

1. Handheld power tools are permitted only as submitted in the historic treatment program. They must be adjustable so as to penetrate or cut only the thickness of material being removed.
2. Pry bars more than 18 inches long and hammers weighing more than 2 lb are not permitted for dismantling work.

3.2 EXAMINATION

A. Preparation for Removal and Dismantling: Examine construction to be removed or dismantled to determine best methods to safely and effectively perform removal and dismantling work. Examine adjacent work to determine what protective measures are necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed or dismantled and location of utilities and services to remain that may be hidden by construction that is to be removed or dismantled.

1. Verify that affected utilities are disconnected and capped.
2. Inventory and record the condition of items to be removed and dismantled for reinstallation or salvage. Enter this information on the inventory of salvaged items.
3. Before removal or dismantling of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
4. Engineering Survey: Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures as a result of removal and dismantling Work.

B. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."

C. Perform surveys as the Work progresses to detect hazards resulting from historic removal and dismantling procedures.

3.3 HISTORIC REMOVAL AND DISMANTLING

A. General: Have removal and dismantling work performed by a qualified historic removal and dismantling specialist. Ensure that historic removal and dismantling specialist's field supervisors are present when removal and dismantling work begins and during its progress.

B. Perform work according to the historic treatment program.

1. Perform removal and dismantling to the limits indicated.
2. Provide supports or reinforcement for existing construction that becomes temporarily weakened by removal and dismantling work, until the Project Work is completed unless otherwise indicated.

3. Perform cutting by hand or with small power tools as permitted by COTR wherever possible. Cut holes and slots neatly to size required, with minimum disturbance of adjacent work.
4. Do not operate air compressors inside building unless approved by COTR in each case.
5. Do not drill or cut columns, beams, joints, girders, structural slabs, or other structural supporting elements, without having Contractor's professional engineer's written approval for each location before such work is begun.
6. Dispose of removed and dismantled items off-site unless indicated to be salvaged or reinstalled.

C. Water-Mist Sprinkling: Use water-mist sprinkling and other wet methods to control dust only with adequate, approved procedures and equipment according to the historic treatment program to ensure that such water does not create a hazard or adversely affect other building areas or materials.

D. Unacceptable Equipment: Keep equipment that is not permitted for historic removal or dismantling work away from the vicinity where such work is being performed.

E. Removing and Dismantling Items on or Near Historic Surfaces:

1. Use only dismantling equipment and procedures within 12 inches of historic surface. Protect historic surface from contact with or damage by tools.
2. Wherever possible, unfasten items in the opposite order from which they were installed.
3. Support each item as it becomes loosened to prevent stress and damage to the historic surface.
4. Dismantle anchorages.

F. Masonry penetrations:

1. Remove masonry carefully, and erect temporary bracing and supports as needed to prevent collapse of materials being removed.
2. Stop removal work and immediately inform COTR and Contractor's professional engineer if any structural elements above or adjacent to the work show signs of distress or dislocation during any phase of removal work.
3. Remove wall in easily managed pieces.
4. During removal, maintain the stability of the partially remaining wall.

G. Concrete penetrations:

1. Remove floor surfaces, fill, and topping to the indicated lower elevations or cleavage planes as indicated on Drawings.
2. Use dismantling methods when removing floor surfaces 12 inches or less away from historic walls.
3. Take away material to a uniform surface at the indicated level.

H. Granite flooring penetrations: Dismantle granite and setting bed in the area indicated and as necessary for plumbing and electrical penetrations.

1. Caution: Immediately beneath the setting bed lie structural concrete waffle slab of the rooms below. Use only procedures and techniques that ensure that the setting bed is

dismantled without damage to the structural integrity of the concrete. Do not cut, chip, or otherwise damage the surface of the granite tiles outside this area for any reason.

2. Notify COTR 15 calendar days before performing dismantling operations on the setting bed.
3. Hours of Work: 12 midnight to 6 a.m., or as approved by COTR.
4. Procedure: Follow dismantling procedure below.

    a. Saw cut granite joints with rigid guides to ensure straight, uniform cuts and to prevent overcutting into adjacent stones. Use thin saw blades so that stones can be reused. Replace with new stone any dismantled stones and adjacent stones if cut irregularly or otherwise damaged, at no additional cost to Government.
    b. Gently loosen and pry stone free from setting bed. If a stone unit cannot be separated from the substrate, cut it up as necessary for removal and replace it.
    c. Saw cut setting bed with parallel cuts 3 to 4 inches apart and of a maximum depth that ends 1/4 inch above the bottom of the setting bed (the top of the structural tile arches).
    d. Using the sawed grooves, carefully chip out material to the limits shown.
    e. Take away material to a uniform surface at the indicated level.
    f. Carefully monitor the progress of the saw cutting. If at any point the material being cut changes in nature, as evidenced by observations such as sounds generated by the cutting blade, resistance to cutting, and color of the dust, stop work in the immediate area, immediately notify COTR of the condition, and assign workers to continue work elsewhere until COTR issues instructions.
    g. Where the actual thickness of the setting bed is more than 1-3/4 inches, continue the dismantling.
    h. If the actual thickness of the setting bed is less than 1-3/4 inches, immediately notify COTR, who may suspend dismantling for reevaluation.
    i. Clean and dry surfaces for inspection by COTR before beginning installation of new work.

5. If any damage to the structural clay tile arches of the rooms below has been caused, or is suspected to have been caused, by the dismantling work, attributable to Contractor's faulty procedure, mishap, or negligence, perform repair or replacement as directed by COTR at no additional cost to Government.

I. Anchorages:

1. Remove anchorages associated with removed items.
2. Dismantle anchorages associated with dismantled items.
3. In nonhistoric surfaces, patch holes created by anchorage removal or dismantling according to the requirements for new work.
4. In historic surfaces, patch or repair holes created by anchorage removal or dismantling according to Section that is specific to the historic surface being patched.

3.4 HISTORIC REMOVAL AND DISMANTLING SCHEDULE

A. Existing [**Items**] [**Construction**] to Be [**Removed**] [**Dismantled**]: <**Insert description of items and construction to be removed**>.

B. Existing Items to Be [**Removed**] [**Dismantled**] and Salvaged: <**Insert description of items to be dismantled and salvaged**>.

C. Existing Items to Be [**Removed**] [**Dismantled**] and Reinstalled: <**Insert description of items to be removed or dismantled and reinstalled**>.

D. Existing Items to Remain: <**Insert description of items to remain**>.

END OF SECTION 024296

SECTION 032500 – ADVANCED COMPOSITE MATERIALS STRENGTHENING SYSTEM

PART 1 - GENERAL

1.1 Description of Work

A. This specification is intended to define the minimum requirements of structural strengthening using externally bonded fiber reinforced polymer (FRP) composite systems.

B. The work includes the furnishing of all materials, labor, equipment and services for the supply, installation and finish of all structural strengthening using externally bonded FRP composite system.

C. The general contractor or subcontractor shall furnish all materials, tools, equipment, transportation, necessary storage, access, labor and supervision required for the proper installation of the externally bonded FRP composite system.

D. The general contractor or subcontractor shall complete as delegated design the design of the externally bonded FRP composite system.

1.2 Work Included

A. This Section of the Specification is not necessarily complete in itself. Read in conjunction with the Contract Document.

1.3 Reference Standards

A. General
1. The publications listed below form a part of this specification to the extent referenced. Where a date is given for referenced standards, the edition of that date shall be used. Where no date is given for reference standards, the latest edition available on the date of the Notice of Invitation to Bid shall be used. For IBC referenced standards, the applicable year as defined by the current IBC year per the building code.

B. International Code Council (ICC)
1. ICC AC125, Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber Reinforced Polymer (FRP) Composite Systems.

2. ICC AC178, Interim Criteria for Inspection and Verification of Concrete and Reinforced and Unreinforced Masonry Strengthening Using Externally Bonded Fiber Reinforced (FRP) Composite Systems.

C. American Standard for Testing and Materials (ASTM)
1. ASTM D7565, Standard Test Method for Determining Tensile Properties of Fiber Reinforced Polymer Matrix Composites Used for Strengthening of Civil Structures.
2. ASTM D3039, Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials.
3. ASTM D7522/D7522M, Standard Test Method for Pull-Off Strength for FRP Bonded to Concrete Substrate; 2015.
4. ASTM D4541, Standard Test Method for Pull-off Strength of Coating Using Portable Adhesive-Testers; 2009.

D. American Concrete Institute (ACI)
1. ACI 440.2R-17, Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures.

E. International Concrete Repair Institute (ICRI)
1. ICRI Technical Guideline No. 310.2-2013 (formerly No. 03732), Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

1.4 MATERIAL QUALIFICATIONS

A. Materials for the FRP system have been designed and pre-qualified:
1. Basis for design: Tyfo® Fibrwrap® Systems, supplied by, Fyfe Co. LLC (4995 Murphy Canyon Road, Suite 110, San Diego, CA 92123. Tel: 858-642-0694, Fax: 858-444-2982, Mid-Atlantic Representative: Dennis Dempsey; (410) 299-4167; ddempsey@aegion.com)
2. Alternate FRP manufacturers must provide all items listed in Section 1.5 of this specification with their bid. Systems without complete submittals shall be considered non-compliant.

1.5 Submittals

A. Quality Control and Quality Assurance:
1. Submit product data indicating product standards, physical and chemical characteristics, technical specifications, limitations, installation instructions, maintenance instructions and general recommendations regarding each individual material.
2. Only epoxy resins will be accepted for construction of FRP systems referenced in this specification. Other resins, such as polyesters/vinyl esters, are not allowed as substitutes. The manufacturer shall clearly define the epoxy resin working time. Any batch that exceeds the batch life shall not be used.

3. The proposed FRP systems shall be compliant with testing requirements per ICC AC125 and provide a current ICC Evaluation Service Report, compliant with the 2015 International Building Code (IBC). The submitted Evaluation Service Report shall cover the type of element to be strengthened (e.g. columns, walls, slabs, beams) and the type of strengthening required (e.g. shear, flexure, axial load, seismic).
4. Written consent from the FRP manufacturer that the surface bonded FRP composite systems are installed by trained certified applicators as per Section 2.2
5. Independent laboratory testing for the required ASTM D7565 and/or ASTM D3039 test procedures for the proposed FRP composite system. Submit testing of minimum 20 specimens for each FRP composite system to verify the design modulus of elasticity as per Section 2.1.1.
6. Independent laboratory testing verifying the submitted fiber anchor design properties. A minimum of 20 specimens of each anchor type (e.g. GFRP or CFRP) shall be submitted.
7. Large-scale test results validating the fiber anchor performance on relevant test specimens. Compatibility between composite anchors and the composite system must be verified through large-scale testing for similar applications.

B. Design and Working Drawings:
1. Design and working drawings shall be based on performance as per Section 1.6.
2. Stamped and signed structural calculations and drawings by a professional Civil Engineer. Design shall be based on the performance criteria defined on the structural drawings.
3. Working shop drawings and calculations prepared and sealed by a professional engineer detailing the type, locations, dimensions, numbers of layers, and orientation of all FRP materials and coatings to be installed. The shop drawings must also indicate a total weight per unit length of each size of anchor (if required) to be used in the project.

C. Product Information:
1. Manufacturer shall have a minimum of ten (10) years' experience confirmed by project references.
2. Provide a current ICC Evaluation Service Report, as per Section 1.5.3
3. Provide approved UL rated assembly data for fire-resistant finishes (2 hour rated assembly per ASTM E119 or Class A Building, Flame Spread & Smoke Development per ASTM E84) as proposed with the FRP system.
4. Properties of the composite materials as determined by independent laboratory testing in accordance with ASTM D7565 and/or ASTM D3039 (tensile modulus, stress and strain) for the proposed fiber composite system. A minimum of 20 tests for each must be submitted.
5. Installation procedures, maintenance instructions, and general recommendations regarding each material to be used.
6. Manufacturer's Material Safety Data Sheets (MSDS) for all materials to be used.
7. Manufacturer's product data sheet indicating physical, mechanical and chemical characteristics of all materials used in the FRP system.

8. Certification by the manufacturer that supplied products complies with local regulations controlling use of volatile organic compounds (VOC's).

1.6 PERFORMANCE

A. Design the composite system to achieve the structural performance shown on the structural drawings. Design calculations for the composite system shall be submitted for approval by the engineer of record and shall be stamped by a registered Civil or Structural Engineer. The composite anchors must meet the minimum total weight per unit length for each size of anchor as per submitted design.

B. FRP design values must be lower than the calculated mean determined from the test results received from the ASTM D7565 and/or ASTM D3039 field test specimens per Section 3.3.

C. The Engineer of Record may suspend the work if the Contractor substitutes an unapproved fiber reinforced composite system or unapproved personnel during construction.

1.7 Product Delivery, Handling and Storage

A. Deliver epoxy materials in factory-sealed containers with the manufacturer's labels intact and legible with verification of date of manufacture and shelf life.

B. Store materials in a protected area at a temperature between 60°F and 100°F.

C. Products shall be stored according to the manufacturer's requirements and shall avoid contact with soil and moisture. Products shall be stored to avoid UV exposure.

1.8 Coordinate With Other Trades

A. Prior to construction, the trades shall be briefed on any new or unusual construction procedures to ensure that they are aware of special conditions (e.g. new penetrations, construction anomalies).

B. Excess fibers shall be provided to allow for installation of adjacent work and finishes per the Contract Documents. This is to allow for limit cutting of fibers. A minimum of 15% shall be allowed for and scaled up as necessary at individual locations. All proposed cutting of fibers shall be approved by the delegated designer and be recorded for each location with drawings prepared by the General Contractor that show all proposed cuts, cumulative for all trade contractors, for a given location.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Approved Tyfo® Fibrwrap® System(s) to be supplied by Fyfe Co. LLC 4995 Murphy Canyon Road, Suite 110, San Diego, CA 92123. Tel: 858-642-0694, Mid-Atlantic Representative: Dennis Dempsey; (410) 299-4167; ddempsey@aegion.com Products include:

B. Tyfo® SCH fiber – primary carbon fiber, unidirectional. Alternate primary carbon fiber systems available upon request.

	Tyfo® SCH-41 System
**Design Modulus of Elasticity (E) - Primary Fiber Direction (ksi)	11900
**Thickness of Composite (in)	0.04
Cross Sectional Area (A) (in^2)	0.04*

* Cross sectional area based on a 1in width x thickness of the gross laminate. Thickness based on one-layer of the Tyfo System.
**As listed in ICC ESR-2103

C. Epoxy saturant/primer: Tyfo® S epoxy is used as a primer and is also combined with the fiber to form the Tyfo® Fibrwrap® System.

D. Primer/Filler: Thickened Tyfo® S, thickened epoxy for protective seal coat, filling voids and primer where needed. Field thickened epoxy may be used to patch “bugholes” up to 1.5” in depth and to fill voids.

E. Detailing Finish: Thickened Tyfo® S epoxy shall be applied to all seams and edges.

F. Fire Protection Finish Tyfo® RR for Class A flame and smoke (ASTM E84), interior finish rating. Tyfo® CFP for 2-hour UL rated assembly (ASTM E119).

G. Aesthetic Finish: Two-coats of either acrylic or polyurethane paint (approved by the owner).

H. Alternate or additional finishes must be approved by the Owner and Manufacturer.

2.2 CERTIFIED APPLICATORS

A. Installations shall be performed by certified applicators only. Certified applicators shall have written verification from the manufacturer that they have received the required certifications and training. At a minimum, the onsite supervisor and/or foreman shall provide written verification from the material manufacturer as being fully trained and certified to install the proposed system. The certifications shall be current (dated within one-year of the project schedule). These certifications shall be included in the final, stamped field QC report.

B. The contractor shall supply a written description of the training course provided by the manufacturer. The training shall include, at a minimum, both classroom and hands-on training with documented activities that cover the scope of the project.

2.3 Other Materials

A. Contractor to provide compatible primer, filler and other materials recommended by the manufacturer as needed for the proper installation of the complete surface bonded FRP composite system.

PART 3 - APPLICATION

3.1 Surface Preparation

A. Column (“Contact-Critical”) Applications
   1. The surface to receive the composite shall be free from fins, sharp edges and protrusions that will cause voids behind the installed casing or that, in the opinion of the Engineer of Record, will damage the fibers. Existing uneven surfaces to receive composite shall be filled with the system epoxy filler or other material approved by the Engineer of Record. Filling of large voids in surfaces to receive composite shall be paid as an extra to the contract work of installing the composite system (small pinholes or micro-bubbles in the concrete surface or resin do not require special detailing). The contact surfaces shall have no free moisture on them at the time of application. If moisture is present, use wet prime epoxy as suggested by the FRP manufacturer, if available.
   2. Repair all damaged and unsound concrete, spalls, and irregular surfaces to create a flat, or slightly convex, surface. Fill surfaces with thickened epoxy to eliminate air surface voids greater than 0.5” diameter. Well-adhered paint and concrete do not require removal.
   3. Round off sharp and chamfered corners to a minimum radius of 0.75” by means of grinding or forming with the system’s thickened epoxy. Variations in the radius along the vertical edge shall not exceed 0.5” for each 12” of column height.

B. Slabs/Beams/Walls (“Bond-Critical”) Applications

1. Surfaces shall be prepared for bonding by means of abrasive blasting or grinding to remove existing laitance and expose aggregate minimum ICRI CSP-2 concrete surface profile. All contact surfaces shall then be cleaned by hand or compressed air. One prime coat of the manufacturer's epoxy shall be applied and allowed to cure for a minimum of one hour. Prior to the application of the saturated composite fabric apply one-layer of the manufacturer's thickened epoxy and fill any uneven surfaces. Provide anchorage as detailed on the construction drawings if required.
2. Round off sharp and chamfered corners (to be wrapped around) and pre-drilled anchor holes (if required) to a minimum radius of 0.75" by means of grinding or forming with the system's thickened epoxy. Variations in the radius along the edge shall not exceed 0.5" for each 12" of length.
3. Repair all damaged concrete, spalls, and irregular surfaces to create a flat, or slightly convex, surface. Fill surfaces with thickened epoxy to eliminate air surface voids greater than 0.5" diameter.

3.2 Installation

A. Preparation work for project: Visit site to ensure that all patch work is complete and cured. Review project specifications in detail.

B. Verify ambient and concrete temperatures. No work shall proceed if the temperature of the concrete surface is less than 40°F or greater than 100°F or as specified on the epoxy component labels. Substrate shall be at least 5.4°F above the dew point.

C. Prepare the epoxy matrix by combining components at a weight (or volume) ratio specified by the manufacturer. The components of epoxy resin shall be mixed with a mechanical mixer until uniformly mixed, typically 5 minutes at 400-600 rpm at 72F.

D. Components that have exceeded their shelf life shall not be used.

E. Saturation of the fabric shall be performed and monitored according to the manufacturer's specified fiber-epoxy resin ratio. Fabric shall be completely saturated prior to application to contact surface in order to ensure complete saturation. Saturation shall be supervised and checked by the certified installer. Both the epoxy resin and fabric shall be measured accurately, combined, and applied uniformly at the rates shown on the approved working drawings and per manufacturer's recommendations.

F. All cutting of fabrics, mixing of epoxy and combination thereof shall take place in a protected area away from critical structure functions and any electrical equipment.

G. Drill holes for fiber anchors (if required)

H. Prepare surfaces as required, including corner preparation.

I. Remove dust and debris by vacuum only with HEPA filtration.

J. Clean up and protect area adjacent to element where FRP composite is being applied.

K. Using a roller or trowel, apply one prime coat of epoxy resin to the substrate (2 mil min.). Allow primer to become tacky to the touch.

L. Fill any uneven surfaces or recesses with thickened epoxy.

M. Apply saturated fabric to substrate surface by hand lay-up, using methods that produce a uniform, constant tensile force that is distributed across the entire width of the fabric, and ensure proper orientation of the fabric. Gaps between composite bands may not exceed 0.5" width in the fabric's transverse joint unless otherwise noted on project drawings. A lap length is required at all necessary overlaps in the primary fiber direction of the fabric. See shop drawings for required lengths.

N. Fiber Anchors: Pre-saturate the composite anchor in a bath. Installation of dry anchors is prohibited. Fill drilled hole halfway with thickened epoxy prior to installation. Splay anchor as detailed on shop drawing.

O. Apply subsequent layers, continuously or spliced, until designed number of layers is achieved, per project drawings.

P. Using a roller or hand pressure, release or roll out entrapped air, and ensure that each individual layer is firmly embedded and adhered to the preceding layer or substrate.

Q. Detail all fabric edges, including termination points and edges, with thickened epoxy

R. Finish: All edges and seams must be finished with thickened epoxy. Use system as directed by the manufacturer. Finish as specified between 24 and 72 hours after final application of epoxy. If after 72 hours the epoxy is cured, the surface must be roughened by hand sanding or brush blasting, prior to finishing.

3.3 Inspection and Testing

A. Field Inspection
1. The contractor shall monitor the mixing of all epoxy components for proper ratio and adherence to manufacturer's recommendations. Record batch numbers for fabric and epoxy used each day, and note locations of installation. Measure square footage of fabric and volume of epoxy used each day.
2. If a Certified Special Inspector is required, the Certified Special Inspector shall periodically observe all aspects of preparation, mixing, and application. All FRP composite applied areas shall be inspected, in accordance with the manufacturer's specifications for voids,

bubbles, and delaminations. All defective areas shall be repaired as per Section 3.4 in this specification.

B. ASTM D7522 and/or ASTM D4541 – Direct Tension Adhesion Tests
   1. Direct tension adhesion testing shall be conducted using the method described by ASTM D7522 and/or ASTM D4541. A minimum of one such test shall be performed for each 1,000 ft² (93m²) of surface area to be covered by the FRP application. Pull-off tests shall be performed on a representative adjacent area to the area being strengthened whenever possible. Tests shall be performed on each type of substrate or for each surface preparation technique used.
   2. The epoxy bonded to the prepared surface shall be allowed to cure as per manufacturer's requirements before execution of the direct tension pull-off test. The locations of the pull-off tests shall be representative and on flat surfaces. If no adjacent areas exist, the tests shall be conducted on areas of the installed FRP system subjected to relatively low stress during service.
   3. The minimum acceptable value for any pull-off test is 175 psi (1.2MPa). The average of the tests shall not be less than 200 psi (1.38MPa). Additional tests may be performed to qualify the work at each identified area. Each pull-off test is to exhibit a failure mode in the substrate and not the epoxy-to-substrate bond plane.

C. Laboratory Testing
   1. Sampling
      a. Record lot number of fabric and epoxy resin used, and location of installation. Measure square footage of fabric and volume of epoxy used each day. Label each sample from each day's production.
      b. A "sample batch" shall consist of two 12" (305mm) by 12" (305mm) samples of cured composite. Note: one 12" (305mm) by 12" (305mm) sample creates 5 coupons for ASTM D7565 and/or ASTM D3039 Tension Tests, see 3.3.5 and 3.3.6 of this specification. A minimum of one "sample batch" shall be made daily. Each sample of the "sample batch" will be taken at appropriate times during the day as to ensure the maximum material deviance in the components of the FRP composite.
   2. Preparation of Samples
      a. Prepare sample on a smooth, flat, level surface covered with polyethylene sheeting, or 16 mil plastic film, prime with epoxy resin. Then place one layer of saturated fabric and apply additional topping of epoxy. Cover with plastic film and squeegee out all bubbles.
      b. Samples shall be stored in a sample box and not moved for a minimum 48 hours after casting. The prepared, identified samples shall be given to a pre-approved and experienced testing laboratory. The laboratory shall then precondition samples for 48 hours at 140°F (60°C) before testing.
   3. ASTM D7565 and/or ASTM D3039 – Material Tension Tests
      a. A minimum of fifteen percent of all 12" (305mm) x 12" (305mm) sample panels shall be tested. Testing specimens shall be cut from samples and tested for ultimate

tensile strength, tensile modulus and percentage elongation as per ASTM D7565 and/or ASTM D3039 in the longitudinal/primary fiber direction.

b. The reported properties for the ultimate tensile stress and the tensile modulus shall be based on the gross laminate thickness as indicated on the product data sheet and the approved evaluation service report.

c. Tensile properties must meet or exceed FRP composite system properties as defined in project specifications. If one coupon does not achieve the design properties, additional coupons from the same sample shall be tested. If these coupons fail (on average), coupons from the other 12" (305mm) x 12" (305mm) sample, from the same batch for that day, shall be tested. If all tested samples of the sample batch do not meet the conditions of acceptance, it is recommended that 25 percent of all samples be tested.

4. Acceptance Criteria

a. FRP design values must be lower than the calculated mean determined from the test results received from the ASTM D7565 and/or ASTM D3039 field test specimens. Acceptable minimum values for ultimate tensile strength, tensile modulus, and elongation shall not be below the submitted design values unless calculations are performed using the tested values that exhibit an acceptable capacity as per the original design demands and concept.

3.4 REQUIRED REMEDIATION

A. Small voids and bubbles on the order of 3" (76mm) diameter shall be injected or back filled with epoxy.

B. Voids and delaminations on the order of 6" in diameter or an area of 5" (127mm) x 5" (127mm) shall be reported to the engineer of record and remediation shall be submitted by the contractor for approval.

C. In the event that the FRP system does not meet the Acceptance Criteria as per laboratory testing and calculations (refer to Section 3.3.6 of this specification), remedial measures shall be taken. Any structural member where the installed FRP system does not meet the Acceptance Criteria, additional layers shall be installed until the FRP meets design requirements, or any other remediation directed by the Engineer of Record.

3.5 Make Good

A. Make good at no cost to the Owner, any damage to the new or existing structures, property or services caused by the installation and testing of the FRP composite.

3.6 Clean up

A. Remove all surplus material, equipment and debris from the site on completion of the work. Leave the site clean.

END OF SECTION 032500

SECTION 033000 – CAST-IN-PLACE CONCRETE

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. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301
   2. ACI 117
   3. ACI 318

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
   1. None

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

C. Special Inspection Agency: A testing agency that is entirely independent of the contractor and commissioned directly by the Owner. The Special Inspection Agency must be properly certified for their scope of work as required in the jurisdiction of the project.

1.4 PREINSTALLATION MEETINGS

A. Review all sections of this specification, including but not limited to the following: special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, anchor rod and anchorage device installation tolerances,] [steel reinforcement

installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

A. General:

1. Action Submittals listed below are submittals that will be reviewed and returned to Contractor.

2. Review of submittals is of a general nature only, and the responsibility for conformance with intent of drawings shall remain with the Contractor. Review does not imply or state that the fabricator has correctly interpreted the construction documents.
3. All submissions shall be in accordance with the submission schedule developed and agreed between the Architect and Contractor at the commencement of the project. Submission shall include dates of order and delivery of materials to the shop and the site.
4. Shop drawing schedule shall allow adequate time for reviews. Reinforcing steel shall not be fabricated or placed before the shop drawings have been reviewed by the Architect and returned.

B. Product Data: For each type of product.

C. Design Mixtures: For each concrete mixture, submit mixture information as required by ACI 301. Mixture submittals shall be reviewed by the Testing Agency and Architect. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. In addition to the ACI 301 submittal requirements, each design mixture submittal shall include the following information: W/C ratio, slump, aggregate grading, total chloride content, and whether the mix is appropriate for pumping.
2. Design mixture submittals shall indicate for which structural elements each mix is to be used.
3. If historical data is used to justify compressive strength, test results shall date from within the past two years.
4. Each mixture design shall have a unique identifying number, and that number shall be the same as shown on all related test data.
5. Provide shrinkage test results for mixes with shrinkage criteria showing that mix meets performance criteria.
6. Indicate amounts of mixing water to be withheld for later addition at Project site.
7. Each mix shall be stamped and signed by a Professional Engineer licensed in the State the Project is located.

D. Steel Reinforcement Shop Drawings: Placing Drawings in accordance with ACI SP 066 that detail fabrication, bending, and placement. Direct copies of the Contract Documents are not acceptable as a submission from the Contractor.
   1. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Include any welding to be done.
   2. Shop drawings shall make it clear where each bar is located. Beams, grade beams and walls shall be shown in elevation. On elevations show locations of sleeves and penetrations.
   3. Check architectural, structural, mechanical, and electrical and other contract documents for anchor bolt schedules and locations, anchors, inserts, conduits, sleeves, and any other items which are required to be cast in concrete, and make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.
   4. Show all areas of congestion. Identify where reinforcing steel will interfere with the placement of embedded items such as anchor bolts, anchors, inserts, conduits, sleeves and any other items which are required to be cast in concrete.

1.6 INFORMATIONAL SUBMITTALS

A. Informational submittals listed below shall be submitted for project record only, and will not be formally returned to contractor.

B. Qualification Data: For Installers, manufacturers, testing agency and other entities for which qualifications are specified in this Section.

C. Welding Procedures for all reinforcement welding. Welding procedures shall be reviewed and approved by the Testing Agency, but are retained by the Architect for information only.

D. Welding certificates.

E. Material and Product Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials, per ASTM C150, ASTM C595, ASTM C618, ASTM C989, and/or ASTM C1240, as applicable.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Welding Electrodes
   6. Fiber reinforcement.
   7. Waterstops.
   8. Curing compounds.
   9. Floor and slab treatments.
   10. Non-shrink grout, per ASTM C1107.
   11. Bonding agents.

12. Adhesives.
13. Vapor retarders.
14. Semirigid joint filler.
15. Joint-filler strips.
16. Post-installed concrete anchors.
17. Repair materials.
18. Carbon dioxide mineralization: Provide concrete producers certificate verifying mineralization of carbon dioxide. Include quantity, location, and supplier of injected CO2.

F. Material Test Reports: For the following, from a qualified testing agency:
   1. Other concrete materials for which material testing is specified in this Section.

G. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
   1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal. Provide calculations by a Professional Engineer licensed in the project jurisdiction, demonstrating transfer of forces to reshores without causing damage to the structure nor resulting in additional permanent deflections.
   2. Design of concrete formwork, shoring, reshoring and bracing shall be the sole responsibility of the Contractor and shall conform to Code requirements and shall be in accordance with the recommendations of ACI 347.
   3. Shop Drawing Requirements:

      a. Shop Drawings shall show location and layout of construction joints, reveals, slab edges, form joints, sleeves, openings, [textures,] locations of tie holes or plugs, location of embedded items and blockouts, and all related details affecting Architectural quality.
      b. Shop Drawings shall show dimensioned location to the face of formwork for walls, beams, columns, slab edges, slab depressions, etc.
      c. Formwork details affecting Architectural finish quality shall be reviewed by the Architect.
      d. Indicate where formwork release agent will be used as applicable.
      e. Where a mock-up is required, submit shop drawings of the mock-up.

H. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

I. Contractor's Quality Control Plan and Quality Control Inspector qualifications. The Contractor shall submit a Quality Control Plan that addresses all inspection issues, including testing and inspection per ACI. The Quality Control Plan shall be reviewed by the Testing Agency but will be retained for information only by the Architect.

J. Field quality-control reports.

K. Mill Test Reports: Submit steel producer's certificates of mill analysis for each heat or melt of reinforcing steel, including steel source, description, heat number, yield point, ultimate tensile strength, elongation percent, bend test and the chemical composition of each heat as determined by ladle analysis, before delivery of steel to site. Where steel is required to be welded, mill reports shall be used to help verify the weldability of the steel.

L. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

E. Adhesive Anchor Installer Qualification: Installation of adhesive anchors horizontally or upwardly inclined shall be performed by personnel certified by the ACI/CRSI Adhesive Anchor Installer Certification program

F. Contractor’s Quality Control Plan: Quality Control includes the functions performed by the Contractor to ensure that the material and workmanship of concrete construction meets the project specifications and applicable standards. The verification testing and inspection carried out by the Testing Agency does not relieve the contractor of the responsibility for conducting their own quality control/inspection program to ensure the requirements of the Contract Documents have been met.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

2.2 FORM-FACING MATERIALS

A. A minimum of 50% of the wood materials used for formwork (e.g., dimensional lumber, plywood, other engineered wood products) shall be "FSC Certified" products which have been harvested in accordance with the rules of the Forest Stewardship Council (www.fscus.org). List of North American FSC-certified companies can be found at https://info.fsc.org/certificate.php.

B. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Overlaid Finnish birch plywood.

C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Foam Filler or High-Density Styrofoam Fill: Expanded polystyrene foam, ASTM C578, Type IX, 1.9 pounds per cubic foot density.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

2.3 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Concrete reinforcement shall contain a minimum of 25% combined post-industrial and post-consumer recycled content where the percentage of recycled content is based on the weight of the component materials.

B. See Drawings for reinforcing material grade specifications.

C. Plain Steel Welded Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. See Drawings for material grade specifications for dowel bars, mechanical couplers, deformed bar anchors and welding electrodes.

B. Zinc Repair Material: ASTM A780/A780M.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 POST-INSTALLED CONCRETE ANCHORS

A. See Drawings for acceptable products for expansion anchors, screw anchors, epoxy and grouted dowels.

2.6 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:
1. Portland Cement: ASTM C150/C150M, Type I, Type II, Type I/II, unless noted otherwise
2. Fly Ash: ASTM C618, Class F
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Silica Fume: ASTM C1240, amorphous silica.
5. Metakaolin: ASTM C618, Class N.
6. Natural Pozzolans: ASTM C618, Class N
7. Cementitious material used shall have at least 2 years of use with proposed aggregates without detrimental reaction.
8. Alkali content shall not exceed 0.6% when tested in accordance with ASTM C114.
9. The temperature of cement delivered to the plant shall not exceed 150 degrees F.

C. Normal-Weight Aggregates: ASTM C33/C33M coarse aggregate or better, graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 3/4 inch nominal, unless noted otherwise.
    a. The maximum size used in a particular location shall be consistent with the form and dimensions of the section being placed, with the location and spacing of the reinforcing steel and with the method of vibration. The aggregate sizes shall be such as will produce dense, uniform concrete, free of rock pockets, honeycombs, or other irregularities.
    b. Aggregate shall contain no thin or elongated pieces. Any piece having a major dimension more than 2-1/2 times the average thickness shall be considered thin or elongated.
    c. If shrinkage-controlled concrete, Coarse Aggregate shall be crushed limestone, granite, or accepted equal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Combined Aggregate Gradation: Combined aggregate gradation for slabs and other designated concrete shall meet the following percentages retained on each sieve below the top size and above the No. 100: 8% - 18% for 1 ½-inch maximum aggregate size, or 8% - 22% for 1-inch or ¾-inch maximum aggregate size.
4. Aggregate types shall conform to the requirements of the fire-rated assemblies to be used on the Project.

D. Air-Entraining Admixture: ASTM C260/C260M, certified by manufacturer to be compatible with other admixtures.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. Retarding Admixture: ASTM C494/C494M, Type B.
   3. Accelerating Admixture or Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type C or Type E.
   4. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
   5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
   6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
   7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
   8. Workability-Retaining Admixture: ASTM C494/C494M, Type S.
   9. Shrinkage-Reducing Admixture: ASTM C494C494M, Type S.
   10. Alkali-Silica Reaction-Inhibiting Admixture: ASTM C494/C494M, Type S. Shall contain a nominal lithium nitrate content of 30 percent.
   11. Viscosity-Modifying Admixture: ASTM C494/C494M, Type S.

F. Water: ASTM C94/C94M and ASTM C1602 clean, free from deleterious matter. Non-potable water is acceptable if meets the chemical content limits of ASTM C1602.

2.7 FIBER REINFORCEMENT

A. Carbon-Steel Fiber: ASTM A820/A820M, Type 1, cold-drawn wire, deformed, minimum of [1.5 inches] [2 inches] [2.4 inches] long, and aspect ratio of [35 to 40] [45 to 50] [60 to 65]. Acceptable products (or approved equal):
   1. Bekaert Corporation: Dramix
   2. Sika Corporation: SikaFiber Force 1050.

B. Carbon-Steel Fiber: ASTM A820/A820M, Type 2, cut sheet, deformed, minimum of [1.5 inches] [2 inches] [2.4 inches] long, and aspect ratio of [35 to 40] [45 to 50] [60 to 65]. Acceptable products (or approved equal):
   1. Fibercon International, Inc.: Fibercon.
   2. Sika Corporation: SikaFiber Force CS-1000.
   3. Concrete Fiber Solutions: CFS 100-2.

2.8 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing [3/8-inch] [No. 4] [No. 8] sieve.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

C. Emery Dry-Shake Floor Hardener: [Pigmented] [Unpigmented], factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.
   1. Acceptable Products (or approved equal):
      a. The Euclid Chemical Company: EucoPlate HD.
      b. BASF Corporation: MasterTop 200.
   2. Color: [As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from manufacturer's full range].

D. Metallic Dry-Shake Floor Hardener: [Pigmented] [Unpigmented], factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.
   1. Color: [As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from manufacturer's full range].
   2. Use non-oxidizing hardener at areas of exterior exposure and as indicated.

E. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.
   1. Acceptable Products (or approved equal):
      a. The Euclid Chemical Company: Surflex.
      b. BASF Corporation: MasterTop 110.

F. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
   1. Acceptable Products (or approved equal):
      a. The Euclid Chemical Company: Surflex.
      b. BASF Corporation: MasterTop 110.
   2. Color: [As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from manufacturer's full range].

2.9 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. The compound shall contain no VOCs.

1. Acceptable Products and Manufacturers (or approved equal):

    a. The Euclid Chemical Company: Euco Diamond Hard.
    b. Laticrete International, Inc.: L&M Seal Hard.
    c. BASF Corporation: MasterKure HD 200 WB.

2.10 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. VOC content shall not exceed 20g/L.
    1. Acceptable Products (or approved equal):

        a. BASF Corporation: MasterKure ER 50.
        b. W.R. Meadows, Inc.: EVAPRE.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating. Meet VOC content limit of 100g/L per South Coast Air Quality Management District Rule 1113-2016, or local regulations, whichever is more stringent.
    1. Acceptable Products and Manufacturers (or approved equal):

        a. The Euclid Chemical Company: Kurex DR-100.
        b. W.R. Meadows: 1100 (formerly 1100-CLEAR).

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, nondissipating [, certified by curing compound manufacturer to not interfere with bonding of floor covering]. Meet VOC content limit of 100g/L per South Coast Air Quality Management District Rule 1113-2016, or local regulations, whichever is more stringent.
    1. Acceptable Products and Manufacturers (or approved equal):

        a. The Euclid Chemical Company: Diamond Clear VOX or Super Diamond Clear VOX.
        b. W.R. Meadows: VOCOMP-20

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating[, certified by curing compound manufacturer to not interfere with bonding of floor covering]. [Meet VOC content limit of 100g/L per South Coast Air Quality Management District Rule 1113-2016, or local regulations, whichever is more stringent.]

1. Acceptable Products and Manufacturers (or approved equal):

    a. The Euclid Chemical Company: Super Diamond Clear VOX.

H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A. Maximum VOC emissions of 350 g/L.
1. Acceptable Products and Manufacturers (or approved equal):

    a. The Euclid Chemical Company: Super Diamond Clear 350
    b. W.R. Meadows: CS-309-25 OTC

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: [ASTM D1751, asphalt-saturated cellulosic fiber] [or] [ASTM D1752, cork or self-expanding cork].

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, [epoxy resin with a Type A shore durometer hardness of 80] [aromatic polyurea with a Type A shore durometer hardness range of 90 to 95] according to ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
2. Acceptable Products and Manufacturers (or approved equal):

    a. The Euclid Chemical Company: Duralcrete Series.
    b. Sika Corporation: Sikadur Hi-Mod Series.
    c. BASF Corporation: MasterEmaco ADH Series.

E. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 BASE PLATE GROUT

A. See Drawings for specification of grout to be used under column base plates and other high-bearing applications.

2.13 REPAIR MATERIALS

A. Patching Mortar:

1. Horizontal repairs, ASTM C928**.** Acceptable products (or approved equal):

    a. Euclid Chemical Co.: Euco Thin Top Supreme, Concrete-Top Supreme
    b. Sika Chemical Corp.: SikaTop 121 or 122
    c. BASF Corporation: MasterEmaco T 310CI
2. Vertical or Overhead repairs, ASTM C928. Use as recommended by manufacturer for overhead use. Acceptable products (or approved equal):

    a. Euclid Chemical Co.: Verticoat, Verticoat Supreme or Speed Crete Red Line
    b. Sika Chemical Corp.: SikaTop 123
    c. BASF Corporation: MasterEmaco N 350CI or MasterEmaco N 425

B. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C109/C109M.
5. Acceptable products (or approved equal):

    a. Euclid Chemical Company, The: Super Flo-Top.
    b. BASF Corporation: MasterTop 110 SL.

C. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109/C109M.
5. Acceptable products (or approved equal):

    a. Euclid Chemical Company, The: Thin Top Supreme or Tammspatch II.
    b. BASF Corporation: MasterEmaco N 300CI.

D. Drypack Mortar for form holes at non-Architectural grade surfaces: Composed of 1-part Portland cement and 2 parts of fine aggregate and water. Match color of adjacent surfaces.

2.14 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Procurement of concrete mix design is responsibility of the Contractor.
2. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
3. At the discretion of the Engineer of Record a manufacturer’s laboratory may also be approved to perform trial batching. The Manufacturer’s lab must be run under the direct supervision of a Professional Engineer and technicians performing the tests must be Both ACI Concrete Field Testing Technician Grade I and Laboratory Testing Technician grade I certified. The facilities must be adequate to properly perform the testing required.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement to meet limits specified in mix design performance specifications. Refer to ACI 301 and ACI 318 for limits on the amount of these ingredients.

C. Limit water-soluble, chloride-ion content in hardened concrete to the limits specified in ACI 301.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

2.15 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. See Drawings for required properties of each type of concrete mix.

2.16 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice," except where noted otherwise.

B. Bending:
   1. In case of fabrication errors do not rebend or straighten reinforcement in a manner that will injure or weaken the material.
   2. Reinforcing bars are to be bent cold, do not preheat, unless approved by Architect.
   3. Do not rebend reinforcement that has previously been bent within 6 inches of existing bend except as allowed by ACI 301.

C. Spirals: Provide a minimum of 1-1/2 finishing turns top and bottom.

D. Unacceptable Materials: Reinforcement with any of the following defects shall not be permitted in the Work and will be replaced without cost:

   1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
   2. Bend or kinks not shown on the Drawings or final shop drawings.
   3. Bars with reduced cross-section due to rusting or other cause.
   4. Bars with dirt, mud, grease or form release agent.

2.17 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M[and ASTM C1116/C1116M], and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 PRECONSTRUCTION MEETING

A. Prior to commencement of concrete work, relevant participants shall meet at the Project site to review the proposed mix designs, methods and sequence of concrete construction, standard of workmanship, material selection, testing and quality control requirements, placement procedures, off-site batching requirements, coordination of the work with other trades and other pertinent topics related to the Work. The following participants shall be represented as a minimum:

1. Owner's Representative
2. Architect/Engineer
3. Construction Manager/General Contractor
4. Concrete Subcontractor
5. Owner's Testing Laboratory
6. Ready Mix Concrete Supplier
7. Admixture Manufacturer Representative
8. Formwork Manufacturer/Supplier
9. Lightweight Aggregate Supplier
10. Concrete pumping subcontractor
11. Any other relevant subcontractor and/or material supplier including plumbing, waterproofing and electrical suppliers

B. The Contractor shall take minutes from this meeting and share them with the Owner. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design and placing techniques shall produce the concrete quality required by these specifications.

3.2 PREPARATION

A. Prior to Work specified in this Section, the Contractor shall carefully inspect the installed Work of other trades and verify that such Work is complete to the point where this installation may properly commence.

B. The Contractor shall verify that forms may be constructed in accordance with all applicable codes and regulations, the referenced standards, and the design documents.

1. Ensure Excavations are sufficient to permit placement, inspection, and removal of forms.
2. Verify reinforcing steel has been inspected prior to concealing with formwork.
3. Verify geotechnical engineer has approved all foundation excavations.

C. The Contractor shall verify all dimensions prior to starting construction.

D. Contractor coordination:

1. Obtain necessary information for coordination of formwork with items to be embedded in concrete.
2. Coordinate size and location of openings in concrete. Obtain Architects approval for openings not shown on Structural Drawings.

E. Discrepancies:

1. Notify the Architect of any discrepancies or inconsistencies.
2. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved

3.3 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. [Class A, 1/8 inch (3.2 mm)] <Insert dimension> for smooth-formed finished surfaces.
2. [Class B, 1/4 inch (6 mm)] [Class C, 1/2 inch (13 mm)] [Class D, 1 inch (25 mm)] <Insert dimension> for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.
3. Bolts, rods, and other devices when used for internal ties and spreaders shall be of such construction that when the forms are removed, no metal shall be within 1 inch of the exterior concrete surfaces or within 1/2 inch of interior concrete surfaces.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.4 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

B. Provide pipe sleeves when pipes pass through concrete. Fill voids in sleeves, inserts and anchor slots with readily removable material to prevent entry of concrete into voids.

C. No conduit shall be cast in concrete unless specifically indicated on the Structural Drawings.

D. Coring of concrete after placement is not permitted without prior approval by the Engineer of Record.

3.5 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete shall be hard enough to not be damaged by form-removal operations, and curing and protection operations shall be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its specified

design compressive strength. Use of the maturity age method per ASTM C1075 to estimate early strength is permitted.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

D. All forms below ground surface, along with all shores and braces, shall be removed before backfilling.

3.6 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.7 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
2. Wherever embedded items interfere with placing of reinforcement notify the Architect and obtain approval before placing any concrete. Do not bend or field cut bars around openings or sleeves.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Weld reinforcing bars according to AWS D1.4/D 1.4M, only where indicated on drawings. Welding is not permitted on bars where the carbon equivalent is unknown. Do not weld within 2 bar diameters of where bars have been bent cold. Welding material, wire cuttings and tramp metal shall be thoroughly cleaned from forms for exposed concrete before any concrete is placed.

E. Where Drawings do not show the spacing of the reinforcing, the minimum clear spacing shall conform to ACI 318/318M.

F. Field bending or straightening of reinforcement shall be in accordance with ACI 301.
   1. Reinforcing partially embedded in concrete shall not be field bent except as shown on the Drawings or accepted by the Architect.
   2. Reinforcement greater than #5 bars shall not be field bent except as shown on the Drawings or accepted by the Architect.

G. Wherever conduits, piping, inserts, sleeves, etc., interfere with placing of reinforcing steel, obtain acceptance of method of procedure before any concrete is placed. Bending of bars around openings or sleeves not permitted.

H. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

I. Splicing: Make splices only at those locations shown on the Drawings or as accepted by the Architect. Splice locations not shown on the Drawings shall be approved in shop drawings before fabrication. Stagger splices in adjacent bars wherever possible.

J. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

K. Install deformed bar anchors, mechanical splices and reinforcing couplers in accordance with the manufacturer's recommendations.

3.8 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
5. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
6. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

C. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Hot and Cold Weather Placement: Comply with ACI 301. Additionally, comply with ACI 306.1 for cold-weather placement and ACI 305.1 for hot-weather placement.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed 1/4 inch on formed-surface irregularities.
   1. Apply to concrete surfaces [not exposed to public view] <Insert locations>.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces [exposed to public view,] [to receive a rubbed finish,] [or to be covered with a coating or covering material applied directly to concrete] <Insert locations>.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1-part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours. Apply grout-cleaned finish at surfaces to receive paint, unless otherwise indicated.
   3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1-part portland cement and 1-part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
   1. Apply scratch finish to surfaces [indicated] [and] [to receive concrete floor toppings] [to receive mortar setting beds for bonded cementitious floor finishes] <Insert locations>.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces [indicated] [to receive trowel finish] [and] [to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo] <Insert locations>.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces [indicated] [exposed to view] [or] [to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system] <Insert locations>.
   2. Finish surfaces to the following tolerances, according to ASTM E1155, for a randomly trafficked floor surface:

      a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
      b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
      c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
      d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.
   3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed [1/4 inch (6 mm)] [3/16 inch (4.8 mm)] [1/8 inch (3.2 mm)].
   4. Slabs supporting modular office partitions, adhered flooring systems, or compact storage shelving must also comply with the manufacturer’s tolerance requirements. Slabs

scheduled to receive wood flooring must also comply with tolerances required for installation of wood flooring.

5. Fill or grind completed floors as necessary to achieve specified finish tolerances. Fill shall be with a self-leveling cementitious product capable of being tapered to a feathered edge.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish. Then, while concrete is still plastic, slightly scarify surface with a fine broom.
   1. Apply trowel and fine-broom finish to surfaces [indicated] [where ceramic or quarry tile is to be installed by either thickset or thinset method].
   2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
   1. Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive [aggregate] [aluminum granule] finish according to manufacturer's written instructions and as follows.
   1. Apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps.
   2. Uniformly spread [25 lb/100 sq. ft. of dampened slip-resistive [aggregate] [aluminum granules] over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
   3. After broadcasting and tamping, apply float finish.
   4. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive [aggregate] [aluminum granules].

H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows.
   1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer.
   2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
   3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.
   4. Apply non-oxidizing metallic dry-shake hardener to loading dock slabs unless indicated otherwise.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Post-Installed Concrete Anchors

1. Install in accordance with the manufacturer's recommendations and ICC-ES reports.
2. Use washers on all bolts.
3. Use care to avoid cutting or damaging reinforcing bars.
4. When exposed to view in the final structure, bolts shall be of a length that will extend entirely through but not more than 1/4-inch beyond the nuts unless otherwise shown on the Drawings.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the one or more of the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
5. Applicable curing methods:

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings or penetrating liquid floor treatments except as permitted below.
    b. Strippable or dissipating curing compounds may be used for trowel finished surfaces to receive resilient flooring, or if the manufacturer certifies that the curing compound does not interfere with bonding of floor covering used on Project.
    c. Interior slabs to receive thin set tile: Cure only with moisture retaining cover. Do not cure with curing compound.
6. Exterior Flatwork: Apply 1 coat of curing/sealing compound as soon as possible after finishing.

3.14 LIQUID FLOOR TREATMENT APPLICATION

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
    1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
    2. Do not apply to concrete that is less than [three] [seven] [14] [28] days' old.
    3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth [and to depth required to reveal aggregate to match approved mockup].
2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
4. Control and dispose of waste products produced by grinding and polishing operations.
5. Neutralize and clean polished floor surfaces.

C. Protection of Liquid Floor Treatments: Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

D. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least [**one**] [**six**] month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval. Defective Concrete is defined as concrete which is under strength, out of line, level or plumb, or shows objectionable cracks, honeycombing, rock pockets voids, spalling, exposed reinforcement, that has any sawdust, wood, or debris embedded in it, and in the Architect's judgment these defects impair the proper strength or appearance of the work. Any concrete work not in accordance with the Specification and Drawings will be deemed to be defective. Repair and replacement work shall be done at Contractor’s expense.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100-cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C567/C567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31/C31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at the age corresponding to the specified design strength.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at the age corresponding to the specified design strength.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results for each specified test shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength, concrete mixture proportions and materials, compressive breaking strength and type of break, and the sample age in days.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Reinforcing Steel

1. Contractor shall notify the testing agency and the Architect at least 48 hours before concrete is to be poured or reinforcing is covered up.
2. Before any concrete is poured on any particular portion of the building, the reinforcing steel and form dimensions will be inspected by the Testing Agency. Any errors or discrepancies shall be corrected before concrete is placed.
3. A special inspector shall be present during all field bending of reinforcement.
4. Installation of deformed bar anchors to be tested in accordance with Section 7.1 of AWS D1.1.
5. Welding of Reinforcement: There shall be continuous inspection during all welding of reinforcement. All butt welds to be inspected using radiographic testing. At the Owners option recognized non-destructive tests such as resistance, Magnetic Particle Examination, and Liquid Penetrant Inspection may be used to inspect the welds.
6. Comply with ICC-ES approvals with respect to special inspection required during installation.
7. Testing and inspection of mechanical splices and reinforcing couplers to conform to manufacturer's recommendations and ICC-ES approval.
8. Unidentifiable Reinforcing Steel: Tested by Testing Agency; paid for by Contractor. Test reinforcing delivered to site which cannot be properly identified by heat number and mill mark for compliance with ASTM A615 as follows:

    a. No. 8 Bar and Smaller: One tensile test and one bend test of each size per 7-1/2 tons, or portion thereof.
    b. No. 9 Bar and Larger: One tensile test of each size per 10 tons, or portion thereof.

F. Survey and Adjustment: Continuously observe formwork operations, record such observations on a daily basis, and submit reports of the results. Instrument check forms before and during concrete placement to assure no movement has taken place. Make appropriate corrections to reposition displaced forms. Certify, by written report submitted on a weekly basis, for each level and story that the elevations, finish lines and building lines of the hardened concrete are within tolerances.

G. Measure floor and slab flatness and levelness according to ASTM E1155 within 48 hours of finishing.

H. Contractor shall correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.18 CONSTRUCTION SITE WASTE MANAGEMENT (CONCRETE)

A. Segregate materials by types for recycling, such as wood, stone, metal, etc.

B. Ready-Mix supplier shall have gray water system to use recycled water in plant operations. Contractor shall document that the supplier has this capability, or demonstrate due diligence in trying to locate a ready-mix supplier with this type of facility.

END OF SECTION 03 30 00

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor framing for ceiling of Pantry 0015. Treat this ceiling as a floor for occasional maintenance access.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
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 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Floor joist framing.
3. Post-installed anchors.
4. Power-actuated anchors.
5. Sill sealer gasket.

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, submit signed and sealed shop drawings and calculations prepared by a professional engineer (P.E.) licensed in the District of Columbia.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
1. Expansion anchors.

2. Power-actuated anchors.
3. Mechanical fasteners.
4. Horizontal drift deflection clips
5. Miscellaneous structural clips and accessories.

1.4 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, or in-house testing with calibrated test equipment, 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 the Steel Stud Manufacturers Association or the Supreme Steel Framing System 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."

1.5 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, as defined in Section 014000 "Quality Requirements," 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 indicated on Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Floor Joist Framing: Vertical deflection of 1/480 for live loads and l/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure,

connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

4. 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 1/2 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.

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. Framing Members, General: Comply with AISI S240 for conditions indicated.

B. 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: G60, A60, AZ50, or GF30.

2.3 FLOOR JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0966 inch.
2. Flange Width: 1-5/8 inches, minimum.
3. Section Properties: As required by the design.

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel joists.
2. Flange Width: 1-1/4 inches, minimum.

2.4 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. Joist hangers and end closures.
7. Hole-reinforcing plates.
8. Gusset plates.

2.5 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. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

C. 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.

2.6 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, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.7 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 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 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 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 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 1/16 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 insulation, specified in Section 072100 "Thermal 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.

3.3 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: As required by Delegated Design.

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

F. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.4 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.5 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.

3.6 PROTECTION

A. 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 057500 - DECORATIVE FORMED METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper trim.
2. Copper backsplash panels.
3. Copper base.

B. Related Requirements:

1. Section 06 4023, Interior Architectural Woodwork for integration of ornamental metal into cabinet and counter design.
2. Refer to QF Drawings for powder-coated Stainless Steel used in food service equipment.

1.2 COORDINATION

A. Coordinate installation of decorative formed metal items. Furnish setting drawings, templates, and directions for installing anchorages, to be embedded in shop fabricated woodwork.

1. All decorative metal items are associated with the Architectural Woodwork and countertops in the Café and the wall elevation of Pantry 0015.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials and adhesives.

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

1. Metal work shop drawings must be submitted as part of the Architectural Woodwork shop drawings
2. Include plans, elevations, component details, and attachment details.
3. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square Samples of metal of same thickness and material indicated for the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For copper finish to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing decorative formed metal similar to that indicated for this Project and with a record of successful in-service performance as well as sufficient production capacity to produce required units.

B. Installer Qualifications: Fabricator of products.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups for complete cabinet or counter door and fixed panel assembly including the following types of decorative formed metal:

   a. Metal base for cabinet fronts and doors.
   b. Metal trim.

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 decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

B. Store products on elevated platforms in a dry location.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. For decorative metal items, obtain each color, grade, finish, type, and variety of metal from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 SHEET METAL

A. General: Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

B. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 temper.

2.3 MISCELLANEOUS MATERIALS

A. Sealants, Interior: Nonsag, paintable sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.

B. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.

1. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless exposed fasteners are unavoidable or are the standard fastening method.

2. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

C. Nonstructural Anchors: For applications not indicated to comply with design loads, provide fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

D. Backing Materials: Provided by fabricator of Architectural Woodwork.

E. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal, will prevent telegraphing and oil-canning, and is compatible with substrate and noncombustible after curing.

F. Isolation Coating: Manufacturer's standard alkali-resistant coating, bituminous paint, or epoxy coating.

2.4 COATINGS

A. Coating for Copper Alloys: Clear, air-dry acrylic based polymer specially developed for coating copper-alloy products. Refer to Finishes.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble the decorative formed metal items and the woodwork substrates in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining woodwork to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.

C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch-wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch and support with concealed stiffeners.

D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.

E. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.

F. Where soldering or brazing is required, solder or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

1. Soldering and brazing procedures may be done only in the shop and only if shown in shop drawings submitted for review. Do not solder or braze in field. .

2.6 REVEAL TRIM

A. Form trim from copper sheet of thickness indicated below. Fabricate to fit tightly to adjoining construction.

1. Copper Sheet: 0.020-inch, or thickness required to comply with design requirements.

a. Finish: Polish or buff for reflective finish, and treat with protective coating.
b. Texture: Smooth.
c. Location: Recessed element between cabinet and counter.

B. Coordinate with woodwork structure. Trim may be extended to attach to structure, then covered with wood trim and countertop.

C. Miter or cope trim members at corners and reinforce with bent metal splice plates to form tight joints.

2.7 BACKSPLASH PANELS

A. Form backsplash panels at countertops at rear counter, trash receptacle, and condiment stand.

1. Copper Sheet: 0.064 inch

a. Finish: Polished, with protective coating.
b. Texture: Peened. Basis of Design is Pattern 1HM by Rigidized Metals, for equal.

2. Panels may straight sheets with concealed edges, or may be panelized by manufacturer to wrap substrate. Refer to detail drawings for size and setting of copper backsplash. No exposed edges in finished condition.

2.8 METAL BASE

A. Form metal base from metal of type and thickness indicated below:

1. Copper Sheet: 0.063 inch.

a. Finish: Finish: Polished, with protective coating.

b. Texture: Peened. Basis of Design is Pattern 1HM by Rigidized Metals, for equal

2. Base may be straight sheet with concealed edges, or may be panelized by manufacturer to wrap substrate. Refer to detail drawings for profile of copper base for cabinet doors and counters.

2.9 COPPER-ALLOY FINISHES

A. Polished or Buffed Finish: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear, organic, air dried, as specified below).

1. Clear Coating: Acrylic based polymer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil.

2. Basis of design system: Albi 69X1732 INCRA.LAC or equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative formed metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.

1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

D. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING AND CLEANING

A. Unless otherwise indicated, clean metals by washing thoroughly with water and soap, rinsing with clean water, and drying with soft cloths.

B. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

A. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 057500

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous wood and lumber products.
2. Fire-retardant-treated lumber.
3. Plywood backing panels.

B. Related Requirements:

1. Section 064023 "Interior Architectural Woodwork" for interior finish millwork including interior support framing.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED LUMBER

A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment is not to promote corrosion of metal fasteners.
2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
3. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.

E. Application: Treat all rough carpentry unless otherwise indicated, including the following:

1. Concealed blocking.
2. Plywood backing panels.
3. Plywood sheathing panel at walking surface, Room 0015.
4. Concealed framing supporting architectural woodwork not specified in Section 064023, Interior Architectural Woodwork.

2.3 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Furring.
4. Miscellaneous framing supporting architectural woodwork

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
5. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.

C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.5 PLYWOOD FLOOR SHEATHING

A. Floor Sheathing: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

B. Provide as walking surface above Rm. 0015

2.6 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on [**ICC-ES AC308**] as appropriate for the substrate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking,and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Refer to architectural woodwork details on Drawings for facing material, trim, special shapes.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).

G. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.

END OF SECTION 061000

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior exposed woodwork associated with finished surfaces of cabinets and counters in the Café.
2. Interior running trim for transparent finish.
3. Interior flat panels and milled wood shapes for transparent finish.
4. Interior frames supporting surfaces for transparent finish.
5. Fire-retardant-treated wood material.
6. Miscellaneous materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and panels required for other areas of the work and miscellaneous items used in interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.

B. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings:

1. Include the following:

    a. Dimensioned plans, elevations, and sections.
    b. Attachment details.

2. Show half- or full-size details for complex work.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
4. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples: For each exposed product and for each shop-applied color and finish.

1. Size:

    a. Panel Products: 12 inches by 12 inches.
    b. Lumber Products: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.

2. Provide samples of up to three finish systems for review on site. Include product data and MSDS sheets on each system.

E. Samples for Verification: For the following:

1. Lumber and Panel Products for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
2. Panel Products for Transparent Finish: Not less than 12 inches (330 mm) wide by 12 inches (300 mm) long, for each species and cut, finished on one side and one edge.
3. For manufactured or shop fabricated special shapes: shape width by 12 inches long for lumber and 12 by 12 inches for panels, for each finish system and color.

    a. Finish one-half of exposed surface.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For architectural woodwork manufacturer and Installer.

B. Product Certificates: For the following:

1. Composite wood products.
2. Adhesives.

C. Evaluation Reports: For fire-retardant-treated wood materials, from ICC-ES.

D. Provide product data documenting test results.for Class A rating when tested using ASTM E84 or NFPA 286.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
2. Installer Qualifications: Manufacturer of products and Licensed participant in AWI's Quality Certification Program.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups of cabinet panels, front and back including door, and one vertical panel of screen including curved canopy. .
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Government specifically approves such deviations by Change Order.
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. Comply with the Architectural Woodwork Standards, Section 2.

B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.9 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.

B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed mortar joints, framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.

B. All finishes must meet a Class A rating when tested using ASTM E84 or NFPA 286. Provide product data documenting test results.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Premium.

B. Hardwood Lumber:

1. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
2. Species: American Walnut.
3. Cut: Plain sliced/plain sawn.
4. Wood Moisture Content: 5 to 10 percent.

2.3 INTERIOR FRAMES IN CONCEALED AREAS

A. Softwood Lumber:

1. Wood Species and Cut for wood framing in areas not exposed to view.
2. Species: Eastern white pine Douglas fir.
3. Cut: Plain sawn.
4. Wood Moisture Content: 5 to 10 percent.

5. Provide stained or painted finish.

2.4 INTERIOR EXPOSED MILLWORK FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Premium.

B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.

1. Species: American Walnut.
2. Cut: Plain sliced/plain sawn.
3. Wood Moisture Content: 5 to 10 percent.

C. For trim or panels wider than available lumber, use veneered construction. Do not glue for width.

D. Provide special shapes as detailed on drawings.

2.5 HARDWOOD SHEET MATERIALS

A. Composite Wood Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
2. Softwood Plywood: DOC PS 1.
3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.6 FIRE-RETARDANT-TREATED WOOD MATERIAL

A. Fire-Retardant-Treated Wood Materials: Where fire-retardant-treated materials are indicated, use materials complying with requirements that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of the Architectural Woodwork Standards. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.
3. Mill lumber before treatment, and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

2.7 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber and Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

   a. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
   b. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.

   2. Fire-Retardant Treatment: Complying with requirements; provide throughout work.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

   1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
   2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.8 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

   1. Ease edges to radius indicated for the following:

      a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
      b. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

   1. Disassemble components only as necessary for shipment and installation.
   2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
   3. Notify COTR seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
   4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.

a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.9 SHOP PRIMING

A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

B. Interior Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."

1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork.

2.10 SHOP FINISHING

A. Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Premium.
2. Finish System:

a. 9: UV Curable, Acrylated Epoxy, Polyester, or Urethane.
b. 10: UV Curable, Water Based.

3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4. Staining: Match approved sample for color.
5. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter in accordance with ASTM D523.

D. Opaque Finish:

1. Architectural Woodworking Standards Grade: Premium.

2. Provide opaque finish to interior framing supporting cabinet and counter walls and doors.
3. Finish System:

   a. 9: UV Curable, Acrylated Epoxy, Polyester, or Urethane.
   b. 10: UV Curable, Water Based.

4. Color: As selected by COTR from manufacturer's full range.
5. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter in accordance with ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims.
2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.

3. For shop-finished items, use filler matching finish of items being installed.

G. Standing and Running Trim:

1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than 96 inches long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity is to prepare and submit report of inspection.

3.4 REPAIR

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.

B. Where not possible to repair, replace defective woodwork.

C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.

1. Fill nail holes with matching filler where exposed.
2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.5 CLEANING

A. Clean interior architectural woodwork on exposed and semi-exposed surfaces.

END OF SECTION 064023

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. 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

1.06 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. Refer to technical sections of the specifications and Drawings for environmental limitations and conditions.

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

A. Confirm service requirements, if any, with COTR

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.

B. 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:

C.

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 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.

2. Interior custom frameless doors and frames

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Interior standard steel doors and frames.

2. Interior custom steel doors and frames.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

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. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.

E. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 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 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 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. At all locations unless otherwise noted.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule on Drawings.
   b. Thickness: 1-3/4 inches.
   c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
   d. Edge Construction: Model 1, Full Flush.
   e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
   f. Core: Manufacturer's standard.

2. Frames:

   a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
   b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
   c. Construction: Face welded.

3. Exposed Finish: Prime.

2.2 INTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

A. Hollow-Metal Doors and Frames: NAAMM-HMMA 860; ANSI/SDI A250.4, Physical Performance Level A. At locations indicated in the Door and Frame Schedule on Drawings.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule on Drawings.
   b. Thickness: 2 1/4 inches.
   c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
   d. Edge Construction: Continuously welded with no visible seam.
   e. Core: Steel stiffened.

2. Frames:

   a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
   b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
   c. Construction: Slip-on drywall.

3. Exposed Finish: Prime.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 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 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. 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.

F. 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.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.5 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Solidly pack mineral-fiber insulation inside frames.
4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

3.3 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

PART 4 - END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: Provide full-size sample of access door and frame and in finish specified, complete assembly. Approved door may be incorporated into the work.

PART 2 - PRODUCTS

2.1 ACCESS DOOR AND FRAMES

A. Flush Access Door with louvers and Exposed Flanges:
1. Description: Face of door flush with frame, with exposed flange and concealed hinge; safety corners.
2. Optional Features: Gasketing Piano hinges.
3. Locations: Wall in Rm 0015.
4. Door Size: 12 inch x 12 inch.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 14 gage, factory primed.
6. Frame Material: Nominal 0.04030-inch, 18 gage, factory primed.
7. Latch and Lock: Cam latch, screwdriver operated.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Provide 5-stage iron phosphate preparation.
2. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

    a. Color: As selected by COTR from full range of industry colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hinges.
2. Mortise locks.
3. Electromechanical locks.
4. Lock cylinders.
5. Operating trim.
6. Surface closers.
7. Wall- and floor-mounted stops.
8. Thresholds.
9. Metal protective trim units.
10. Auxiliary door hardware.
11. Auxiliary electrified door hardware.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames".
2. Section 083113 "Access Doors and Frames" for access door hardware, including cylinders.
3. Section 284621.11 "Addressable Fire-Alarm Systems" for connections to building fire-alarm system.
4. Section 284621.13 "Conventional Fire-Alarm Systems" for connections to building fire-alarm system.

1.2 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 Government'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.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation and Keying Conference: Conduct conference at Project site.

1. Conference participants must include Installer's Architectural Hardware Consultant and Smithsonian OPS.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system, including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Electronic security requirements.
f. Address for delivery of keys.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Hinges.
2. Mortise locks.
3. Electromechanical locks.
4. Lock cylinders.
5. Operating trim.
6. Surface closers.
7. Wall- and floor-mounted stops.
8. Thresholds.
9. Metal protective trim units.
10. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Product Data Submittals: For each product.

C. 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.

D. Samples: For each exposed product in each finish specified, in manufacturer's standard size.

1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

E. Samples for Initial Selection: For each type of exposed finish.

F. 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.

G. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Government'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.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.7 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 Government 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) OR an Architectural Opening Consultant (AOC).

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lockup 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 to manufacturer of key control system for subsequent delivery to Government.

D. Deliver keys and permanent cores to Government by registered mail or overnight package service.

1.9 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 Insert number years from date of Substantial Completion unless otherwise indicated below:

a. Electromagnetic Locks: Five years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. 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.

2.2 PERFORMANCE REQUIREMENTS

A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

C. Accessibility Requirements: All door hardware is on doors in an accessible route, and must comply with the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

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 5 lbf.
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 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: ANSI/BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allegion plc.
    b. Cal-Royal Products, Inc.
    c. Hager Companies.

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. Mortise Locks: Minimum 3/4-inch latchbolt throw.
2. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: To match building standard.
2. Levers: Cast.

a. Match COTR's sample of building standard.

3. Escutcheons (Roses): Cast.
4. Dummy Trim: Match lever lock trim and escutcheons.

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. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

F. Mortise Locks: ANSI/BHMA A156.13, Security Grade 1; stamped steel case with steel or brass parts; Series 1000.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. SARGENT Manufacturing Company; ASSA ABLOY.
c. Yale Security Inc; ASSA ABLOY.

2.5 ELECTROMECHANICAL LOCKS

A. Electromechanical Locks: ANSI/BHMA A156.25, Grade 1; motor or solenoid driven; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. SARGENT Manufacturing Company; ASSA ABLOY.
c. Yale Security Inc; ASSA ABLOY.

2. Type: Mortise deadlocking latchbolt.

2.6 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
1. Provide Yale LFIC SB keyway "0" bitted. to accept the Medeco core to be used later. SI locksmith will supply the Cash room cylinder. All other Yale LFIC cylinders will need to furnish by the project with keyway SB.

B. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.7 KEYING

1. Existing System:

   a. Master key or grand master key locks to Government's existing system.
   b. Re-key Government's existing master key system into new keying system.

2. Keyed Alike: Key all cylinders to same change key.

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 Government.

2.8 KEY CONTROL SYSTEM

A. Key Lock Boxes: Designed for storage of two keys.

2.9 OPERATING TRIM

A. Operating Trim: ANSI/BHMA A156.6; stainless steel unless otherwise indicated. Match COTR’s sample of building standard.

2.10 SURFACE CLOSERS

A. Surface Closers: ANSI/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.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Allegion plc.
   b. SARGENT Manufacturing Company; ASSA ABLOY.
   c. STANLEY; dormakaba USA, Inc.

2.11 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allegion plc.
b. Hager Companies.
c. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

2.12 THRESHOLDS

A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.

2.13 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch-thick copper; with manufacturer's standard machine or self-tapping screw fasteners.

2.14 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware: ANSI/BHMA A156.35.

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 COTR.

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 ANSI/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; however, 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. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.16 FINISHES

A. Provide finishes complying with ANSI/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 in accordance with ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

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 in accordance with 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 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. Replace construction cores with permanent cores as directed by Government.
2. Furnish permanent cores to Government for installation.

E. Key Control System:
1. Key Lock Boxes: Install where indicated or approved by COTR to provide controlled access for fire and medical emergency personnel.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with COTR.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. 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.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. 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. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. 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 is to 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 Government's continued adjustment, maintenance, and removal and replacement of door hardware.

3.8 DEMONSTRATION

A. Train Government's maintenance personnel to adjust, operate, and maintain door hardware.

END OF SECTION 087100

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing systems.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for floor joists.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Framing systems.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For high-strength steel studs and tracks, post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 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 the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

B. Horizontal Deflection: For composite and non-composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 10 lbf/sq. ft. .

C. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

D. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.

E. Design framing systems in Room 0015 to accommodate a floor load of 50 psf for occasional maintenance by staff on platform above ceiling..

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated
2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.

    a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Studs and Track: AISI S220.

1. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection: 0.0296 minimum, unless 0.0329-inch or heavier is required for specific loading.
2. Depth: As indicated on Drawings.

C. High-Strength Steel Studs and Tracks: Roll-formed with surface deformations to stiffen the framing members.

1. Minimum Base-Steel Thickness: As required by horizontal deflection performance requirements.
2. Depth: As indicated on Drawings.

D. Slip-Type Head Joints: Where indicated, provide the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch minimum vertical movement.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: 0.0329 inch.

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels:

1. Minimum Base-Steel Thickness: 0.0296 inch0.0329 inch.
2. Depth: 7/8 inch 1-1/2 inches.

H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

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 the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

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 supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLATION OF FRAMING SYSTEMS

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 unless otherwise indicated.
2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.

B. Where studs are installed directly against limestone masonry walls at exterior walls, install isolation strip between studs and exterior wall. Coordinate to fasteners to mortar joints as much as possible. Notify COTR if fasteners will impact limestone surfaces.

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.

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 24 inches o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Abuse-resistant gypsum board.
4. Mold-resistant gypsum board.
5. Interior trim.
6. Aluminum trim.
7. Joint treatment materials.
8. Sound-attenuation blankets.
9. Acoustical sealant.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.3 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.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

2.3 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested in accordance with ASTM C1629/C1629M.

1. Core: 5/8 inch, Type X.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
5. Long Edges: Tapered.
6. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
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. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
3. Provide molding for 1” recess suitable for 5/8”

C. Copper Trim: Rolled sheets in profiles and dimensions indicated.
1. Refer to 05 7500 “Decorative Formed Metal”

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 drying-type, all-purpose compound.

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.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

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."

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 ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 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.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. 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 and vertical surfaces unless otherwise indicated.
3. Abuse-Resistant Type: Public side of wall at Coatroom 0015 and elevator lobby/corridor..
4. Mold-Resistant Type: Interior wall and ceiling of room 0015.
5. At Room 2087B where wall is to be infilled, match thickness of gypsum wallboard with exiting.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. 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.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 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 in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. L-Bead: Use at exposed panel edges.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3. Level 5: Public side of wall between Room 0015 and elevator lobby, and all other public museum spaces.

    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 096516 - RESILIENT SHEET 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. Vinyl sheet flooring with backing and integral base.
   2. PVC wall panels integrated into vinyl sheet flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient sheet flooring.

   1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   2. Show details of special patterns.

C. Samples for Initial Selection: For each type of resilient sheet flooring indicated.

D. Samples for Verification: For each type of resilient sheet flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of each color, texture, and pattern required.

   1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

E. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

F. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet 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. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL SHEET FLOORING WITH BACKING F3

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. Altro.
2. Armstrong Flooring, Inc.
3. Forbo Flooring Systems.

B. Product Standard: ASTM F1303.

1. Type (Binder Content): Type II, minimum binder content of 34 percent.
2. Wear-Layer Thickness: Grade 1.
3. Overall Thickness: .12".
4. Interlayer Material: None.
5. Backing Class: Class A (fibrous).

C. Wearing Surface: Embossed with embedded abrasives.

D. Sheet Width: As standard with manufacturer.

E. Seamless-Installation Method: Heat welded.

F. Colors and Patterns: Selected from manufacturer's full range.

2.2 VINYL WALL COVERING WP1

A. Basis of design includes but is not limited to:
1. Altro Puraguard

B. Description: Provide vinyl products in rolls from same production run and complying with the following:

1. FS CCC-W-408D for Type III, Heavy Duty.
2. ASTM F793/F793M for peelable strippable wall coverings.

a. Category: III, Decorative with High Serviceability.

C. Total Weight: 21 lbs, excluding coatings.

D. Width: 48 inches.

E. Repeat: Random.

F. Mildew Resistance: Rating of zero or 1 when tested in accordance with ASTM G21.

G. Features:

1. Stain-Resistant Coating

2. Impact resistant
3. Antimicrobial.
4. Phthalate free.
5. Heavy-metals free.
6. Halogenated-fire-retardant free.
7. Microvented.

H. Colors, Textures, and Patterns: As selected by COTR from manufacturer's full range.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Colors: Match flooring.

D. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: Tapered vinyl cap provided or approved by resilient sheet flooring manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.

E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet 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 resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate. Substrate should be made smooth, clean, and dry using Portland-cement based patching compound. Gypsum-based products are not suitable and silicate based admixes and spray products are not suitable.

D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet 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.

H. Adhere resilient sheet 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.

I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

J. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet 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 resilient sheet 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 flooring surfaces before applying liquid floor polish per manufacturer instructions.

1. Apply two coat(s).

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Carpet tile with attached backing.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for removing existing floor coverings.
2. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Pattern of installation.
4. Pattern type, location, and direction.
5. Type, color, and location of edge, transition, and other accessory strips.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of carpet tile.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

D. Samples for Verification: Actual sample of finished products for each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

B. Qualification Statements: For Installer.

C. Sample Warranties: For carpet tile.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Government that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 full-size units.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by carpet tile manufacturer.

1.9 CARPET TILE F2

A. Color: As selected by COTR from manufacturer's full range.

B. Pattern: As selected by COTR from manufacturer's full range.

C. Primary Backing/Backcoating: Manufacturer's standard composite materials.

D. Secondary Backing: Attached to carpet cushion

E. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.

F. Performance Characteristics:

1. Texture Appearance Retention Rating (TARR): Heavy traffic, 3.0 minimum in accordance with ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.
3. Dry Breaking Strength: Not less than 100 lbf (445 N) in accordance with ASTM D2646.
4. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
5. Colorfastness to Crocking: Not less than 4, wet and dry, in accordance with AATCC 165.

1.10 INSTALLATION ACCESSORIES

A. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

B. Vinyl Transition Strips: Vinyl finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

C.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 PREPARATION

A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

2.3 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Free lay; install carpet tiles without adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

2.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

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. Gypsum board.
2. Hollow Metal Doors and Frames
3. Mechanical and Electrical systems as identified

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.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 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. Environmental Product Declaration: For each product.
   2. Health Product Declaration: For each product.
   3. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

C. Samples for Initial Selection: For each type of topcoat product.
   1. Submit full color deck from the selected manufacturer.

D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

   1. Submit Samples on rigid backing, 8 inches square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

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 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 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 100 sq. ft..
      b. Other Items: COTR 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 COTR at no added cost to Government.

   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless COTR 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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

PART 3 - EXECUTION (Not Applicable)

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. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Do not paint any existing wood surfaces. Protect these surfaces prior to starting the work.

C. 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.

D. 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.

E. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

F. 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. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces:

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. Other items as directed by COTR.

2. 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: Government 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 COTR, 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. 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, MPI Gloss Level 3, MPI #145.

B. Wood Substrates: Wood trim and MDF.

1. Institutional Low-Odor/VOC Latex System, MPI INT 6.3V:
    a. Prime Coat: Primer, latex, for interior wood, MPI #39.
    b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    c. Topcoat: Latex, interior, institutional low odor/VOC, semigloss (MPI Gloss Level 5), MPI #147.

C. Gypsum Board 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 2, MPI #144.

END OF SECTION 099124

SECTION 11 40 00
FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes food service equipment indicated on Drawings and schedules.

B. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment items.

C. Related Sections: The following Documents and Sections contain requirements that relate to this section:

1. Refer to Division 21 Sections for connections to fire alarm systems, electrical wiring, disconnects, and other electrical materials required to complete the installation of the food service equipment.
2. Refer to Division 23 Sections for supply and exhaust fans; exhaust ductwork; service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; fire extinguishing systems; and other materials required to complete the food service equipment installation.

1.2 DEFINITIONS

A. Terminology Standard: Refer to NSF 2, "Food Equipment" or other applicable NSF standards for definitions of food service equipment and installation terms not otherwise defined in this Section or in other referenced standards.

1.3 SUBMITTALS

A. Product Data: For each type of food service equipment indicated. Include manufacturer's model number and accessories and requirements for access and maintenance clearances, water and drainage, power or fuel, and service-connections including roughing-in dimensions.

B. Drawings: In accordance with the project schedule furnish the Consultant and Owner's representative with one full size set of electronic documents in the universally compatible PDF (Portable Document Format) file format. Reproduced copies of bid documents shall not be accepted if used as part of this submittal. Hard copies may also be required by the Owner.

1. Prepare plans at 1/4"=1'-0" scale showing all items of foodservice equipment. Each item shall have a numbered tag keyed to the item specifications detailed herein.

2. Prepare separate dimensioned electrical and mechanical rough-in drawings at 1/4"=1'-0" scale showing the exact point of penetration of floors, walls, and ceilings for all services required to operate the equipment that the Contractor shall furnish. These drawings shall also show dimensioned locations of final connections to equipment. Indicate floor drains, floor sinks, receptacles, lights, and other equipment requirements.
3. Prepare separate dimensioned drawings at 1/4"=1'-0" scale showing the location and size of all bases, depressions, special height walls, location of equipment requiring structural support in the walls, openings in walls for equipment, and critical dimensions.
4. All equipment specified for fabrication shall be detailed and fully dimensioned to a minimum scale of 3/4"=1'-0" for plan and elevation views and 1-1/2"=1'-0" for sections.

C. Wiring Diagrams: Details of wiring for power, signal, and control systems and differentiating between manufacturer-installed and field-installed wiring.

D. Piping Diagrams: Details of piping systems and differentiating between manufacturer-installed and field-installed piping.

E. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for exposed products with color finishes.

F. Samples for Verification: Of each type of exposed finish required, minimum 4-inch- (100-mm-) square or 6-inch- (150-mm-) long sections of linear shapes and of same thickness and material indicated for work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

G. Product Certificates: Signed by manufacturers of refrigeration systems or their authorized agents certifying that systems furnished comply with requirements and will maintain operating temperatures indicated in the areas or equipment that they will serve.

H. Maintenance Data: Operation, maintenance, and parts data for food service equipment to include in the maintenance manuals specified in Division 1. Include a product schedule as follows:

1. Product Schedule: For each food service equipment item, include item number and description indicated in Contract Documents, manufacturer's name and model number, and authorized service agencies' addresses and telephone numbers.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing food service equipment, who has completed installations similar in design and extent to that indicated for this Project, and who has a record of successful in-service performance.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing food service equipment similar to that indicated for this Project and with a record of successful in service performance.

C. Source Limitations: Obtain each type of food service equipment through one source from a single manufacturer.

D. Product Options: Drawings indicate food service equipment based on the specific products indicated. Other manufacturers' equipment with equal size and performance characteristics may be considered. Refer to Division 01 Section 23 "Alternates."

E. Regulatory Requirements: Comply with the following National Fire Protection Association (NFPA) codes:

1. NFPA 54, "National Fuel Gas Code."
2. NFPA 70, "National Electrical Code."
3. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations”

F. Listing and Labeling: Provide electrically operated equipment or components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

G. AGA Certification: Provide gas-burning appliances certified by the American Gas Association (AGA).

H. ASME Compliance: Fabricate and label steam-generating and closed steam-heating equipment to comply with ASME Boiler and Pressure Vessel Code.

I. ASHRAE Compliance: Provide mechanical refrigeration systems complying with the American Society of Heating, Refrigerating and Air-Conditioning Engineers' ASHRAE 15, "Safety Code for Mechanical Refrigeration".

J. NSF Standards: Comply with applicable NSF International (NSF) standards and criteria and provide NSF Certification Mark on each equipment item, unless otherwise indicated.

K. ANSI Standards: Comply with applicable ANSI standards for electric-powered and gas burning appliances; for piping to compressed-gas cylinders; and for plumbing fittings, including vacuum breakers and air gaps, to prevent siphonage in water piping.

L. SMACNA Standard: Where applicable, fabricate food service equipment to comply with the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Kitchen Equipment Fabrication Guidelines," unless otherwise indicated.

M. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section 31 “Project Management” relating to project meetings. Review methods and procedures related to food service equipment including, but not limited to, the following:

1. Review access requirements for equipment delivery.
2. Review equipment storage and security requirements.
3. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
4. Review structural loading limitations.
5. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver food service equipment as factory-assembled units with protective crating and covering.

B. Store food service equipment in its original crating and protective covering. Store in a dry location.

C. Reused Equipment: Coordinate and show sizes, utilities, and other requirements as determined by inspecting equipment noted as existing to be reused. Include all costs for tagging, marking, removing, storing, cleaning, redelivering and installing such equipment. Provide, if specified, accessories necessary for the equipment to conform with the new application. All requirements within the contract documents apply to reused equipment as if contractor furnished, except warranties.

D. Owner or Vendor Supplied Equipment: Coordinate space, cutouts in, and utilities for, but do not install, unless otherwise directed Owner or Vendor supplied equipment noted on the contract documents as such.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before equipment fabrication and indicate measurements on Shop Drawings and Coordination Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish required dimensions and proceed with fabricating equipment without field

measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate equipment layout and installation with other work including light fixtures, HVAC equipment, and fire-suppression system components.

B. Coordinate location and requirements of service-utility connections.

1.8 WORK BY OTHERS

A. All rough-in plumbing, steam, electrical, and ventilation work required in connection with this equipment will be done by other contractors unless specifically called for in Itemized Specifications and detailed data.

B. Final connection from the roughing-in point to the various pieces of equipment requiring such connections, and the supplying of all necessary materials and labor for this work shall be the responsibility of the General Contractor.

C. Electrical work provided by the General Contractor:

1. Furnish and install all rough-in wiring for foodservice equipment, including convenience receptacles at walls. Unless noted as “By KEC” on food service electrical connection drawings, all electrical convenience receptacles shall be provided by the General Contractor. All receptacles shall include stainless steel face plates.
2. Furnish and install all wiring and conduit between rough-in points and connection points on equipment, making connection thereto in accordance with wiring diagrams and/or information furnished by the Kitchen Equipment Contractor.
3. Furnish and install all required disconnect switches and/or junction boxes between building utilities, rough-in points and connection points on equipment.
4. Furnish and install shunt trip breakers for equipment under fire suppression system and connect to system control panel.
5. Furnish and install all electrical wiring required between remote refrigeration system(s) and their respective evaporator coils.
6. Furnish and install all electrical wiring between foodservice equipment control panels and their respective equipment connections, such as disposals, exhaust hoods, etc.
7. Furnish and install all electrical wiring between fire suppression control systems and building alarm, notification, and control systems.

D. Plumbing work provided by the General Contractor:

1. All exposed piping and fittings shall be type "L" copper painted with 3 coats of high-grade stainless/steel paint. Non-exposed piping to be copper.
2. Furnish and install all rough-in piping for hot and cold water supply and waste line service to foodservice equipment, including slurry and return water lines for any waste pulping equipment.
3. Furnish and install all hot and cold water piping, with shut-off valve in each line and pressure reducers where required, and make final connections.
4. Furnish and install all waste piping, tailpieces, waste traps, steam traps, strainers, vents, etc., and make final connection to waste outlet on equipment as furnished by Kitchen Equipment Contractor.
5. Furnish and install steam pressure-reducing valves where necessary for proper operation of steam equipment as stated in the item specifications.
6. If code requires that walk-in panel structures have internal building sprinkler water lines and heads, all piping, drops, and heads shall be provided by the General Contractor. KEC shall be responsible for drilling all panel access holes and re-insulating and sealing holes upon completion of the installation. Locations for such holes and drops shall be field coordinated with all responsible contractors on-site (KEC, GC, PC)
7. Install gas shut-off, solenoid valve provided by K.E.C as a part of the fire suppression system.

E. Any sleeves required for refrigeration will be furnished by Kitchen Equipment Contractor. The mounting and connection of the refrigeration system between units and remote compressors will be done by the Kitchen Equipment Contractor. The General Contractor will be responsible for final electrical and plumbing connections of refrigeration systems to building services, including heat trace wiring required for evaporator coil drain lines at all walk-in freezers.

F. Plumbing, heating, and ventilating contractors are to see that all lines are flushed free of foreign matter before fixtures are connected.

G. The General Contractor shall provide all concrete bases, curbs, and recesses as detailed in the item specifications and on the Food Service Special Conditions plans.

1.9 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Refrigeration Compressor Warranty: Submit a written warranty signed by manufacturer agreeing to repair or replace compressors that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Breakage.
2. Faulty operation.

C. Warranty Period: 5 years from date of Substantial Completion for refrigeration compressors. All other equipment provided shall include a one-year warranty covering all parts and labor, plus any extended warranties available from individual manufacturers. All equipment including refrigeration systems both self-contained and remote shall be warrantied by the installer on the project for one year as indicated in the preceding sentence. The warranty begins the first day of the first year the equipment is put into operation by the Owner of the facility.

PART 2 - PRODUCTS

1.1 MATERIALS

Stainless-Steel Sheet, Strip, Plate, and Flat Bar: ASTMA666, Type304, stretcher leveled, and in finish specified in “Stainless Steel Finishes” article 2.6.

Stainless-Steel Tube: ASTMA554, GradeMT-304, and in finish specified in "Stainless-Steel Finishes" Article 2.6.

Zinc-Coated Steel Sheet: ASTMA653, G115 coating designation; commercial quality; cold rolled; stretcher leveled; and chemically treated.

Zinc-Coated Steel Shapes: ASTMA36 zinc-coated according to ASTMA123 requirements.

Plastic Laminate: Complying with NEMALD3 and NSF35 requirements; NSF certified for end-use application indicated; 0.050 inch (1.27 mm) thick for horizontal and vertical surfaces and 0.042 inch (1.07 mm) thick for post-formed surfaces; smooth texture; and easily cleanable.

Color: As selected by COTR from manufacturer's full range of colors.

Plywood and Lumber: Provide plywood and lumber as specified in Division 06 "Wood, Plastics, and Composites."

Sealant: ASTMC920; Type S, Grade NS, Class 25, Use NT. Provide elastomeric sealant NSF certified for end-use application indicated. Provide sealant that, when cured and washed, meets requirements of Food and Drug Administration's 21CFR, Section177.2600 for use in areas that come in contact with food.

Color: As selected by COTR from manufacturer's full range of colors.
Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

Tempered Glass: ASTMC1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), Class1 (clear), Qualityq3 (glazing select). Provide products complying with ANSI-Z97.1, manufactured by horizontal (roller-hearth) process, and 6 mm thick, unless otherwise indicated. Provide exposed safety edges, if any, seamed before tempering.

Plastic: Except for plastic laminate, provide plastic materials and components complying with NSF51.

Sound Dampening: NSF-certified 3 mm thick tape-type sound-deadening material by 3-M or equal for use between metal support structures and underside of metal work surfaces.

Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds.

1.2 ACCESSORIES

Cabinet Hardware: Provide NSF-certified stainless steel hardware for equipment items as indicated.

1.3 CUSTOM FABRICATION, GENERAL

Fabricate food service equipment according to NSF2 requirements. Use factory assembled components to greatest extent possible.

~~Plastic-Laminate and Wood Casework: Fabricate in accordance with Division 06 "Wood, Plastics, and Com~~

Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Provide ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.

Welded Butt Joints: Provide full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.

Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.

Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and undepressed.

Coat unexposed stainless-steel welded joints with suitable metallic-based paint to prevent corrosion.

After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint20, high-zinc-dust-content, galvanizing repair paint to comply with ASTMA780.

Fabricate field-assembled equipment prepared for field-joining methods indicated. For metal butt joints, comply with referenced SMACNA standard, unless otherwise indicated.

Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.

Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.

Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.

Provide surfaces in food zone, as defined in NSF2, free from exposed fasteners.

Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

Provide pipe slots on equipment with turned-up edges and sized to accommodate service and utility lines and mechanical connections.

Provide enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.

1.4 STAINLESS STEEL EQUIPMENT

Edges and Backsplashes: Provide equipment edges and backsplashes indicated complying with referenced SMACNA standard, unless otherwise indicated.

Sound Dampening: NSF-certified 3 mm thick tape-type sound-deadening material by 3-M or equal for use between metal support structures and underside of metal work surfaces.

Tables: Fabricate with reinforced tops, legs, and reinforced undershelves or cross bracing to comply with referenced SMACNA standard, unless otherwise indicated, and as follows:

Tops: Minimum 0.0781-inch- (1.984-mm-) (14 Gauge) thick stainless steel, unless otherwise indicated.

Legs: 1-5/8 inch (41.3 mm) OD, minimum 0.0625-inch- (1.588-mm-) (16 Gauge) thick stainless steel with stainless-steel gusset and adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.

Undershelves: Minimum 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.

Top and Undershelf Reinforcement: Provide minimum 0.0781-inch- (1.984-mm-) thick, stainless steel reinforcing, unless otherwise indicated.

Cross Bracing: 1-1/4 inch (31.75 mm) OD, minimum 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.

Sinks:. Undermount Sinks specified in Part 3-1.5D.

Wastes: 2-inch (50-mm) nickel-plated bronze, rotary-handle waste assembly with stainless-steel strainer plate and nickel-plated brass, connected overflow.
Drainboards: Minimum 0.0781-inch- (1.984-mm-) thick stainless steel, pitched to sink at 1/8 inch per 12 inches (3 mm/300 mm) of length. Reinforce drainboards with minimum 0.0781-inch- (1.984-mm-) thick stainless steel 1-1/4" angle, unless otherwise indicated.
Legs: 1-5/8 inch (41.3 mm) OD, minimum 0.0625-inch- (1.588-mm-) thick stainless steel with stainless-steel gusset welded to 0.1094-inch- (2.779-mm-) thick, stainless steel support plate. Provide adjustable insert bullet-type feet with minimum adjustment of 1 inch (25 mm) up or down without exposing threads, unless otherwise indicated.
Drainboard Braces: 1 inch (25 mm) OD, minimum 0.0625-inch- (1.588-mm-) stainless steel tube for drainboard lengths longer than 24" (600 mm), unless otherwise indicated.
Cross Bracing: 1-1/4 inch (31.75 mm) OD, minimum 0.0625-inch- (1.588-mm-) thick stainless steel, unless otherwise indicated.

Wall Shelves and Overshelves: Fabricate to comply with referenced SMACNA standard, unless otherwise indicated, and with minimum 0.0625-inch- (1.588-mm-) thick, stainless steel shelf tops.

1.5 STAINLESS-STEEL FINISHES

General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

Remove or blend tool and die marks and stretch lines into finish.
Grind and polish surfaces to produce uniform, directional textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

Concealed Surfaces: No.2B finish (bright, cold-rolled, unpolished finish)

Exposed Surfaces: No.4 finish (bright, directional polish).

When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

1.6 ELECTRICAL AND MECHANICAL REQUIREMENTS

Standard UL listed materials, devices, and components shall be selected and installed in accordance with NEMA Standards and recommendations and as required for safe and efficient use and operation of the foodservice equipment without objectionable noise, vibration, and sanitation problems.

Provide recognized commercial grade signals, "on-off" pushbuttons or switches, and other speed and temperature controls as required for operation of each item, complete with pilot lights and permanent engraved, plastic laminate signs and graphics identifying each item. Provide stainless steel cover plates at controls and signals.

Each item requiring electrical power shall be equipped with either a terminal box for permanent connection or with cord and plug for interruptible connection, as indicated. Provide NEMA standard grounding-type plugs, where used.

Furnish all foodservice equipment completely wired internally using wire and conduit suitable for wet locations, including a separate grounding wire.

Provide Hubbell three-wire or four-wire grounding-type connectors and neoprene cords installed on each item of plug-in equipment. Coordinate the work with the Contractor so that the receptacles provided match the specific plugs provided as part of the plug-in equipment. Reduce the length of all cords furnished with the specified equipment to a suitable or appropriate length and so they do not interfere with other equipment or foodservice operations.

All electrically heated equipment shall be internally wired to a thermostatic control and an "on-off" red neon light indicator, which shall be mounted in a terminal box on a removable stainless steel access panel.

Only rigid steel conduit shall be used, zinc-coated where unexposed and chrome-plated where exposed. All wiring shall be run concealed wherever possible.

Provide on or for each motor-driven appliance or electrical heating or control unit, a suitable control switch or starter of the proper type and rating and in accordance with Underwriters Code wherever such equipment is not built in. All other line switches, safety cut-outs, control panels, fuse boxes, other control fittings, and connections, when not an integral part of the unit or furnished loose by the equipment manufacturer shall be furnished and installed with electrical work unless otherwise specified. All electrical controls, switches, or devices provided loose for field installation as a part of the item specified shall be installed in the field by the Contractor unless otherwise specified.

All equipment furnished shall be so wired, wound, or constructed so as to conform with the characteristics of electrical and other services at the job site.

Appliances shall be furnished complete with motors, driving mechanism, starters, and controllers, including master switches, timers, cut-outs, reversing mechanism, and other electrical equipment if and as applicable. Wiring and connection diagrams shall be furnished with electrically operated machines and for all electrically wired fabricated equipment.

Appliances shall be of rigid construction, free from objectionable vibration. Quietness of operation of all foodservice equipment is a requirement. Remove or repair any equipment producing objectionable noise and/or vibration as directed by the Architect.

Motors shall be of the drip-proof, splash proof, or totally enclosed type, having a continuous duty cycle and ball bearings, except small timing motors which may have sleeve bearings. All motors shall have windings impregnated to resist moisture. Motors located where subject to deposits of dust, lint, or other similar matter from the machine on which installed shall be of the totally enclosed type. Motors shall have ample power to operate the machines for which designated under full load operating conditions without exceeding their nameplate ratings. Horsepower requirements on driven equipment shall be determined by the manufacturer based on normal operation at maximum capacity. The nominal rated motor horsepower shall be not less than the horsepower required for normal operation of the equipment at maximum capacity. Insulation shall be NEMA Class B, or better.

All switches, controls, etc., shall be conspicuously labeled as to use with plastic nameplates secured to the adjacent surface as previously specified in Article 2.01-C. Submit a sample for approval.

Where specified for custom fabricated equipment, provide a compartment with electrical sub-panel that shall be pre-wired in conduit concealed in cabinet body construction and connected to all electrical components built into or set upon the counter. Electrical sub-panel shall be UL listed, 3-phase, 4-wire circuit breaker type with a ground buss main breaker and individual breakers for each serviced load. All buss shall be copper and the circuit breakers shall be the molded case, bolt-on type with thermomagnetic quick-make, quick-break trip. Multi-pole circuit breakers shall have an internal trip bar. The circuit breakers shall have an interrupting capacity of 10,000 amperes at 120 volts and there shall be a separate breaker for each connected load. Each breaker shall be sized for 125% of the connected load and a minimum of two (2) extra, single pole, 20 amp circuit breakers shall be provided. The loads shall be connected through the breakers in a phased sequence to balance the load on each phase. Main connection to the panel shall be made with electrical work.

Water inlets shall be located above the positive water level wherever possible to prevent siphoning of liquids into the water supply system. Wherever conditions shall require a submerged inlet, a suitable type of check valve (except in jurisdictions where check valves are prohibited) and vacuum breaker shall be provided with the fixture to prevent siphoning. Where exposed, piping and fittings shall be chrome-plated. Where vacuum breaker piping is through equipment, provide chrome -plated escutcheon plates to cover holes.

Provide and install indirect waste lines from equipment which shall discharge into floor drains or safe wastes, chrome-plated where exposed. Extend to a point at least 1" (or as required by local or state code) above the rim of the floor drain, cut bottom on 45-degree angle and secure in position.

All horizontal-piping lines shall be run at the highest possible elevation and not less than 6" above the floor, through equipment where possible.

No exposed piping in or around fixtures or in other conspicuous places shall show tool marks or more than one thread at the fitting.

All steam operating valves on or in fabricated and purchased foodservice equipment shall be provided with composition hand wheels, which shall remain reasonably cool in service.

Provide suitable pressure-reducing valves for all equipment with such components that might reasonably be expected to be affected over a period of time by adverse pressure conditions, including but not limited to dishwashers, booster heaters, coffee urns, steam boilers, etc.

Provide and install complete refrigeration systems--charged, started, and operating properly--including, but not limited to: compressors, condensers, racks, coils, vibration eliminators, sight glasses (moisture indicating type), expansion valves, filters, oil separators, thermostats, defrost time clocks, all controls and control wiring, liquid line driers, piping, and refrigeration grade copper tubing with all sweat joints using Safety-Silv No.1200 (with as few joints as possible).

Where specifications call for pre-piped lines (i.e., from a fixture to a valve compartment, etc.), provide such work in strict conformance with other sections of the specifications which set forth standards for this type of work or in conformity with the requirements of the Board of Fire Underwriters or ASHRAE Standards, whichever is the greater.

All mechanically refrigerated cold pans shall have a normally closed liquid line electric solenoid valve installed before the expansion valve and wire to a silent-type toggle switch complete with an "on-off" red neon light indicator and both mounted in a terminal box on a removable access panel. This switch shall be fed by a separate control circuit and shall not to be wired into the compressor circuit so that it shall stop the flow of refrigerant to the cold pan and not turn off the compressor. The compressor shall then pump down and turn off through the action of the pressure control.

Each refrigeration item specification is written to provide minimum specifications and scope of work. All refrigeration equipment shall be designed and installed to maintain the following general temperatures unless otherwise specified.

Walk-in Refrigerators	+35ºF./1.7ºC.
Walk-in Freezers	-10ºF./-23.3ºC.
Reach-in Refrigerators	+35ºF./1.7ºC.
Reach-in Freezers	-10ºF./-23.3ºC.
Undercounter Refrigerators	+35ºF./1.7ºC.
Undercounter Freezers	-10ºF./-23.3ºC.
Cold Pan	+0ºF./-17.8ºC.

Provide (including payment if subcontracted) all electrical and refrigeration components needed for complete refrigeration systems and complete (or have completed by the respective trades) all connections of and to said components.

An evaporator coil defrost system shall be provided and installed by the Contractor on all walk-in refrigerator and freezer rooms where the refrigeration systems are designed to operate at room temperature of less than 35ºF.

Verify the requirements of and provide any or all additional refrigeration specialty(s) or component(s) required or recommended by the manufacturer for proper operation under the specific operating conditions and location of each system specified.

Verify and provide manufacturer's certification (or certification by manufacturer's authorized agent) that the equipment selection hereinafter specified for each refrigeration system is properly sized and shall meet the operating requirements set forth for each system regarding maintaining specified operating temperature, hours of compressor running time, and system pressures and velocities as recommended by the equipment manufacturer(s).

All refrigeration systems shall be installed and wired in strict conformance with the manufacturer's instructions and recommendations. The Contractor shall ensure that all refrigeration condensing units are ventilated properly and are accessible for repair, maintenance, and inspection.

Hang the evaporator coils per the manufacturer's recommendation at the locations as shown on the drawings. Unit shall be mounted sloping such that the drain pans are pitched to the drain lines. The coils shall be hung using nylon or other approved non-conductive, non-corrosive fasteners. Unless specified otherwise, coils shall be installed 4" from the interior walk-in ceiling. Furnish #12 gauge galvanized steel fish plates of suitable size and shape on the exterior ceiling of the walk-in to spread the weight of the coils adequately. The coils shall be connected to the condensing unit and the installation shall constitute a complete working system capable of maintaining the interior temperatures specified regardless of the heavy usage the walk-in units may receive.

Furnish and install a copper drain line from each coil outlet to a point 1" above the floor drain. Drain lines shall be trapped immediately above the floor drain. The freezer drain line shall be wrapped with a continuous electrified heater tape that shall be furnished as part of the refrigeration system contract. Drain runs inside the walk-in shall be installed in accordance with local codes and in such a manner as to not interfere with shelving and not be susceptible to mechanical damage.

Refrigeration tubing shall be the Type L, ACR hard drawn degreased, sealed copper and shall be installed with horizontal runs sloped 1" per 20 feet toward the condensing units. All refrigerant piping shall be properly supported by adjustable hangers spaced and adjusted to the drop required. Where vertical runs of more than 5' occur in the suction line, the risers shall be trapped at the bottom. Piping is to be installed so that refrigerant or oil cannot drain back into the coils from the suction line.

All suction and refrigerant lines shall be insulated with minimum 1/2" Armstrong armaflex or equal cellular type insulation. Metal pipe sleeves shall be provided where piping passes through a wall, ceiling, or floor. Space around the tubing shall be filled with mastic insulating compound. Install a permanent suction line filter in each compressor suction line with pressure fitting ahead of the filter to facilitate checking of pressure drop through the filter. All penetrations through walk-in cooler or freezer structures shall be fully insulated and sealed to be vapor tight to prevent condensation within any light fixtures, switch boxes, junction boxes, or any other fittings. Refrigeration and drain lines shall be fully sealed and provided with escutcheon plates by the installer.

Furnish and completely install a thermostat to control the refrigeration temperatures for each individual compartment. The Contractor shall interconnect the blower coils with the condensing unit.

The condensing units shall be mounted on a welded steel rack. The rack shall contain all of the accessories and components necessary to form a complete condensing unit package. Each condensing unit shall have a factory mounted, pre-wired control panel/disconnect switch complete with circuit breakers, contactors, and time clocks as required.

The Contractor shall be responsible during check out and initial operation to make sure that:

All controls are properly adjusted, including refrigeration circuits, room air temperature controls, etc.

All condensers carry an overload protector.

That a competent service mechanic is available during the first eight (8) hours of operation.

That all switches, starters, and controls are identified as to function.

The refrigeration systems shall be furnished with a one-year refrigeration service contract, covering all parts and labor, with service available seven days per week, 24-hours per day. Continuation of the service contract after the first year shall be at the option of the Owner. The refrigeration system shall be warranted for one year and the compressors shall carry the manufacturer's extended five-year warranty.

Furnish four (4) copies of complete remote refrigeration system control wiring and piping diagrams. One (1) copy shall be framed in Plexiglas and mounted at compressor location.

Unless otherwise specified, all thermometers for walk-in units shall be furnished with suitable length armored capillary tubes to allow the sensing bulb to be installed in the incoming air stream to the blower coil with all runs fastened to the walk-in walls to prevent it from damage. This identical requirement applies to alarm systems when specified.

PART 3 - EXECUTION

1.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, service-utility connections, and other conditions affecting installation and performance of food service equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine roughing-in for piping, mechanical, and electrical systems to verify actual locations of connections before installation.

1.2 INSTALLATION, GENERAL

A. Install food service equipment level and plumb, according to manufacturer's written instructions, original design, and referenced standards.

B. Complete equipment field assembly, where required, using methods indicated.

1. Provide closed butt and contact joints that do not require filler.
2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in "Fabrication, General" Article.

C. Install equipment with access and maintenance clearances according to manufacturer's written instructions and requirements of authorities having jurisdiction.

D. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

E. Except for mobile and adjustable-leg equipment, securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.

F. Install hoods to comply with NFPA96 requirements and to remain free from vibration when operating.

G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches (1200 mm) o.c. maximum.

H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

1.3 PROTECTING

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure food service equipment is without damage or deterioration at the time of Substantial Completion.

1.4 COMMISSIONING

A. Startup Services: Engage factory-authorized service representatives to perform startup services and to demonstrate and train Owner's maintenance personnel as specified below.

1. Coordinate food service equipment startup with service-utility testing, balancing, and adjustments. Do not operate steam lines before they have been cleaned and sanitized.
2. Remove protective coverings and clean and sanitize equipment, both inside and out, and re-lamp equipment with integral lighting. Where applicable, comply with manufacturer's written cleaning instructions.

3. Test each equipment item for proper operation. Repair or replace equipment that is defective in operation, including units that operate below required capacity or that operate with excessive noise or vibration.
4. Test refrigeration equipment's ability to maintain specified operating temperature under heavy-use conditions. Repair or replace equipment that does not maintain specified operating temperature.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
6. Test motors and rotating equipment for proper rotation and lubricate moving parts according to manufacturer's written instructions.
7. Test water, drain, gas, steam, oil, refrigerant, and liquid-carrying components for leaks. Repair or replace leaking components.
8. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance for each food service equipment item.
9. Review data in the operation and maintenance manuals. Refer to Division 01 Section 70 “Execution and Closeout Requirements."
10. Review data in the operation and maintenance manuals. Refer to Division1 Section "Operation and Maintenance Data."
11. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

1.5 SCHEDULE OF EQUIPMENT

A. In the case of a discrepancy between the contract drawings and specifications, the greater quantity, more stringent, or more costly alternative shall be used as the basis of cost.

B. Equipment that has received the EPA “Energy Star” rating shall be provided where possible.

C. Refer to Paragraph 1.5.D for the disposition of Owner or Vendor-supplied equipment.

D. The following specified items of equipment form the basis for design of the project. The words "or equal" are implied for the specification of each item. Equal items shall conform, to the satisfaction of the Architect, to the quality, size, functionality, and utility requirements as set forth in the Contract Documents. Design and construction costs resulting from changes to accommodate alternate equipment will be at the expense of the Contractor.
   1. Where items other than the basis of design item are provided, the contractor shall assume all costs associated with accommodating substituted equipment, including, but not limited to, the costs for modifications to installed construction work, the costs for modifications to installed utilities, the cost for any redesign of systems or structure to accommodate the substituted items, and similar costs associated with the accommodation of substituted items, except where such substitutions are approved in writing by the Owner or his designated representative. Please note that the Owner reserves the right to accept or reject proposed substitutions at his or her discretion and without the need for justification to the proposer of such substitutions.

2. Each model number includes the code *C181 as a suffix. This code is known as the Specifier Identification System (SIS Number). It is not to be removed by the bidders for any reason and for any purpose, including for the requesting of pricing quotes from manufacturers or suppliers when preparing bids. Its purpose is to identify the specifier to the vendors providing equipment in the event it is necessary to communicate questions, clarifications and comments, from prior to bid award through the final purchase. It is to be used on all correspondence including fax and e-mail when communicating with manufacturer representatives and factories. Evidence of the removal of this SIS Number by a bidder or contractor may be cause for rejection of bids or removal from the project after contract award. Where the bidder wishes to use an alternate product, the alternate must be submitted with the SIS of *C181 appended to it, as if it were so specified. For further information review the SIS system on the NAFEM (North American Association of Food Equipment Manufacturers) website at www.nafem.org. At the time of the publication of these specifications, the detailed URL for an explanation of the SIS was located at www.nafem.org/resources/sis_faq.aspx. Contact NAFEM in accordance with instructions on the same website.
3. Removal of or camouflage of the SIS number on these specifications, or any excerpt of this specification, when used in any communication with any organization in connection with the contract by the KEC may be cause for cancellation of the KEC's contract.
4. NOTE TO HEALTH DEPARTMENT EXAMINERS: The SIS identifier is a suffix to NSF nationally recognized model numbers. It will be attached to the model number by an asterisk and then the identifier code. A sample using a fictitious model number is: K4568*C181, where K4568 represents the model number and C181 represents the SIS identifier. It does not modify the approved model number.

ITEM # 1.01 SERVING COUNTER
Quantity: One (1)
Basis of Design:
Manufacturer: RPI Industries
Model: INTEGRATIONS-II-BLEND-REIS-9

Size and Shape per Plan, Elevations and Details
All Standard construction per this Section and related project drawings, full 304 stainless steel.
S/S base cabinet base framing with 4" legs, 16 ga interior shelving, 18 ga cabinet body with openings for undercounter equipment
Top and exterior finishes as selected by COTR
Refer to the Architectural specifications for materials and finishes
Coordinate fit and finish with Items as shown on plan
2" diam. grommet in top at Item 1.02 with rubber cord plug
Provide penetrations in cabinetry for utilities from floor
KEC to send equipment only as requested by RPI factory for proper coordination, fit and finish
Cut outs and fabrication per Quartz / Solid Surface Manufacturers Standards

Fully integrated Dura-Straight HD sub top encapsulated on all sides with HP-BR-Phenolic sheet, with cut outs for drop in / slide in equipment

Laser cut cabinet assembly parts to within 1000's of an inch accuracy, 16 ga stainless self-squaring top frame, all parts are formed on computerized brakes, easily adapted for Dura Straight sub top when required, 18 ga, body, mechanically fastened with vibrationless fasteners, 16 ga removable shelf with TU-2 back and sides and TU-2 front. Removable SK-32 pilasters without use of tools. SK-4-SS legs mounted to full perimeter 14 ga, galvanized sealed hi hat bottom support system assembled with vibrationless fasteners to cabinet body, adaptable for legs or casters. Durable hinge support rails with riv-nutted mounting. Built in rear stainless die wall/ utility chase with Integrated easily removable stainless access panels, held in place with # 8 ST-PS stainless fasteners.

Aprons sized to accommodate equipment controls and switches

Open area for electric evap pan for Item 1.11

Item 1.04 SCCB48R-CD-UC-SEAMLESS and Item 1.07 Ambient Visi Bond display included as built in for seamless design

LF-ladder frame stainless equipment support framing to be an integral part of counter construction where required

Pre mounted junction boxes in recessed housing as needed for equipment, switches, outlets

Open stainless lined recessed alcoves for item 1.04, 1.09 and 1.11Customer side of counter finish as specified on Architectural sheets

Stainless and Millwork surround with built in utility chase, stainless die wall and millwork radius cabinet end sections. 7-11 furniture grade plywood panel construction with exterior grade glue base, Black Matte laminate interior finish

CF-1 tambour exterior with finish as specified by COTR

Recessed CT-1 merchandising shelves with MT-2 interior sides and back

Curved millwork doors fabricated from bendable wiggle board panels and pressure bend form to shape on ends with CF-1 finish, Black Matte laminate back finish. 174H7100E hinge mounting plate with 71T9680 soft close hinges for thick doors with 6 alignment positioning, LOC 8054-25D-346a cam locks.

Fixed recessed curved shelves as shown on left end customer facing, RPI black matte laminate finish

WEG WD-1 Edge-Guard along top and bottom with bullnosed on customer side proud from face of CF-1 finished material and MT-2 recessed reveal along top

MT-2 field applied toe base during installation, no spring clamps

Counter to be Pre wired with (1) 3 phase load center, breakers, MC cable, junction boxes, switches and outlets as required to be shipped loose for hook up and installation By Electrical Contractor is based upon National Electrical cade and ETL standards and must be ETL listed and tagged.

Counter, Equipment, Electrical NOTE

Due to the sizes of the counters, they will be shipped in sections. Counter tops, sneeze guards, any equipment requested by RPI to be sent to their factory will be removed from the counters and shipped loose, electrical connections will be disconnected, MC cable will be tagged, rolled up and set in cabinet with load center. Once the counters are installed at the job location by RPI,

RPI will pull the MC cable back thru the counters to the appropriate location. RPI will then set the tops, equipment, sneeze guards and the Electrical Contractor will have to connect all internal, field electric connections and make final hook ups at "No Cost" to RPI Industries.
Counter to be fabricated by a QCP Premium Licensed AWI member for commercial and residential
Counters and tops to be Installed by RPI Factory Trained Personnel
Entire counter to be fabricated to NSF 2 requirements and include label predicated upon all finishes are sealed and cleanability per NSF requirements.
Full size template included for coordination of all trades in the field
Or Approved Comparable Product by one of the following Manufacturers: Countercraft and Low Temp Industries

ITEM # 1.02 POS REGISTER
Quantity: One (1)

NIKEC/BY OWNER
This item is not in the Kitchen Equipment Contract

ITEM # 1.03 OPEN NUMBER

ITEM # 1.04 OPEN DISPLAY MERCHANDISER
Quantity: One (1)
Basis of Design:
Manufacturer: RPI Industries
Model: SCCB48R-CD-UC=SEAMLESS Under Counter Grab n Go

Size and Shape per Plan, Elevations and Details
Continental Refrigerated Bakery Grab & Go Case, self-service, 48"W, self-contained refrigeration, rear breathing, removable stainless steel deck pans with hemmed edges to contain spills, electric condensate evaporator pan, thermometer, LED canopy light, mirror aluminum interior ends, stainless steel perforated back panel, laminate exterior, black base, includes mobile caster and self leg leveler, R134A refrigerant, 1/2 HP, cETLus, ETL-Sanitation
Unit included and to be built into Item 1.01 for seamless design
NOTE: Minimum door clearance for this unit is 36"
Rear fold down door for loading
Self-contained refrigeration, standard
Exterior Back Finish: Stainless steel with black air grill
Removable locking security panels
See Architectural details for specifics on millwork finishes at front of case.

Refer to the Architectural details and specifications for materials and finishes at Item1.01
Counter in front of Item 1.04
KEC to coordinate installation with Counter Fabricator
Or Approved Comparable Product by one of the following Manufacturers: Structural Concepts, Oscartek

ITEM # 1.05 OPEN NUMBER

ITEM # 1.06 OPEN NUMBER

ITEM # 1.07 NON-REFRIGERATED PASTRY CASE, COUNTERTOP
Quantity: One (1)
Basis of Design:
Manufacturer: RPI Industries
Model: VB-AD-4

Size and Shape per Plan, Elevations and Details
½" clear tempered low iron Star Fire glass panels, polished all edges
UV Bonded
Fixed horizontal shelf
Metal channel bottom guard for mounting
Refer also to specification for Item 1.01
KEC to coordinate installation with Counter Fabricator
Or Approved Comparable Product by one of the following Manufacturers: Structural Concepts and Turbo Air

ITEM # 1.08 OPEN NUMBER

ITEM # 1.09 WASTE RECEPTACLE, 23 GALLON
Quantity: Ten (10)
Basis of Design:
Manufacturer: Rubbermaid Commercial Products
Model: 3540

Waste Container, 23 Gallon, Slim Jim,
Color Gray
Ten (10) Model 1980602 Slim-Jim® Trolley, 23.9"L x 14.7"W x 8.4"H, accommodates 3540 & 3541 containers, 120 lb. max capacity, black , Made in USA

Or Approved Comparable Product by one of the following Manufacturers: FMP, Impact Products

ITEM # 1.09A WASTE RECEPTACLE DOLLY
Quantity: Ten (10)
Basis of Design:
Manufacturer: Rubbermaid Commercial Products
Model: 1980602

Ten (10) Model 1980602 Slim-Jim® Trolley, 23.9"L x 14.7"W x 8.4"H, accommodates 3540 & 3541 containers, 120 lb. max capacity, black , Made in USA
Or Approved Comparable Product by one of the following Manufacturers: FMP, Impact Products

ITEM # 1.10 OPEN NUMBER

ITEM # 1.11 COLD FOOD WELL, WITH REFRIGERATED BASE
Quantity: One (1)
Basis of Design:
Manufacturer: RPI Industries
Model: VIAP4-0-R-SC-RC

Size and Shape per Plan, Elevations and Details
VIAP4 air pan with refrigerated counter base with (1) drawer, accommodate (1) full size hotel pan, base with plinth, flipable stainless steel cutting board mounted on s/s slide-in panel, all stainless construction, deep well with adjustable height base decks, lift up coated coil for easy cleaning, programmable digital refrigeration control with digital temperature display, PER refrigerated base:
High-grade material quality: housing completely of grade 1.4301 chromium nickel steel. Ideal for meat and vegetables: corrosion resistant and odorless CNS fin coil evaporator with circulating air; uniform temperature and air humidity. Easy cleaning: rounded and tightly welded bottom tray.
All visible sides polished; covered refrigerant lines; fully automatic, electric defrost by means of heating rod
Floor drain required on site
Temperature adjustable from +38F to +45F
Unit to include loose electric evap pan to mounted in Item 1.01
R448a refrigerant
KEC to coordinate installation with Counter Fabricator

Or Approved Comparable Product by one of the following Manufacturers: Low Temp Industries and Delfield

ITEM # 1.07 VISI-BOND VERTICAL SHIELD
Quantity: One (1)
Basis of Design:
Manufacturer: RPI Industries
Model: VB-VS-5

Size and Shape per Plan, Elevations and Details
½" clear low iron Star Fire top glass with 3-sided tempered glass panels, polished all edges UV Bonded
Fixed horizontal shelf
Metal channel bottom guard for mounting
Refer also to specification for Item 1.01 and 1.11
KEC to coordinate installation with Counter Fabricator
Or Approved Comparable Product by one of the following Manufacturers: Structural Concepts and Turbo Air

ITEM # 1.12 BACK COUNTER
Quantity: One (1)
Basis of Design:
Manufacturer: RPI Industries
Model: INTEGRATIONS-II-BSWC-12

Size and Shape per Plan, Elevations and Details
All Standard construction per RPI's drawings and Foodservice drawings, full 304 stainless steel.
S/S base cabinet base framing with 16 ga interior interior loose pan bottom, 18 ga cabinet body with openings for undercounter equipment
Top and exterior finishes as selected by COTR
3cm Quartz top with coved back splash
6" diameter stainless RPI-6-2 trash chute
KEC to send equipment only as requested by RPI factory for proper coordination, fit and finish,
LF-ladder frame stainless equipment support framing to be an integral part of counter construction
Cut outs and fabrication per Quartz / Solid Surface Manufacturers Standards for Items 1.13, 1.14, 1.15, 1.25, 1.28
Fabricated in sections sized accordingly for access for delivery and installation
Provide penetrations in cabinetry for utilities from walls, floors, etc
Pre mounted non wired empty junction boxes in recessed housing as needed for equipment, switches, outlets in rear stainless steel support die wall at slide in equipment locations

Laser cut cabinet assembly parts to with in 1000's of an inch accuracy, 16 ga stainless self-squaring top frame, all parts are formed on computerized brakes, easily adapted for Dura Straight sub top when required, 18 ga, body, mechanically fastened with vibrationless fasteners Durable hinge support rails with riv-nutted mounting. Built in stainless rear die wall/ utility chase with Integrated easily removable stainless access panels, held in place with # 8 ST-PS stainless fasteners.
Aprons sized to accommodate equipment controls and switches
Stainless premium doors with PUL-TB-1.5-SS pull and (3) multi positional hinges placed in accordance for strength and alignment of door. Stainless doors to be DP-INS style with #4 horizontal finish, 175H7190 mounting plates with 71T5680 soft close hinge with 6 alignment positioning, LOC 8054-26D-346a cam locks
Integrated MTL-1 toe base on doors, ½" toe clearance
Adjustable stainless bottom pans in sink cabinetry to be set and sealed with NSF approved silicon sealant during installation
Counter to be fabricated by a QCP Premium Licensed AWI member for commercial and residential
Counters and tops to be Installed by RPI Factory Trained Personnel
Entire counter to be fabricated to NSF 2 requirements and include label predicated upon all finishes are sealed and cleanability per NSF requirements.
Full size template included for coordination of all trades in the field
Or Approved Comparable Product by one of the following Manufacturers: Countercraft and Low Temp Industries

ITEM # 1.13	HAND SINK, UNDERMOUNT, ADA
Quantity:	One (1)
Basis of Design:	
Manufacturer:	Advance Tabco
Model:	DI-1-5 MODIFIED to be Undermounted

Hand Sink, 13"W x 19"D overall, 10"W x 14"D front-to-back x 5" deep bowl, 20/304 stainless steel, includes: K-52 deck mounted gooseneck faucet, 3-1/2" basket drain, NSF (cutout size 12-1/4"W x 18-1/4"D)
To Be Modified to be Undermount Installed
K-316-LU Wrist Handles Only, for splash or deck mount hand sink faucet (1 pair hot & cold 4" long blades), fits faucets supplied after November 2015 with hot & cold color rings that do not have exposed screw head
K-52OMIT To Delete Faucet
K-62 Extra Heavy Duty Faucet, 4" O.C, deck mounted with 3-1/2" gooseneck spout, chrome plated quarter-turn wedge style handles with hot & cold indexes, brass chrome plated body & spout, lead free
Install in Back Counter, Item 1.12

Sink must be installed to meet ABA reach requirements
KEC to coordinate installation with Counter Fabricator
Or Approved Comparable Product by one of the following Manufacturers:John Boos, Eagle Group

ITEM # 1.14 SOAP DISPENSER
Quantity: One (1)
Basis of Design:
Manufacturer: Bobrick Washroom
Model: B-822

Install in Back Counter, Item 1.12
KEC to coordinate installation with Counter Fabricator
Installed per ABA requirements and within parallel approach ABA range
Or Approved Comparable Product by one of the following Manufacturers: Advance Tabco, Eagle Group

ITEM # 1.15 PAPER TOWEL DISPENSER
Quantity: One (1)
Basis of Design:
Manufacturer: Bobrick Washroom
Model: B-526

Install in Back Counter, Item 1.12
KEC to coordinate installation with Counter Fabricator
Installed per ABA requirements and within parallel approach ABA range
KEC to verify paper towel size with Owner
Or Approved Comparable Product by one of the following Manufacturers: Advance Tabco, Rubbermaid

ITEM # 1.16 OPEN NUMBER

ITEM # 1.17 OPEN NUMBER

ITEM # 1.18 SOUP KETTLE, COUNTERTOP
Quantity: One (1)
Basis of Design:
Manufacturer: Vollrath
Model: 72170

Cayenne® Colonial Kettle™, 7 quart, Warmer, black merchandiser package, with 7 quart, inset, cover with hinge, soup cards, soup'r clip, 15-3/4" diameter, 11-1/2"H, cast aluminum body, recessed controls, unbreakable legs, 700w, 5.8amps, 120v/60hz/1-ph, ETL, UL, NSF, Made in USA (Refer to vollrathfoodservice.com for full warranty policy)
47488 Kool-Touch Hinged Cover, stainless with black phenolic knob, fits 46063 & 46075, Marmites/Insets, 77070 Double Boiler, & 78184 Inset, imported (Refer to vollrathfoodservice.com for full warranty policy)
Or Approved Comparable Product by one of the following Manufacturers: Winco, Omcan

ITEM # 1.19 FOOD WARMER, COUNTERTOP
Quantity: One (1)
Basis of Design:
Manufacturer: Vollrath
Model: 72430

Cayenne® Model SS-4 Food Warmer, round, countertop, 8-3/4" dia. x 7-7/8"H, 6" deep well, 4-1/8 quart (No. 10 Can), front dial thermostatic control, aluminum well, stainless steel exterior, non-skid feet, includes: 4 quart insert & hinged cover, 120v/60/1-ph, 350 watts, 3 amp, cord with NEMA 5-15P, cULus, NSF
47486 Kool-Touch® Hinged Inset Cover, 18-8 stainless, mirror finish with black phenolic knob, fits the 78164 4-1/8 quart, inset, imported
Or Approved Comparable Product by one of the following Manufacturers: Nemco, Eagle Group

ITEM # 1.20 RAPID COOK OVEN
Quantity: One (1)
Basis of Design:
Manufacturer: TurboChef
Model: SOTA-TOUCH CONTROL

i1-9500-801 Sota™ Convection/Microwave Oven, Rapid Cook, electric, 16" wide, High lever user interface touch controls with wifi, ventless, countertop, insulated cook chamber, stores up to 256 recipes, internal catalytic converter, LED timer, pull down door with ergonomic handle, multi-speed convection blower, removable rack and bottom jetplate, smart voltage sensor technology (US only), includes (2) solid aluminum pan, (1) oven cleaner, (1) oven guard, (1) aluminum paddle, (2) trigger sprayers, (1) standard rack, stainless steel interior, powder coated, corrosion-resistant steel outer wrap and door, 4" legs, cULus, CE, UL EPH Classified, ANSI/NSF 4, TUV
MDD-1001 Open Kitchen bundle, includes - 1 x ConnectWare module, 1 x Secure Access Point (SAP), 3 year subscription for Open Kitchen
Or Approved Comparable Product by one of the following Manufacturers: Merrychef, ACP

ITEM # 1.21 OPEN NUMBER

ITEM # 1.22 OPEN NUMBER

ITEM # 1.23 REFRIGERATOR, UNDERCOUNTER
Quantity: Three (3)
Basis of Design:
Manufacturer: Traulsen
Model: CLUC-48R-SD-LR

Centerline™ Compact Undercounter Refrigerator, Reach-in, two-section, 48" W, 13.28 cu. ft. capacity, self-contained rear-mount refrigeration, (1) left hinged/ (1) right hinged solid doors (field reversible), electronic control with LED display, (2) epoxy coated shelves per section, stainless steel exterior, anodized aluminum interior, (4) casters, R450A refrigerant, cETLus, ETL-Sanitation, ENERGY STAR®
Three (3) CLUCACC-42CASTER 2-3/4" Stem Caster, set of 4
Or Approved Comparable Product by one of the following Manufacturers: Delfield, Traulsen

ITEM # 1.24 ESPRESSO MACHINE, AUTOMATED
Quantity: One (1)
Basis of Design:
Manufacturer: Eversys Inc.
Model: ENIGMA E'4M- EARTH

Enigma E'4M Automated Espresso Coffee Machine, 2 group, super automatic, up to 350 espresso per hour production capacity, (2) 10" touch screen controls, electronic e'Foam Micro Air Dosing (MAD) system, electronic milk texturing system, includes: (2) Everfoam steam arms, (2) ceramic burr grinders, (2) 3.3 lb coffee bean hoppers, (1) 1.5 lb grounds drawer, (1) hot water spout, (1) 5.4 liter steam boiler, (2) 1.5 liter coffee boilers, earth
This equipment requires a water filter. Awaiting owner direction on Conventional or RO System
Or Approved Comparable Product by one of the following Manufacturers: Schaerer, Nuova Simonelli

ITEM # 1.25 COUNTERTOP RINSER
Quantity: One (1)
Basis of Design:
Manufacturer: Espresso Parts / Ascaso USA

Model: EPPRCT6102

Barista Basics Countertop Rinser, 10.1"W x 7"D x 7"H, countertop rinser, outside dimensions of pan 10, ¼" x 6, 3/8" x 2, 1/2" (260 x 162 x 62mm), outside dimensions of counter flange 10, ¾" x 6, 4" (273 x 171mm), made of stainless steel, cold water connector 3/8", john guest type press fitting, drain connector 1/2" barb fitting, NSF
Or Approved Comparable Product by one of the following Manufacturers: Perlick, Glastender

ITEM # 1.26 ICE MAKER
Quantity: One (1)
Basis of Design:
Manufacturer: Ice-O-Matic
Model: UCG100A

Ice Maker, gourmet cube-style, undercounter, air-cooled, self-contained condenser, approximately 114 lb/54 kg production/24 hours, 48-1/2 lb. capacity built-in bin, stainless steel and fingerprint-proof plastic construction, adjustable legs, R290A Hydrocarbon refrigerant, 115v/60/1-ph, cord, cETLus, ETL-Sanitation
IFI4C In-line Water Filter Cartridge, single, designed for use with ice makers, with IsoNet® scale inhibitor, 1/4" compression, for max. cube capacity 600 lb/day, 1.0 gpm, 10 micron
1011411-87 Shorter leg set, True Undercounter Leg, for UCG100, UCG130 & UCG130GA
This equipment requires a water filter. Awaiting owner direction on Conventional or RO System
Or Approved Comparable Product by one of the following Manufacturers: Manitowoc, Hoshizaki

ITEM # 1.27 OPEN NUMBER

ITEM # 1.28 WORK SINK, UNDERMOUNT
Quantity: One (1)
Basis of Design:
Manufacturer: Advance Tabci
Model: DI-1-168 MODIFIED to be Undermounted

Work Sink, 1-compartment, 16"W x 14"D front-to-back, 8" deep bowl, Deep Drawn™ sink bowl, 18 gauge 304 stainless steel, includes: deck mounted gooseneck faucet (K-52), & basket drain, NSF
To Be Modified to be Undermount Installed
K-50OMIT To Delete Faucet

K-62 Extra Heavy Duty Faucet, 4" O.C, deck mounted with 3-1/2" gooseneck spout, chrome plated quarter-turn wedge style handles with hot & cold indexes, brass chrome plated body & spout, lead free
K-15 Lever Waste Drain, twist handle operated with built in overflow, fits 3-1/2" drain opening, 2" NPT & 1-1/2" IPS outlet connections
K-4 Support Bracket, for lever waste drain handle, (1) support required for each lever drain
K-316-LU Wrist Handles Only, for splash or deck mount hand sink faucet (1 pair hot & cold 4" long blades), fits faucets supplied after November 2015 with hot & cold color rings that do not have exposed screw head
Install in Back Counter, Item 1.12
KEC to coordinate installation with Counter Fabricator
Or Approved Comparable Product by one of the following Manufacturers:John Boos, Eagle Group

ITEM # 1.29 HOT WATER DISPENSER
Quantity: One (1)
Basis of Design:
Manufacturer: Curtis
Model: WB5NB

Hot Water Dispenser, electric with aerator, 5 gallons capacity, 4-1/2 to 15 gallons per hour, 5 gallon tank volume, 18-5/8"H faucet, automatic refill, large LED display, 140“-210“F temperature range, includes: cord and plug, black, 120/220v/50/60/1-ph, 1500/5000 watts, 12.5/22.7 amps, 1 GPM, (2) 3W+G, 20-90 psi, 1/4" flare fitting
CSC5AC00 Water Filtration System, 5" filter, 4,000 gallon rated life, 35°-100°F temperature range, HydroBlend™ technology, chlorine/sediment/taste/odor removal, scale prevention, quick disconnect filter head, 10 micron, 0.8 GPM, 35-125 psi, 3/8" FNPT
This equipment requires a water filter. Awaiting owner direction on Conventional or RO System
Or Approved Comparable Product by one of the following Manufacturers: BUNN, Fetco

ITEM # 1.30 RICE COOKER
Quantity: Two (2)
Basis of Design:
Manufacturer: Town Equipment
Model: 57137

RiceMaster® Rice Cooker/Steamer, electronic, 37 cup uncooked capacity, one touch, auto cook/hold, cooks in 43 minutes, 120v/60/1-ph, 18 amps, 2160 watts, NEMA 5-15P, ETL, NSF
Or Approved Comparable Product by one of the following Manufacturers: Admiral Craft, Panasonic

ITEM # 1.31 OPEN NUMBER

ITEM # 1.32 OPEN NUMBER

ITEM # 1.33 OPEN NUMBER

ITEM # 1.34 HAND SINK, ABAuantity: One (1)
Basis of Design:
Manufacturer: Advance Tabco
Model: 7-PS-46

ABA Compliant Hand Sink, tapered bowl design, wall mounted, 14" wide x 16" front-to-back x 5" deep bowl, 18 gauge 304 stainless steel, heavy duty splash mount faucet with wrist handles, deck mounted soap dispenser (pump), undermounted front-loading paper towel dispenser, stainless steel skirt with removable access panel & enclosed bottom, drain with crumb basket, wall brackets, NSF, cCSAus
Installed per ABA requirements

Or Approved Comparable Product by one of the following Manufacturers: Eagle Group, John Boos

ITEM # 1.35 MOP SINK FAUCET
Quantity: One (1)
Basis of Design:
Manufacturer: Advance Tabco
Model: K-240

Service Sink Faucet, wall mount, heavy duty, 8" OC, 6-1/2" spout, with hose thread and pail hook, vacuum breaker spout, wall braced, chrome-plated brass
Or Approved Comparable Product by one of the following Manufacturers: Eagle Group, T&S Brass

ITEM # 1.36 MOP SINK CABINET
Quantity: One (1)
Basis of Design:
Manufacturer: John Boos
Model: PBJC-222584-X

Janitor Cabinet, 25"W x 22-1/2"D x 84"H overall size, enclosed cabinet with open back for plumbing, (2) lockable louvered swing doors, includes: 20" x 16" x 12" deep mop sink with drain, overhead shelf, rear-mounted mop holder with (2) locking cams, service faucet with vacuum breaker and 120" hose, 18/300 stainless steel, NSF (Available in Effingham and Nevada)
Or Approved Comparable Product by one of the following Manufacturers: Eagle Group, John Boos

ITEM # 1.37 OPEN NUMBER

ITEM # 1.38 REFRIGERATOR
Quantity: Four (4)
Basis of Design:
Manufacturer: True Mfg. - General Foodservice
Model: TUC-24-HC~SPEC3

SPEC SERIES® Undercounter Refrigerator, 33 - 38°F, SPEC Package 3 includes: (1) heavy stainless steel door, steel handle, door lock standard, (2) gray PVC coated adjustable wire shelves, electronic temperature control with digital temperature display, stainless steel sides and back, stainless steel interior, front breathing, R290 Hydrocarbon refrigerant, 1/6 HP, 115v/60/1-ph, 2.0 amps, NEMA 5-15P, cULus, UL EPH Classified, CE, Made in USA
Four (4) Self-contained refrigeration standard
Four (4) Standard stainless steel top
Two (2) Left Hand Hinged, Unit comes with field reversible hinges and is built with hinging on right side of unit, KEC to modify when installing
Two (2) Right Hand Hinged, Standard: Unit comes with field reversible hinges and is built with hinging on right side of unit.
Or Approved Comparable Product by one of the following Manufacturers: Delfield, Traulsen

ITEM # 1.39 OPEN NUMBER

ITEM # 1.40 OPEN NUMBER

ITEM # 1.41 OPEN NUMBER

ITEM # 1.42 SHELVING, UNIT

Quantity: Two (2) Units
Basis of Design:
Manufacturer: Metro
Model: MetroMax Q

Each unit to consist of five (5) tiers of shelves, four posts and four swivel casters with brakes
Ten (10) Model MQ2148G Quick Ship - MetroMax® Q Shelf, 48"W x 21"D, removable open grid polymer shelf mats on an epoxy coated steel frame with quick adjust corner releases, (4) wedge connectors, Microban® antimicrobial product protection, 800 lb. capacity per shelf, NSF
Eight (8) Model MQ74UPE Quick Ship - MetroMax® Q Post, 73-3/16"H, for use with stem casters, epoxy coated steel with built in Microban® antimicrobial product protection, taupe
Eight (8) Model 5PCBX Quick Ship - Polymer Stem Caster, brake, 5" dia., 1-1/4"W face, -20° F to 120°F temperature range, polyurethane wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts and shelves)
Mount first shelf at 10” above finished floor with remaining shelves spaced equally apart
KEC to verify shelving size requirements with jobsite conditions
Or Approved Comparable Product by one of the following Manufacturers: Cambro, John Boos

ITEM # 1.43 WORKTABLE
Quantity: One (1)
Basis of Design:
Manufacturer: Advance Tabco
Model: TKSS-309

Work Table, 108"W x 30"D, 14 gauge 304 stainless steel top with 5"H backsplash, stainless steel legs with side and rear crossrails, adjustable stainless steel bullet feet, NSF
TA-61 Modify Length of Table: 9’9” long
TA-61 Modify width of Table: 2’4” wide
Two (2) TA-31 Side Splash, 5" high, provide both a left and right side splash
Or Approved Comparable Product by one of the following Manufacturers: Eagle Group, John Boos

ITEM # 1.44 WALL SHELF
Quantity: Two (2)
Basis of Design:
Manufacturer: Advance Tabco
Model: WS-18-108

Shelf, wall-mounted, 108"W x 18"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 18/430 satin finish stainless steel, NSF (units 84" & longer have (3) support brackets)

Or Approved Comparable Product by one of the following Manufacturers: Eagle Group, John Boos

ITEM # 1.45 THREE COMPARTMENT SINK
Quantity: One (1)
Basis of Design:
Manufacturer: Advance Tabco
Model: FC-3-1515-15RL (MODIFIED)

Fabricated Sink, 3-compartment, 1'-10" left and 2'-7" right drainboard, bowl size 14" x 15" x 14" deep, 16 gauge 304 stainless steel, tile edge splash, rolled edge, 8" OC faucet holes, stainless steel legs with adjustable side cross-bracing, 1" adjustable stainless steel bullet feet, overall 21" F/B x 75" L/R, NSF
Three (3) K-15 Lever Waste Drain, twist handle operated with built in overflow, fits 3-1/2" drain opening, 2" NPT and 1-1/2" IPS outlet connections
Three (3) K-4 Support Bracket, for lever waste drain handle, (1) support required for each lever drain
K-472 Faucet hole revision
Two (2) K-454 Side splash, integral (welded), for NSF sinks and dish tables, height matches backsplash height, provide both left and right side splash
Two (2) K-450 Extend drainboard length
K-510 Prepare sink for undercounter dishwasher.
KEC to verify field measurements prior to order and fabrication
Or Approved Comparable Product by one of the following Manufacturers: Eagle Group, John Boos

ITEM # 1.46 DISHWASHER, UNDERCOUNTER
Quantity: One (1)
Basis of Design:
Manufacturer: Hobart
Model: LXER-2

Advansys™ Dishwasher, undercounter, accommodates optional two-level racking accessory, 23-15/16"W x 26-13/16"D x 32-1/2"H, high temperature sanitizing, Energy Recovery, 30, 24, 13 Racks/Hour, Fresh Water Rinse, .62 gal/rack, Automated Delime Cycle, 3 selectable cycles - light, normal, heavy (Pot and Pan cycle on heavy cycle), Advanced Service Diagnostics, , Detergent, Rinse Aid and Delimer Pump, cULus, ENERGY STAR®, Free factory startup for installations within a 100 mile radius of a Hobart service office; installation beyond 100 miles will be charged at the quoted rate by the local Hobart service office
Or Approved Comparable Product by one of the following Manufacturers: Electrolux, Champion

ITEM # 1.47 PRE-RINSE FAUCET WITH ADD ON FAUCET
Quantity: One (1)
Basis of Design:
Manufacturer: T & S Brass
Model: 5PR-8W08

Pre-Rinse Unit, 8" centers, wall mount base, 6" wall bracket, 8" add-on faucet, quarter-turn Cerama cartridges, low lead
Or Approved Comparable Product by one of the following Manufacturers: Advance Tabco, Eagle Group

ITEM # 1.48 SWING FAUCET, 12"
Quantity: One (1)
Basis of Design:
Manufacturer: T & S Brass
Model: B-0290-04

Big-Flo Mixing Faucet, wall mount, 8" adjustable centers, 12" swing nozzle with plain end outlet, 4" wrist handles with color coded indexes, low-lead, 3/4" female NPT, ANSI, NSF, ADA Compliant
Or Approved Comparable Product by one of the following Manufacturers: Advance Tabco, Eagle Group

ITEM # 1.49 SHELVING, WALL MOUNTED
Quantity: Three (3)
Basis of Design:
Manufacturer: Advance Tabco
Model: WS-15-60

Model WS-15-60 Shelf, wall-mounted, 60"W x 15"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 18/430 satin finish stainless steel, NSF
Or Approved Comparable Product by one of the following Manufacturers: Eagle Group, John Boos

ITEM # 1.50 CORNER GUARD, STAINLESS STEEL
Quantity: One (1)
Basis of Design:
Manufacturer: Advance Tabco
Model: CUSTOM CORNER GUARD

Fabricated per Detail CG.1
14 Gauge Stainless Steel, all edges to be fully welded, ground smooth and polished.
Verify radius of outside corner to be protected, and brake in 1/2" hug-tite edge for snug fit.
Verify finished thickness of wall and add 1/8" for clearance.
Or Approved Comparable Product by one of the following Manufacturers: Eagle Group, John Boos

ITEM # 2.01 REFRIGERATOR, REACH-IN
Quantity: One (1)
Basis of Design:
Manufacturer: Traulsen
Model: RHT232NUT-FHS

Spec-Line Refrigerator, Reach-in, two-section, 46.0 cu. ft., self-contained refrigeration, StayClear™ Condenser, stainless steel exterior and interior, standard depth, narrow full-height door or doors with Santoprene® EZ-Clean Gaskets, (3) adjustable wire shelves per section, microprocessor controls, 6" adjustable stainless steel legs, 5/8 HP, cULus, NSF
Standard refrigerant, standard
Full height solid door, standard
Left door hinged left/right hinged right, standard
Or Approved Comparable Product by one of the following Manufacturers: True Mfg. – General Foodservice, Delfield

ITEM # 2.02 REFRIGERATOR, REACH-IN
Quantity: One (1)
Basis of Design:
Manufacturer: Traulsen
Model: RHT232NUT-FHS

Spec-Line Refrigerator, Reach-in, two-section, 46.0 cu. ft., self-contained refrigeration, StayClear™ Condenser, stainless steel exterior and interior, standard depth, narrow full-height door or doors with Santoprene® EZ-Clean Gaskets, (3) adjustable wire shelves per section, microprocessor controls, 6" adjustable stainless steel legs, 5/8 HP, cULus, NSF
Standard refrigerant, standard
Full height solid door, standard
Left door hinged left/right hinged right, standard
Or Approved Comparable Product by one of the following Manufacturers: True Mfg. – General Foodservice, Delfield

ITEM # 2.03 OPEN NUMBER

ITEM # 2.04 WORKTABLE
Quantity: One (1)
Basis of Design:
Manufacturer: Advance Tabco
Model: KSS-365

Work Table, 60"W x 36"D, 14 gauge 304 stainless steel top with 5"H backsplash, 18 gauge stainless steel adjustable undershelf, stainless steel legs with stainless steel bullet feet, NSF
TA-255 Casters, expanding adapter, for 1-5/8" dia. O.D. tube/table legs, 400 lb capacity per caster, set of (4) (2 with brakes)
US-36-60 Work Table Undershelf, for work tables 60"W x 36"D, 18 gauge stainless steel, NSF
Or Approved Comparable Product by one of the following Manufacturers: Eagle Group, John Boos

ITEM # 2.05 FREEZER, REACH-IN
Quantity: One (1)
Basis of Design:
Manufacturer: Traulsen
Model: RLT132DUT-FHS

Spec-Line Freezer, Reach-in, 24" wide, 17.7 cu. ft., self-contained refrigeration, stainless steel exterior and interior, standard depth, full-height doors, (3) adjustable wire shelves per section, microprocessor controls, unit can be programmed to operate at -10° F, 1/2 HP, cULus, NSF
6-year parts and labor and 7 year compressor, standard. Visit www.traulsen.com for details
Door hinged per Plan
Or Approved Comparable Product by one of the following Manufacturers: True Mfg. – General Foodservice, Delfield

ITEM # 2.06 INDUCTION DOUBLE BURNER
Quantity: One (1)
Basis of Design:
Manufacturer: Vollrath
Model: 69722S-2-S

Signature Server® Custom Downdraft Vent System: Includes Base and 22" tall Tempered Curved Breathguard with Integrated ANSUL R-102 Fire Suppression System, Downdraft Recirculating Vent with (2) Grease and (2) Carbon/Particulate Filters. Includes qty. 2 - 59501DV Mirage Drop-In Ranges. Includes stainless kickplates (front, left and right sides), 5" casters with

adjustable legs). UL certified to UL710B, UL197, UL-Sanitation. NSF certified to NSF4. Meets the requirements of EPA Method 202 from Section 59 of UL710B and NFPA96. Emissions < 5.00 mg/m3 using 30% fat ground beef. Made-to-Order in the USA.
Stainless Base (all exterior sides)
Stainless steel, 18/300 series
Owners choice: Plate rest or cutting board or neither on operator side
No tray slide or plate rest on customer side
Or Approved Comparable Product by one of the following Manufacturers: Spring, Lakeside

ITEM # 2.07 LOW TEMPERATURE HOT HOLDING CABINETS
Quantity: One (1)
Basis of Design:
Manufacturer: Alto-Shaam
Model: 1000-UP

Halo Heat® Heated Holding Cabinet, mobile, double-compartment, on/off simple control with adjustable thermostats, insulated, capacity for (8) 18" x 26" x 1" sheet pans in each compartment, heavy-duty stainless steel exterior and interior, 5" heavy-duty casters (2 rigid and 2 swivel with brake), EcoSmart®, cULus, UL EPH ANSI/NSF 4, CE, IPX3, TUV NORD
Reach-in design, standard
Solid door, hinged on right, standard
Or Approved Comparable Product by one of the following Manufacturers: Metro, Cres Cor

ITEM # 2.08 TWO COMPARTMENT SINK
Quantity: One (1)
Basis of Design:
Manufacturer: Advance Tabco
Model: FS-2-1824-18RL

Fabricated Sink, 2-compartment, 18" right and left drainboards, bowl size 18" x 24" x 14" deep, 14 gauge 304 stainless steel, tile edge splash, rolled edge, 8" OC faucet holes, stainless steel legs with adjustable side cross-bracing, 1" adjustable stainless steel bullet feet, overall 29-1/2" F/B x 72" L/R, NSF
Two (2) K-4 Support Bracket, for lever waste drain handle, (1) support required for each lever drain
Two (2) K-15 Lever Waste Drain, twist handle operated with built in overflow, fits 3-1/2" drain opening, 2" NPT and 1-1/2" IPS outlet connections
Or Approved Comparable Product by one of the following Manufacturers: Eagle Group, John Boos

ITEM # 2.08A POT SINK FAUCET
Quantity: One (1)
Basis of Design:
Manufacturer: T & S Brass
Model: B-0290-04

Big-Flo Mixing Faucet, wall mount, 8" adjustable centers, 12" swing nozzle with plain end outlet, 4" wrist handles with color coded indexes, low-lead, 3/4" female NPT, ANSI, NSF, ADA Compliant
Or Approved Comparable Product by one of the following Manufacturers: Advance Tabco, John Boos

ITEM # 2.09 RAPID COOK OVEN
Quantity: One (1)
Basis of Design:
Manufacturer: TurboChef
Model: SOTA-TOUCH CONTROL

i1-9500-801 Sota™ Convection/Microwave Oven, Rapid Cook, electric, 16" wide, High lever user interface touch controls with wifi, ventless, countertop, insulated cook chamber, stores up to 256 recipes, internal catalytic converter, LED timer, pull down door with ergonomic handle, multi-speed convection blower, removable rack and bottom jetplate, smart voltage sensor technology (US only), includes (2) solid aluminum pan, (1) oven cleaner, (1) oven guard, (1) aluminum paddle, (2) trigger sprayers, (1) standard rack, stainless steel interior, powder coated, corrosion-resistant steel outer wrap and door, 4" legs, cULus, CE, UL EPH Classified, ANSI/NSF 4, TUV
MDD-1001 Open Kitchen bundle, includes - 1 x ConnectWare module, 1 x Secure Access Point (SAP), 3 year subscription for Open Kitchen
Or Approved Comparable Product by one of the following Manufacturers: Merrychef, ACP

ITEM # 2.10 UTILITY CART
Quantity: Two (2)
Basis of Design:
Manufacturer: Lakeside Manufacturing
Model: 222

Utility Cart, 3-shelf with 30"W x 20"D x 35-3/4"H, shelf size 27"W x 18"D, stainless steel tubular U-frame, 20 gauge stainless steel shelves with reinforced edges, 500 lb. capacity, 9-1/2" shelf clearance, push handle on each short side, 4" swivel casters, NSF (ships fully assembled), Made in USA
Two (2) Sets Casters, Lake-Glide, 4" (2 brake)

Or Approved Comparable Product by one of the following Manufacturers: Cambro, Metro

ITEM # 3.01 REVERSE OSMOSIS SYSTEM
Quantity: One (1)
Basis of Design:
Manufacturer: Everpure
Model: BWS350/50 HF

Reverse Osmosis System, (2) CTO-Q activated-carbon cartridge prefilter, (1) AMS-QT membrane cartridge, (1) MA-Q15 proprietary mineral postfilter, (1) 50 gallon atmospheric storage tank, digital TDS meter, full system bypass valve, 1 HP floor-mounted repressurization pump, 350 gpd, 3/8" inlet, 3/8" outlet
RO SYSTEM INSTALL - LEVEL II Installation of Level II RO Models - EZ-RO 375-650 ATM & ATM-BL, plate mount MRS (ROmate tank, tank kit and EBV), OP175-350, BWS350, BWS350/HF. Includes pre/post filter install when applicable (EVNTW0083)
SITESURVEY Site survey for point-of-use RO or filtration system - Provide rough-in and pre-installation guidance - execute water test if needed (test kit sold separately)
Or Approved Comparable Product by one of the following Manufacturers: 3M Purification, APEC

ITEM # 3.02 WATER FILTRATION SYSTEM
Quantity: One (1)
Basis of Design:
Manufacturer: Everpure
Model: EV932401

Insurice® Water Filtration System, Insurice® Single-i2000², Single, (1) i2000² Micro-Pure® II Precoat primary filtration cartridge, reduces chlorine, taste & odor, inhibits scale, outlet pressure gauge, flushing valve, 9,000 gallons, 1.67 gpm, 0.5 micron, 3/8" inlet, 3/8" outlet, NSF 42 & 53
Or Approved Comparable Product by one of the following Manufacturers: 3M Purification, APEC

SECTION 12 3661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.
2. Quartz agglomerate backsplashes.
3. Quartz agglomerate end splashes.

B. Related Requirements:

1. Section 06 4023 “Interior Architectural Woodwork” for casework supports at M3 and M4

2. Section 11 4000 “Food Service Equipment” for stainless steel cabinet supports at 1.01 and 1.12 and food service requirements for sealant.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. One full-size quartz agglomerate countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of polymers, resins, and pigment and complying with ISFA 3-01.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cambria.
b. Corian.
c. Wilsonart LLC.

2. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Solid Wood Edges and Trim: Clear walnut lumber, free of defects, selected for compatible grain and color, and kiln dried to 7 percent moisture content. Match WD-1.

C. No Particleboard.

D. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Countertops: 3cm thick, quartz agglomerate.

C. Backsplashes: 3 cm thick, quartz agglomerate.

D. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

E. Joints:
1. Fabricate countertops in sections for joining in field, with joints at locations indicated.

a. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
b. Joint Type, Bonded: 1/32 inch or less in width.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
4. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants" and Section 11 4000 “Food Service Equipment” for food service sealant requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
   1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.19

SECTION 210529 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Fastener systems.
5. Equipment supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. NFPA Compliance: Comply with NFPA 13.

D. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon or stainless steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural carbon steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon steel channel with inturned lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.

2.6 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural carbon steel shapes.

2.7 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M carbon steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099123 "Interior Painting."

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use carbon steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

E. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon steel plate, and with U-bolt to retain pipe.
9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

G. Hanger-Rod Attachments: Comply with NFPA requirements.

H. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

I. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

J. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

K. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 210529

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinklers.
4. Alarm devices.
5. Pressure gauges.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, or BIM model, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.

B. Qualification Data: For qualified Installer and professional engineer.

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.

C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Sprinkler system design shall be approved by authorities having jurisdiction.

a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
b. Sprinkler Occupancy Hazard Classifications:

1) Ordinary Hazard, Group 2.

2. Minimum Density for Automatic-Sprinkler Piping Design:

a. Ordinary Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.

3. Maximum Protection Area per Sprinkler:

a. Ordinary Hazard, Group 2 Occupancy: 130 sq. ft.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black-Steel Pipe: ASTM A53/A53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M.

C. Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

D. Uncoated-Steel Couplings: ASTM A865/A865M, threaded.

E. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Cast-Iron Flanges: ASME 16.1, Class 125.

G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick.

a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

H. Grooved-Joint, Steel-Pipe Appurtenances:

1. Pressure Rating: 175-psig minimum.
2. Uncoated Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Standard: UL 193.
2. Design: For horizontal or vertical installation.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber, and fill-line attachment with strainer.
4. Drip cup assembly pipe drain without valves and separate from main drain piping.
5. 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.

G. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175-psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

2.4 AIR VENT

A. Manual Air Vent/Valve:

1. Description: Ball valve that requires human intervention to vent air.
2. Body: Forged brass.
3. Ends: Threaded.
4. Minimize Size: 1/2 inch.
5. Minimum Water Working Pressure Rating: 300 psig.

2.5 SPRINKLER PIPING SPECIALTIES

A. Flow Detection and Test Assemblies:

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.

3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded or grooved.

B. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

2.6 SPRINKLERS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes: Rough brass or bronze.

E. Sprinkler Guards:

1. Standard: UL 199.
2. Type: Wire cage with fastening device for attaching to sprinkler.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 PRESSURE GAUGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch diameter.

C. Pressure Gauge Range: 0- to 250-psig minimum.

D. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

E. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

F. Install sprinkler piping with drains for complete system drainage.

G. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

H. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

I. Install alarm devices in piping systems.

J. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

K. Install pressure gauges at each zone control assembly and at each sprinkler test connection. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal and install where they are not subject to freezing.

L. Fill sprinkler system piping with water.

M. Install sleeves for piping penetrations of walls, ceilings, and floors.

N. Install sleeve seals for piping penetrations of concrete walls and slabs.

O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

D. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

E. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

G. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

H. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply. Install permanent identification signs indicating portion of system controlled by each valve.

C. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.

D. Air Vent:

1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.
3. Pipe from outlet of air vent to drain.

3.5 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections**:**

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.9 PIPING SCHEDULE

A. Standard-pressure, wet-pipe sprinkler system, NPS 3 and smaller, shall be standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded jointed.

B. Standard-pressure, wet-pipe sprinkler system, NPS 4, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.10 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Concealed pendent sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Upright Sprinklers: Rough bronze in unfinished spaces not exposed to view.

END OF SECTION 211313

SECTION 220101 - PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for all plumbing 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 22.

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. Plumbing work of this project includes, as a brief general description, the following:

1. Sanitary and vent piping systems to support café and related ancillary spaces.
2. Domestic water piping systems to support café and related ancillary spaces.
3. Domestic water heater, and related expansion tank, thermostatic mixing valve and recirculation pump.
4. Removal and replacement of existing fats/oils/grease interceptor at basement level 3 to support Kitchen at basement level 2.

5. Fats/Oils/Grease interceptor to support Gallery Level Café and associated back of house kitchen.
6. Floor sinks and floor drains to support Gallery Café, associated Gallery Level back of house kitchen and basement level B2 kitchen.

F. See Division 01 for requirements related to SI'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, the following options apply to Division 22 specifications.

1. Products specified by reference standards or by description only: Any product meeting those standards or description.

2. 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.

a. Where other acceptable manufacturers are named, Contractor may provide products of those named manufacturers only, which meet the specifications.
b. Where specification permits "equal" products, without naming other acceptable manufacturers, Contractor may use products of any manufacturer, which meet the specifications.

3. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

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.

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 22 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 SI.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse SI 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. 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 plumbing 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, 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 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 plumbing items but not specifically described in the plumbing item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the plumbing item by identification specification paragraph.

5. Product data sheets shall be 8.5-inch by 11-inch 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 Contracting Officer's Technical Representative (COTR), 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. Lubrication charts: Prepare lubrication charts for each piece of mechanical equipment that requires grease or oil.

    a. Include the following:

        (1) Types of lubricants required
        (2) Locations of lubrication points
        (3) Frequency of lubrication.

    b. Provide one extra set of lubrication charts mounted in plastic covers, besides those required in Operating and Maintenance Manuals.

3. 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.
4. 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.

5. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
6. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
7. Part 1: Directory, listing names, addresses, and telephone numbers of mechanical engineers; Contractor; mechanical subcontractors; and major mechanical equipment suppliers.
8. 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 pump curves and similar performance charts.
    b. List of plumbing equipment, including operating weight of each.
    c. Parts list for each plumbing fixture, faucet, and pump, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for plumbing equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
    g. Valve charts, including locations of flow fittings.

9. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data for plumbing systems.
    b. Photocopies of certificates.
    c. Photocopies of warranties and guarantees.
    d. Test reports: Copies of the results of all tests required under all sections of specifications.

10. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with COTR comments. Revise content of documents as required prior to final submittal.
11. Submit final volumes revised, within ten days after final inspection.
12. Submit DVD optical disc storage media specified in Section 220500.

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. American National Standards Institute (ANSI)
3. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
4. ASME International (ASME)
5. American Society for Testing and Materials (ASTM)
6. American Society of Sanitary Engineering (ASSE)
7. American Water Works Association (AWWA)
8. International Code Council (ICC)
9. Manufacturer's Standardization Society of the Valve and Fittings Industry Inc. (MSS)
10. National Electrical Code, NFPA 70 (NEC)
11. National Electrical Manufacturer's Association (NEMA)
12. National Fire Protection Association (NFPA)
13. National Sanitary Foundation (NSF)
14. The Occupational Safety and Health Act (OSHA)
15. Piping and Drainage Institute (PDI)
16. 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. Maintain the area and return it to its original condition at project completion.

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 SI 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. Follow the requirements listed in Division 1.

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 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 SI 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, 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, SI 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 220101

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to more than one section of Division 22.

B. Equipment installation requirements.

C. Basic material and equipment required for the plumbing piping work.

D. Underfloor piping installation.

E. Identification of plumbing systems and equipment.

F. Cleaning.

G. Operating instructions.

H. Piping tests.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 220101.

B. Operation and Maintenance Manuals: Division 01 and Section 220101.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME A 13.1: Scheme for the Identification of Piping Systems
2. ASME B 31.9: Building Services Piping

B. American Society of Testing and Materials

1. ASTM B 32: Standard Specification for Solder Metal
2. ASTM B 88: Standard Specification for Seamless Copper Water Tube
3. ASTM B 813: Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
4. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

5. 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 D10.9: Specification for Qualification of Welding Procedures and Welders for Piping and Tubing

D. NSF

1. NSF/ANSI 61: Drinking Water System Components - Health Affects
2. NSF/ANSI 372: Drinking Water System Components – Lead Content

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 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. Shop drawings:

1. Schedule of welding and brazing procedures proposed for each piping system in the project.
2. Shop drawings of backboards for piping specialties.

B. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in the article "Quality Assurance" below.

C. Test reports: Field test results for each piping system as specified in Part 3 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.

1. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

B. Welding procedures and operator qualifications for structural welding: AWS D1.1, Structural Welding Code Steel, electric arc process.

C. Brazing, and soldering procedures and operator qualifications for building systems piping:

1. ASME B31.9, Building Services Piping.

2. Copper Development Association “Copper Tube Handbook.”
3. Safe Drinking Water Act.

D. UL label:

1. Electrical control panels, equipment, materials and devices provided or installed as work of Division 23 shall be UL listed and shall bear a UL label.
2. Equipment, including custom assemblies, shall be listed and labeled as an assembly.
3. If a UL label is not available, the item shall be tested and labeled by a qualified nationally recognized testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70 (NEC).
4. Provide testing, if required, without addition to the contract sum.

E. Qualifications of DVD documentation technician: For video documentation specified in “Operating Instructions (Demonstration),” employ persons knowledgeable in video and audio production and editing who practice photography and videography as their primary profession.

F. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

G. Products shall contain no urea-formaldehyde content.

PART 2 - PRODUCTS

2.1 GENERAL

A. General piping techniques, testing, identification, and operating instructions specified in this section apply to products specified in other sections of Division 22.

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 PIPING MATERIALS

A. Soldering materials:

1. Solder: Free of lead, antimony, and zinc and meeting the requirements of ASTM B 32. No solder containing lead is permitted.

a. Tin 95.5 percent, copper 4 percent, and silver 0.5 percent.

(1) Equal to “Silvabrite 100” manufactured by Engelhard Corporation.

b. Tin, copper, bismuth, and silver.

(1) Equal to “Oatey Silver” manufactured by Oatey.

2. Flux:

a. Meeting the requirements of ASTM B 813 and NSF 61 certified.
b. Equal to Oatey H-2095.

B. Threaded pipe joint materials:

1. Pipe jointing compound:

a. Pipe joint compound recommended by the manufacturer for use at the temperature and pressure of the system.
b. For sanitary piping overhead of food storage, preparation, and serving and dining areas: Litharge and glycerin.

2. Pipe joint tape: Polytetrafluoroethylene (PTFE) pipe thread tape, “Teflon.”

2.3 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.

C. Valve tags: Brass, 1.5 inch (40 mm) in diameter with black-filled numbers not less than 0.25 inch (6 mm) high, complete with brass attachment chains.

D. Ceiling identification tags: Laminated plastic with adhesive back, engraved black letters on white background, minimum 0.5 inch (15 mm) wide and length as required for 0.375 inch (10 mm) high letters for name of concealed device and number.

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.

F. Provide installations compliant with NFPA 70.

3.2 EQUIPMENT INSTALLATION

A. Prepare for installation:

1. Coordinate work to assure that any required recesses for equipment are correct.
2. Examine areas and conditions where equipment will be installed for rough in locations, compliance with installation requirements and tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
3. Visually check equipment. Replace any damaged components prior to installation.
4. Remove temporary devices used for equipment transport.
5. Assemble equipment that is not assembled in the factory.

B. Install equipment:

1. Set equipment plumb and level.
2. Install such that labels and safety instructions are clearly visible.
3. Drawings show the general arrangement of piping, and other elements. Coordinate elements to allow access doors to open fully, allow access to removable access panels or casing panels, maintain clearances in front of control panels and electrical components required by the NFPA 70, and maintain the manufacturer's recommended service clearances.
4. Install components inside of equipment enclosures such that they are serviceable when access panels are removed.
5. Install piping hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment. Support equipment independently from piping.
6. Support:

    a. Floor-mounted equipment:

        (1) Securely fasten in place with connections to wall and floor.
        (2) Provide supplemental structure as required.

    b. Suspended equipment: Securely hang from structure above. Comply with requirements of Section 220529. Provide 0.5 inch (12.5 mm) minimum diameter threaded rods.
    c. Wall-mounted equipment: Securely fasten to wall with metal fasteners, anchors, brackets, sleeves or other devices recommended by the equipment manufacturer. Provide blocking where required.
    d. Coordinate supports so they do not interfere with access to other equipment that requires service.
    e. Provide vibration isolation where required.

7. Snugly fit equipment to architectural finishes in finished spaces unless otherwise indicated.
8. Connect associated piping, power, controls, and other associated systems.
9. Conceal associated piping and electrical connections in finished spaces unless otherwise indicated.
10. In rooms without ceilings or other finishes to conceal piping, and electrical connections, arrange these elements to provide a neat and finished appearance.
11. Install dielectric pipe fittings at connections where dissimilar metals are joined.
12. Coordinate with installation of building automation system controls.
13. Install equipment with a safety listing or certification as required to comply with their listing or certification requirements.

C. Install and wire items furnished with equipment:

1. Install control devices, accessories, and appurtenances furnished loose with equipment.
2. Wire devices furnished with equipment that are not factory-wired.

a. Comply with requirements in Division 26.
b. Comply with requirements in NFPA 70.
c. Comply with the manufacturer's installation requirements.

D. Prepare equipment for use:

1. Clean equipment and repair any damaged finishes. Remove paint splatters, dirt, and debris. Repair damaged finish to match original finish.
2. Adjust tension on belts.
3. Lubricate equipment.
4. Adjust equipment packaged controls to put the system into operation as intended.
5. Start up and operate equipment in accordance with manufacturer's instructions.
6. Verify smooth rotation and proper direction of rotation of motors.
7. Test controls, unit operation, and safety devices. Replace any failed components and retest.
8. Provide equipment identification.

3.3 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. Pipe connection flexibility:

1. Connect mains and branch connections to equipment and fixtures with at least four pipe fittings, including tee in main.
2. Connections shall be arranged so that movement in piping due to expansion and contraction will not transmit excessive force to equipment or fixtures.

E. Install unions or flanges in the piping at each item of equipment, solenoid valve, central thermostatic mixing valve, and appliance, so as to provide easy removal of the equipment, valve, or appliance.

F. Pitch water piping so that air in the system can be properly vented. Provide shutoff valves where necessary to isolate parts of system for repairs without draining the entire system.

G. 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 damp-proofing of the building shall be unharmed by the installation of the work. Where pipe has to pierce waterproofing or damp-proofing, including outside walls, the penetration shall be made watertight. Waterproofing damaged or destroyed shall be repaired or replaced with new waterproofing.

H. 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.

I. Threaded connections:

1. Cut threads full and clean.
2. Apply specified pipe joint compound or tape on male threads only.
3. Where piping is installed in crawl spaces and tunnels, cover exposed threads with rust-inhibitive paint. Apply after joints have been assembled and tested.

J. Copper tubing installation:

1. Cut pipe with a tubing cutter or fine-tooth saw. Cuts made with a saw shall be true and square, and the end shall be filed smooth with a fine-tooth file. Remove all marks and burrs with sandpaper.
2. Solder joints for copper tubing: Clean ends of tubing and inside of fitting ends thoroughly with emery cloth before applying flux.
3. Provide dielectric fittings between copper and steel piping to prevent electrolysis.
4. Follow the techniques for soldering and brazing pipe, fittings, and valves as recommended by the manufacturer.

3.4 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 identify function, equipment served, 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. 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 with colors as required by OSHA and conforming to ASME A 13.1.
5. Identify every thermometer, gauge, and control device.
6. Provide valve tags for all valves except shutoff valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.

D. Ceiling identification tags: Provide on the access door or, in suspended ceilings, on the ceiling support adjacent to the unit.

1. Valves: Identify with the same number shown on the valve tag.

3.5 CLEANING

A. Cleaning: Clean all piping and equipment. Where items are to be painted, clean ready for painting.

3.6 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish the necessary technicians, skilled workers, and helpers to operate all the plumbing 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 Smithsonian 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 Smithsonian personnel.

E. Record each instruction session only in DVD media format (video and audio format), including both the sessions specified above and added sessions required in technical sections for specialized equipment. Provide one complete set of DVDs with each Operating and Maintenance Manual.

F. Schedule the general and specialized instruction periods for a time agreed upon by the COTR.

3.7 PIPING TESTS

A. Hydrostatic testing:

1. Notify COTR in writing at least 24 hours prior to the test.
2. Test before pipes are concealed or insulated.
3. Piping may be tested in sections as the work progresses.
4. Provide fluid, pumps, valves, and gages required for testing.
5. Where water is used as the test fluid, provide ambient temperature water and provide means to avoid freezing. Drain and dispose of test fluid when testing is concluded.
6. Isolate equipment and expansion tanks during test.
7. Isolate or remove any components with a pressure rating below the required test pressure.
8. Brace and support piping during the test, so that no movement, displacement, or damage results from the application of the test pressure.
9. Provide a pressure relief valve, set at a pressure no more than one-third higher than test pressure, to protect against damage caused by expanding liquid or other source of overpressure during test.
10. Replace piping or fittings found defective with new material.
11. Sanitary piping tests:

a. Before connection of the plumbing fixtures, and before connection to the sewer, cap or plug all new sanitary and storm drainage piping systems of the building.
b. Test following the methods of testing required by the plumbing code, and no less than the duration and pressures required in the Schedule of Piping Systems Tests.
c. Where pipes are in trenches, leave the trenches open until the completion of the test.

12. Documentation of tests: Prepare a test report for each portion of piping tested, identified by service, material, location, and pipe size. Include these items:

a. Date of test.
b. Starting and completion times.
c. Initial test pressure.
d. Final test pressure.
e. Problems or leaks detected.
f. Corrective actions taken.
g. Record of successful completion of testing.
h. Name, title, and signature of person conducting test.

13. Piping Systems Test Schedule:

System	Test Pressure psig (kPa)	Duration	Allowable Drop	Medium
Domestic water piping (cold, hot, tempered, & recirculated)	125 (860)	4 Hours	None	Water
Sanitary waste piping	4.3 (30)**	4 Hours	None	Water

* If pressure drops, locate leaks with soap and water solution
** Where piping is above food service area, test pressure shall be 11 psig (76 kPa).

END OF SECTION 220500

SECTION 220502 - SLEEVES AND PLATES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sleeves and escutcheon plates for piping systems.

1.2 SUBMITTALS

A. Product data: Sleeves, plates, and sealants.

PART 2 - PRODUCTS

2.1 SLEEVES, PLATES, AND ACCESSORIES

A. Steel sleeves: Schedule 40 black steel pipe, ASTM A 53.

B. Copper sleeves: Type L, ASTM B 88 hard drawn.

C. Cast-iron sleeves: Extra heavy, equal to product of U.S. Pipe Co. with waterstop and ends as shown on the drawings.

D. Sealing compound in walls and floors:

1. Bare and insulated pipes carrying fluids 150 degrees F (65 degrees C) and below:

   a. High-performance, moisture cured, 1-component, polyurethane-based, non-sag, elastomeric sealant. Use a primer for applications required by the manufacturer.
   b. Basis of design: Sika Corporation “Sikaflex – 1a.”

2. Bare and insulated piping carrying fluids 151 degrees F (66 degrees C) and above:

   a. One-part RTV silicone, neutral-cured, architectural grade sealant. Use a primer for applications required by the manufacturer.
   b. Basis of design: Dow Corning Corporation “795 Silicone.”

E. Floor, wall, and ceiling plates for new piping: Stamped or cast brass with chrome finish and set screw.

PART 3 - EXECUTION

3.1 INSTALLING SLEEVES

A. Install sleeves for piping, or piping with insulation continuous through sleeve, passing through walls, partitions, beams, or slabs.

B. Do not cut, drill, or burn structural steel for installation of piping without specific instructions from the COTR.

C. Locations in non-fire-rated construction:

1. Install steel sleeves for penetrations of steel, iron, and insulated piping.
2. Install copper sleeves for penetrations of uninsulated copper tubing and piping.
3. Install plastic sleeves for penetrations of plastic piping. Plastic piping and sleeves are not permitted in ceiling spaces used as HVAC system plenums, or in shafts used for building HVAC air distribution.

D. Locations in floors and fire-rated construction: Sleeves used in piping penetrations through fire-rated construction shall be an acceptable component of the through-penetration firestop assembly as specified in Section 220507 Firestopping for Plumbing Work.

1. Where firestop assembly is UL listed, sleeve material shall be as directed in the listing.
2. Where other specified approval and acceptance is required, sleeve shall be as described in the approved assembly.

E. Install sleeves through walls and partitions flush with finished surfaces.

F. Sleeves through floors shall extend 0.75 inch [20] mm above top of finished floor and be finished neat and level. Sleeves through mechanical or equipment room floors shall extend one inch (25 mm) above finished floor. Provide projecting sleeves with anchor clips to prevent them from being loosened and knocked down in the floor construction.

G. Sleeves for penetrations in kitchen and food service areas shall finish 0.75 inch (20 mm) above floor or flush with wall surfaces and be neatly sealed to wall or floor. Seal space between pipe and sleeve with waterproof sealant or fire barrier as required, and finish even with sleeve.

H. Sleeves for insulated piping with vapor barrier shall be large enough to pass piping and insulation shall be sized to allow a one-inch gap between insulation and sleeve to accommodate insulation.

I. Seal spaces between sleeves and pipe, or pipe insulation, in nonrated walls, with mineral wool.

3.2 INSTALLING PLATES

A. Exposed piping passing through interior walls, partitions, floors, and ceilings shall be fitted with plates of size and depth to conceal sleeves. Secure plates firmly in place with set screws.

B. Do not install floor or wall plates on pipes in the kitchen and food service areas.

END OF SECTION 220502

SECTION 220504 - PLUMBING DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Demolition.

B. Disposal.

C. Protection

1.2 RELATED SECTIONS

A. Demolition: Section Division 02.

B. Hazardous material removal: Division 02.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Extent and location of demolition is indicated on the drawings.

B. Comply with demolition and disposal requirements of Division 02.

C. Perform demolition operations expeditiously and in accordance with accepted practice and applicable building code provisions. Perform demolition operations neatly and with the least possible disturbance to the building.

D. If, in the course of the work, workers encounter a material they suspect to be hazardous:

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.

E. Provide temporary barriers, danger signals, and appurtenances for protection of personnel and equipment during demolition operations.

F. Drain and refill portions of existing piping systems necessary for the work.

1. Provide isolation valves, if necessary, to keep systems operational in occupied areas.
2. Schedule and coordinate draining with the COTR in accordance with Division 01 requirements for system shutdowns.

G. Demolish, remove, demount, and disconnect inactive and obsolete piping, fittings, specialties, equipment, fixtures, insulation, and associated appurtenances.

1. Remove materials above accessible ceilings.
2. Drain and cap items to remain behind finished surfaces.
3. Patch and repair surface materials as required in Division 0.

3.2 DISPOSAL

A. Dispose of equipment and materials removed, and other waste material, as work progresses.

B. Do not allow demolition debris to accumulate on site. Remove products of demolition from the building daily as a minimum.

3.3 PROTECTION

A. Protect existing materials that will remain. 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.

B. Provide and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Keep standby patching materials on hand to patch and maintain protection as required. Remove protection and barriers after demolition operations are complete.

C. Ensure weathertightness at all times. Prevent the entry of dust or water.

END OF SECTION 220504

SECTION 220505 - EQUIPMENT CONNECTIONS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment connections for plumbing, to food service and SI provided equipment.

1.2 RELATED SECTIONS

A. Piping connections: Section 220500.

B. Rough-in dimensions and lists of accessories: Suppliers of equipment specified in other divisions.

C. Schedule of roughing-in and connections: Drawings.

1.3 SUBMITTALS

A. Product data: Any product required for connection but not specified in other sections.

1. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.

1.4 QUALITY ASSURANCE

A. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61, NSF/ANSI 372 with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.

B. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.

C. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Shutoff valves for plumbing fixtures:

1. Concealed: Ball valve, lead free, compliant with NSF/ANSI-61 and NSF/ANSI-372, bronze body, bronze ball, PTFE seat, full port, two-piece, blowout-proof stem, soldered, rated for operation at 100 psi (689 kPa) at 300 degrees F (149 degrees C).

    a. Basis of design: Nibco Inc. No. S-685-80-LF.

2. Exposed: Chrome-plated, 1/2-inch FIP straight stop valve, lead free, compliant with NSF/ANSI-61 and NSF/ANSI-372. Rated at 140 degrees F (60 degrees C).

    a. Basis of design: Chicago Faucet Co. No. 45-LKABCP or Brass Craft Mfg., Co. No. OR-82XC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Rough in and connect to plumbing equipment. Install valves, balancing valves, thermometer wells, gauge tappings, control valves, air vents, traps, strainers, drains, and appurtenances as shown on diagrams on drawings and specified under other sections of the specifications.

B. Rough in and connect to food service, SI-supplied, and other equipment requiring water, drain, or other piping connections, that is specified, furnished and set in place in other divisions or listed in the Schedule of Roughing-in and Connections on the drawings.

1. Faucets, drains, trim, and necessary vacuum breakers, solenoid valves, flow control fittings supplied with the sinks and equipment are specified herein or under other divisions.
2. Rough-in dimensions and list of accessories shall be provided by the equipment supplier.

C. Install the faucets, drains, trim, and accessories and provide necessary supply stops, P traps, and shock absorbers with necessary fittings to make a complete and satisfactory installation of every item of equipment.

D. Provide water supply shutoff valves, and unions at each item of equipment. Where exposed adjacent to chromium-finished piping, the water shutoff valves shall be chromium plated.

END OF SECTION 220505

SECTION 220509 - PLUMBING EXPANSION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pre-charged bladder-type expansion tank for potable water system.

1.2 RELATED SECTIONS

A. Demonstration, training, and equipment installation: Section 220500.

B. Equipment hangers and supports: Section 220529.

C. Piping: Section 221116.

1.3 SUBMITTALS

A. Product data: Each type of expansion tank, including all accessories.

1. Certification that products comply with NSF/ANSI 61.

1.4 QUALITY ASSURANCE

A. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.

B. Acceptance product marking: NSF®-61.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the specified and scheduled products, or comparable products by one of the following:

1. Expansion tanks:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell and Gossett Domestic Pump Div of ITT
d. Taco

e. Wessels

2.2 EXPANSION TANK FOR POTABLE WATER

A. Pressurized bladder type tank, containing impermeable bladder which separates the air cushion from the system water. Operating temperature: 240 degrees F maximum. Pre-charged to manufacturer's standard pressure.

B. Shell: Welded steel, constructed, tested and stamped in accordance with ASME BPV for Unfired Pressure Vessels for a working pressure of 125 psi. Lined with protective coating.

C. Bladder: Butyl rubber, flexible but not stretchable under working conditions, removable for inspection.

D. FDA approval: Wetted components FDA-approved materials.

E. Size and capacity: Shown on the drawings.

F. Supports: For horizontal or vertical support on concrete equipment foundation, as diagramed on the drawings.

G. Basis of design: Amtrol model number scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment as indicated on the drawings. Comply with requirements in Section 220500.

B. Verify air pressure in the bladder is equal to the minimum expected system pressure at the tank based on the incoming service pressure and the tank location. Adjust pressure as needed.

3.2 OPERATING INSTRUCTIONS

A. As specified in Section 220500, provide operating instructions.

END OF SECTION 220509

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Unless otherwise specified in a particular section or required for a particular application, motors shall conform to the following requirements, whether factory-installed or field-installed.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Motor capacitors: Division 26.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Pumps:

1. Domestic water pumps: Section 221123.

1.4 REFERENCES

A. NEMA MG 1: Motors and Generators.

B. NEMA MG 11: Energy Management Guide for Selection and Use of Single-Phase Motors.

C. UL 508: Industrial Control Equipment.

1.5 DEFINITIONS

A. Energy efficient motor: Motor meeting the nominal and minimum efficiency levels listed for its horsepower and speed in Table 12-10 of NEMA MG 1.

B. Nominal efficiency: Efficiency as defined in Table 12-8, Efficiency Levels, in NEMA MG 1, and identified on the motor nameplate.

1.6 SUBMITTALS

A. Wiring diagrams required for the proper installation of plumbing equipment.

B. Submit product data which verifies compliance with ASHRAE 90.1 or provide certified performance ratings by a qualified independent testing agency.

C. Certifications:

1. Actual motor power factor for each motor, certified test results for each motor proposed for use on this project.
2. Field test showing corrected power factor, if required.

1.7 QUALITY ASSURANCE

A. UL label: As specified in Section 220500, Common Work Results for Plumbing.

B. Plumbing equipment shall meet the energy performance requirements of ASHRAE 90.1.

1.8 REGULATORY REQUIREMENTS

A. Motors shall conform to the requirements of NEMA MG1 and applicable portions of the National Electric Code (NEC, NFPA 70).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Motors:

1. A.O. Smith
2. Baldor Electric Co.
3. Marathon
4. Rockwell
5. Siemens
6. Toshiba International

2.2 BASIC MOTOR REQUIREMENTS

A. Capacity: Each motor shall have sufficient capacity and torque to start, accelerate, and operate the machine it drives without exceeding the motor nameplate rating at the speed specified, or at any speed and load which may be obtained by the drive actually furnished.

B. Starting: Each automatically controlled motor shall be capable of starting as frequently as the control sequence may demand. Motors not automatically controlled shall be capable of making no fewer than 4 starts per hour.

C. Ratings: Motors shall be rated for continuous duty at 100 percent of rated capacity, and temperature rise shall be based on ambient temperature of 40 degrees C.

D. Phase: Unless otherwise indicated, motors one-half horsepower and larger shall be polyphase and motors smaller than one-half horsepower shall be single-phase motors.

E. Motor construction:

1. Motors for pumps, unless specified otherwise in the equipment section, shall be open drip-proof NEMA design B construction.

F. Efficiency: The term “energy efficient” is defined in the article “Definitions” in Part 1 above.

1. Single-phase motors, alternating-current fractional horsepower, rated 1/20 to 1 horsepower, 250 volts or less: NEMA MG 11, types and efficiencies selected for their applications.

2.3 SINGLE-PHASE MOTORS

A. Permanent split-capacitor or split-phase type.

B. Bearings: Sealed, prelubricated ball-bearing type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount direct-connected motors securely and in accurate alignment. The drive shall be free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.2 OPERATING INSTRUCTIONS

A. As specified in Section 220500, provide operating instructions.

END OF SECTION 220513

SECTION 220519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Thermometers.

B. Pressure gauges.

C. Water Meters.

1.2 RELATED SECTIONS

A. Pipe installation and testing: Section 220500.

1.3 SUBMITTALS

A. Product data: For each type of meter, gauge, device, and fitting specified.

1. Scale range.
2. Ratings.
3. Calibrated performance curves.
4. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.

B. Show flow measurement locations on valve charts specified in Section 220523, for general-duty valves.

1.4 QUALITY ASSURANCE

A. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61, NSF/ANSI 372 with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.

B. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Meters and gauges:

1. AMETEK; U.S. Gauge
2. Ashcroft; Dresser Instrument
3. Miljoco Corporation
4. Taco, Inc.
5. H.O. Trerice Co.
6. Weiss Instruments
7. Weksler; Dresser Instrument

2.2 THERMOMETERS

A. General:

1. Graduation: To the scale shown on the drawings, or of a scale so that the normal working temperature of the system is near the mid-point of the scale.
2. Case: Industrial, cast aluminum with baked enamel finish, dust and moisture tight.
3. Window: Acrylic or glass.
4. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

B. Pipe-mounted liquid-in-glass thermometers: Brass well, separable sockets.

1. Display: 9 inches (230 mm), blue organic liquid in glass tube.
2. Accuracy: ±1 scale division.
3. Stem: Aluminum or stainless steel, 6-inch (150-mm) stem length and socket with 2.5-inch (64-mm) lagging extension neck for use in insulated piping.
4. Where thermometer wells only are required, provide separable socket with 2.5-inch (64-mm) lagging extension, fitted with attached chain and cap.
5. Basis of design: Trerice Adjustable Angle and Trerice Thermowells.

C. Pipe-mounted light-powered digital thermometers

1. Display: 9/16” LCD, metric or imperial units, 0.1 degree resolution, 10 Lux ambient operation.
2. Range: -58 degrees F to 158 degrees F (-50 degrees C to 70 degrees C).
3. Accuracy: ±1 percent.
4. Stem: Aluminum or stainless steel, 6-inch (150-mm) stem length and socket with 2.5-inch (64-mm) lagging extension neck for use in insulated piping.
5. Where thermometer wells only are required, provide separable socket with 2.5-inch (64-mm) lagging extension, fitted with attached chain and cap.
6. Basis of design: Trerice SX9 Solar Therm and Trerice Thermowells.

2.3 WATER METER

A. Water meter shall be equal to Badger Meter “Recordall” model as scheduled on the drawings.

B. Meter construction shall comply with ANSI/AWWA Standard C700 and consist of three basic components: Meter housing, measuring chamber, and permanently sealed register or encoder. Meter shall be lead free bronze alloy, and corrosion resistant engineered polymer material used for measuring chamber.

C. Meter shall comply with lead free provisions of the Safe Drinking Water Act, Certified to NSF/ANSI Standards 61 and 372 and carry the NSF-61 marking on the housing.

D. Meter shall meet or exceed registration accuracy for the low flow rates, normal operating flow rates and maximum continuous operating flow rates as specifically stated in AWWA Standard C700.

E. Connection: Male NPT.

F. Straight reading, permanently sealed magnetic driver register. Register shall have six-odometer wheel totalization display, 360 degree test circle with center sweep hand, and flow finder to detect leaks. Registration in U.S. gallons.

G. Provide dry type pulse output transmitter, Model EPT-1.

PART 3 - EXECUTION

3.1 INSTALLING GAUGES, THERMOMETERS AND WELLS

A. Provide pipe-mounted gauges and thermometers as indicated on the drawings.

B. Provide wells for pipe-mounted gauges and thermometers, where indicated on the drawings.

C. Furnish and deliver to COTR at final inspection, one additional pipe line thermometer as above specified, with 6-inch (152-mm) stem length, for use in the thermometer wells. Range shall be 30 to 180 degrees F (0 to 83 degrees C).

3.2 INSTALLING WATER METER

A. Install in accordance with the manufacturer’s recommendations.

END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Shutoff valves.

B. Check valves.

C. Balancing valves.

D. Drain valves.

1.2 RELATED SECTIONS

A. Piping installation and testing: Section 220500.

B. Piping systems:

1. Domestic water piping: Section 221116.
2. Sanitary waste and vent piping: Section 221316.

C. Automatically operating valves: Section 221119.

D. Automatic water temperature control valve for domestic hot water: Section 221119.

E. Backflow preventers.

1.3 REFERENCES

A. ASME B16.10: Face-to-Face and End-to-End Dimensions of Valves.

B. ASME B16.34: Valves - Flanged, Threaded, and Welding End.

1.4 SUBMITTALS

A. Product data: For each type of valve. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

1. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.

B. Maintenance data: For inclusion in operation and maintenance manual specified in Division 01 and Section 220101. Include manufacturer's instructions for adjusting, servicing, disassembling, and repairing.

C. Valve charts: Furnish valve charts typed on 8.5 by 11-inch (216 by 279-mm) bond paper, showing locations of all manual and automatic control valves, and flow meters. Include:

1. Number
2. Location
3. Service
4. Function
5. Area served

D. Valve numbering system shall be approved by the COTR prior to final submittal. Place one copy of approved chart in a plastic envelope and mount on wall where directed. Provide another copy for each of the Operating and Maintenance Manuals.

1.5 QUALITY ASSURANCE

A. Ferrous valves shall conform to ASME B16.10 and B16.34 for dimension and design criteria.

B. Copper alloy valves (brass and bronze) shall have no more than 15 percent zinc in the alloy.

C. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61, NSF/ANSI 372 with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.

D. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements. Product specifications herein may not define all product options necessary to meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Shutoff valves:

1. Ball valves: Subject to compliance with requirements, provide the specified NIBCO valve, or comparable product by one of the following:

    a. Apollo Valves
    b. Milwaukee Valve Co.
    c. NIBCO
    d. Stockham Valve & Fittings
    e. Victaulic Company of America
    f. Walworth Co.
    g. Watts Regulator Co.

B. Check valves:

1. Check valves: Subject to compliance with requirements, provide the specified NIBCO valve, or comparable product by one of the following:

    a. Combination Pump and Valve Co.
    b. Mueller Steam Specialty
    c. NIBCO
    d. Victaulic Company of America

C. Balancing valves: Subject to compliance with requirements, provide the specified Bell & Gossett valve, or comparable product by one of the following:

1. Watts Regulator Co.
2. Armstrong

D. Drain valves: Subject to compliance with requirements, provide the specified NIBCO valves, or comparable products by one of the following:

1. Apollo Valves
2. Milwaukee Valve Co.
3. NIBCO
4. Stockham Valve & Fittings
5. Victaulic Company of America
6. Walworth Co.
7. Watts Regulator Co.

2.2 SHUTOFF VALVES

A. Ball valves:

1. Valves NPS 0.25 (DN 8) through NPS 2 (DN 50:

a. 600 psi CWP, two-piece silicon bronze alloy body, full port, blowout-proof stem, PTFE seats, stainless steel ball and stem, extension handle for use in insulated piping, threaded or soldered ends.
b. Basis of design: NIBCO T-685-66-LF or S-685-66-LF.

2.3 CHECK VALVES

A. Center-guided, spring-loaded silent-action type check valves:

1. Valves NPS 0.5 (DN 15) through NPS 2 (DN 50):

a. 250 psi CWP, silicone bronze body, PTFE disk, stainless steel stem and spring, threaded or soldered ends.
b. Basis of design: NIBCO T-480-Y-LF or S-480-Y-LF.

2.4 BALANCING VALVES

A. Balancing valves:

1. NPS 3 (DN 80) and smaller: Calibrated balancing valve.

a. Materials: Low-lead brass body (<0.25 percent lead content), stainless steel ball with carbon filled TFE seat rings.
b. Pressure and temperature ports. Differential pressure readout ports across valve seat.
c. Ratings (NPT): Entire assembly 400 psi, 250 degrees F (2758 kPa, 121 degrees C).
d. Flow element: Variable orifice flow meter.
e. Adjustable pre-set balancing points with memory stop and isolation valve.
f. Drain port: 1/4-inch NPT.
g. Bi-directional design.
h. Bellows type meter gauge kit with case, provide one for use on the entire project.
i. Basis of design: Bell & Gossett Circuit Setter Plus.

2.5 DRAIN VALVES

A. Drain valves:

1. Provide with supplemental ASSE 1011 or ASSE 1052 backflow preventer.

2. Full-port, two-piece ball valve, bronze body, bronze ball, replaceable PTFE seats and seals, vinyl-covered steel handle, threaded or soldered inlet, threaded cap with brass chain. Provide extension handles where used in insulated piping. Remove handle where valve is accessible to the public.
3. Pressure rating: 600-psig (4137-kPa).
4. NPS 0.75 (DN 20) inlet.
5. NPS 0.75 (DN 20) ASME B1.20.7 garden-hose thread outlet.
6. Basis of design: NIBCO T-585-80-LF-HC or T-585-80-LF-HC.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install valves to be readily accessible for operation and maintenance, and with ample clearance for turning handles or operators.

B. For valves in inaccessible locations, provide access doors as specified in a related section.

C. Identify valves as specified in Section 220500, Common Work Results for Plumbing.

1. Provide tags for all valves except stop valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.
2. Provide ceiling identification tags where valves are above an accessible suspended ceiling. Number shall correspond to tag number.

3.2 INSTALLING SHUTOFF VALVES

A. Install shutoff valves for water piping where indicated:

1. Sizes NPS 4 (DN 50) and smaller: Ball valves.

3.3 INSTALLING CHECK VALVES

A. Provide center-guided, spring-loaded silent-action type check valves in domestic water lines.

3.4 INSTALLING BALANCING VALVES

A. Install balancing valves where indicated.

B. Locate valve to provide a minimum of 5 pipe diameters of straight inlet and 2 pipe diameters of straight outlet.

3.5 INSTALLING DRAIN VALVES

A. Provide drain valve at every low point of a water system, and where indicated.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe hangers and supports.

B. Trapeze pipe hangers.

C. Metal framing systems.

D. Insulation protection.

E. Fasteners.

1.2 RELATED SECTIONS

A. Plumbing Piping Insulation: Section 220719.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME B31.9: Building Services Piping.

B. ASTM International

1. ASTM A 36: Standard Specification for Carbon Structural Steel
2. ASTM A 53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A 307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
4. ASTM A 563: Standard Specification for Carbon and Alloy Steel Nuts
5. ASTM A 1064: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
6. ASTM C 533: Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
7. ASTM C 552: Standard Specification for Cellular Glass Thermal Insulation
8. ASTM F 594: Standard Specification for Stainless Steel Nuts
9. ASTM F 3125: Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated

C. American Welding Society

1. AWS-D.1.1: Structural Welding – Steel

D. Metal Framing Manufacturer's Association

1. MFMA-4: Metal Framing Standards Publication
2. MFMA-103: Guidelines for the Use of Metal Framing

E. Manufacturer's Standardization Society

1. MSS SP-58: Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.4 DEFINITIONS

A. Hot Systems: Maximum operating (service) temperatures 120 degrees F (49 degrees C) and above.

B. Ambient Systems: Maximum operating temperatures 60 to 119 degrees F (16 to 48 degrees C).

C. Cold Systems: Maximum operating temperatures 59 degrees F (15 degrees C) and below.

1.5 SUBMITTALS

A. Product data:

1. Provide manufacturer's literature showing compliance with specifications for each type of hanger, framing system, support, fastener and accessory materials.
2. Provide a schedule of piping types and sizes and associated pipe hanger types.
3. Provide a schedule of building attachment types and associated attachment hardware.
4. Provide a schedule of pipe types and sizes and proposed hanger spacing and support rod diameters.
5. Provide manufacturer's recommended pipe hanger spacing criteria for stainless steel piping.
6. For supports used as components of fire protections systems, include certification of listing and label as required in "Quality Assurance" below.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Qualifications of welders: As specified in Section 220500, Common Work Results for Plumbing.

B. Hangers and supports used as components of fire protection systems shall:

1. Comply with NFPA 13.
2. Be listed and labeled by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pipe hangers:

1. Anvil International
2. Carpenter and Paterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. PHP Systems/Design

B. Metal framing systems:

1. Anvil International
2. Cooper Industries
3. Hydra-Zorb
4. PHD Manufacturing, Inc.
5. PHP Systems/Design
6. Unistrut

C. Pipe covering protection shields:

1. Anvil International
2. Carpenter and Patterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. Pipe Shields, Inc.
7. Rilco Manufacturing Co., Inc.

2.2 PIPE HANGERS AND SUPPORTS

A. General: Comply with requirements of MSS SP-58.

B. Hangers and clamps:

1. Typical interior applications: Galvanized steel or factory painted.
2. For use with uninsulated copper pipe: Copper plated.

C. Trapeze pipe hanger: MSS SP-58, Type 59, shop-fabricated or field-fabricated pipe support assembly made from structural carbon-steel shapes with pipe saddles and U-bolts to secure piping on top of hanger.

D. Supplemental materials:

1. Threaded rod: Continuously threaded.

    a. Zinc-plated or galvanized carbon steel for indoor applications.
    b. Stainless steel for outdoor and corrosive applications.

2. Nuts and washers: Provide the same material used for threaded rods (ASTM A 563 for steel, ASTM F 594 for stainless steel).
3. Structural carbon-steel shapes: ASTM A 36.
4. Steel pipe: ASTM A 53, Grade B, Type E (electric resistance welded), Schedule 40, black and galvanized steel.

E. Metal framing systems:

1. Description: Shop- or field-fabricated, pipe-support assembly made of channels, nuts, bolts, structural connections, accessories, fittings, and other manufactured components.
2. Standard: Comply with MFMA-4 for factory-fabricated components for field assembly.
3. Channels: Continuous slotted galvanized 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. Metal framing system pipe clamps:

    a. Galvanized steel clamp pipe support with elastic stop nut, and hex head machine screw, and manufactured to connect to metal framing system channels.
    b. For insulated piping: Clamp shall have friction tape on inside of clamp surface, manufactured to connect to pipe clamp insulating insert over pipe.

c. For uninsulated piping: Clamp shall have an integral molded thermoplastic elastomer clamping insert on inside of clamp surface, manufactured to connect to uninsulated pipe.

F. Insulation protection:

1. Pipe covering protection shield:

a. Shield: Galvanized steel, meeting the requirements of MSS SP-58 Type 40. Provide with alignment ridges when used in conjunction with pipe hanger.
b. Structural insulation insert: Structural insulation insert to form the insulation for the lower half of, or the entire pipe circumference Provide ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.

2. Combination insulating insert and insulation protection shield:

a. Insulating insert material for cold and ambient system piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier. Insert thickness shall match adjacent piping insulation thickness.
b. Insulating insert material for hot system piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.
c. Insulation protection shield: Galvanized steel.
d. Insulating insert and insulation protection shield shall cover entire circumference of pipe.
e. Insulating insert length: Extend 2 inches minimum (50 mm) beyond insulation protection shield.

3. Pipe covering protection saddle:

a. Saddle: Steel, meeting requirements of MSS SP-58 Type 39
b. Insulation insert: Insulating material located in the space between saddle and pipe.

4. Pipe clamp insulating insert:

a. Insulating insert material: Closed-cell, sponge or expanded rubber, ASTM C 534, Type I for tubing material, with integral supports constructed from non-compressive closed cell material, single piece construction with self-adhesive closure strips. Insert thickness shall match adjacent piping insulation thickness. If insulation thickness is not available, provide maximum available thickness and seal insulation vapor barrier at thickness transition.
b. Insulation protection jacket: Aluminum or stainless steel, bonded to insulation insert.
c. Insulating insert and jacket shall cover entire circumference of pipe.
d. Basis of design: Armacell "Armafix" insulating inserts.

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. Fasteners to drywall or cavity wall construction:

1. Toggle bolts with hollow wall drive anchors or nylon anchors as required.
2. Basis of design: ITT Phillips Anchors "Red Head" toggle bolts.

C. Fasteners to wood construction: Lag bolts.

D. Bolts, nuts, and washers: ASTM A 307, or ASTM F 3125 where high strength is required.

E. Adhesive anchors, stainless-steel threaded anchors with epoxy adhesive in glass container.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide hangers and supports in accordance with schedules at the end of this section, as modified by specifications for each location and type.

B. Comply with MSS SP-58. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Where required, provide structural steel shapes or metal framing system channels and hardware to transfer load from a hanger 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.

E. Support horizontal piping from above with hangers and threaded rod where possible, unless otherwise indicated.

F. Secure vertical piping at stack bases.

G. Support vertical piping at each floor with riser clamps. Provide additional supports as needed not to exceed scheduled maximum vertical support spacing.

H. Provide hanger sizes to allow for continuous insulation for insulated piping systems.

I. Fabricate wall-mounted and floor-mounted supports using metal framing systems or structural steel where required.

J. Support groups of small piping along a structural wall using a metal framing system secured to the wall.

K. 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.

L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

P. Trapeze pipe hangers: Provide where required for grouping of parallel runs of horizontal piping.

1. Weld steel according to AWS D-1.1.
2. Hang with threaded rods. Size threaded rods in accordance with MSS SP-58.
3. Design trapeze pipe hangers and supports based on supported load plus a 50 percent minimum safety factor.
4. Hanger spacing shall not exceed the requirements for the smallest pipe in the rack.
5. Hanger spacing shall not exceed 6 feet (1.8 m) where hung from wood.

Q. Metal framing systems: Provide where required for grouping of parallel runs of piping, and support together on field-assembled strut systems. Comply with MFMA-103 for metal framing system selections and applications.

R. Where piping penetrates metal studs within metal stud partitions, provide polymer inserts manufactured for the purpose to isolate piping and insulation from the metal stud material.

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 for any pipe size.
2. Secure threaded rods to MSS SP-58 Type 23 beam clamps for beams with maximum flange thickness of 0.75 inch (19 mm) and for single pipes NPS 2 (DN 50) and smaller.

C. Attaching to bar joists:

1. Provide MSS SP-58 Type 19 top-beam C-clamps attached to top flange of the joists at panel points.
2. Piping perpendicular to joists:

a. Pipes NPS 2.5 (DN 65) and smaller: Support from at least every other joist to spread the load among joists. Where multiple pipes are grouped together, stagger hangers to distribute the load among available joists.

b. Pipes NPS 3 (DN 80) and larger: Support from every joist to spread the load among joists.
c. If additional support is required between joists, hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists, and hang piping from metal framing system channel or structural steel shape.

3. Piping parallel to joists:

a. Hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists. Hang piping from metal framing system channel or structural steel shape.
b. For pipes NPS 2.5 (DN 65) and smaller: A single pipe may be hung from a single joist.

D. Attaching to concrete slabs and composite slabs:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting pipe from concrete slabs or composite slabs. Where approved, provide mechanical expansion anchors and steel bolts or rods.

E. Attaching to steel decks: Not permitted.

F. Attaching to wood construction:

1. Trusses: Follow roof truss manufacturers' recommendations for attachment locations, loads, spacing, and methods of attachment.
2. Joists: Provide MSS SP-58 Type 34 side beam connectors.

3.3 INSTALLING CAST-IRON PIPING

A. Support piping within 18 inches (460 mm) of each horizontal joint in addition to satisfaction of maximum hanger spacing. Where there are multiple joints in a 4 foot (1.2 m) section, supports may be provided at every other joint.

B. Support piping at changes in direction.

C. Where pipe is supported by hangers more than 18 inches (460 mm) long, provide lateral support at a maximum interval of 40 feet (12.2 m) with sway bracing.

D. Secure closet bends, traps, and similar items against movement in any direction.

3.4 PIPING HANGER AND SUPPORT SCHEDULES

A. Insulated cold and ambient applications: Applications include, but are not limited to, domestic cold water and insulated sanitary and storm water systems.

HANGERS & SUPPORTS FOR INSULATED COLD AND AMBIENT APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Types 1 & 40	Clevis hanger & pipe covering protection shield.	NPS 0.5 (DN 15) through NPS 2 (DN 50)
Types 1 & 40 (with structural insulation insert)	Clevis hanger & pipe covering protection shield, with structural insulation insert.	NPS 2.5 (DN 65) and larger
Type 59 (with combination insulating insert and insulation protection shield)	Trapeze pipe hanger with pipe saddles & U-bolts (with combination insulating insert and insulation protection shield).	NPS 0.5 (DN 15) through NPS 4 (DN 100)
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37 (with combination insulating insert and insulation protection shield)	Adjustable pipe stanchion saddle with U-bolt and floor flange anchored to floor (with combination insulating insert and insulation protection shield).	All sizes where supported from floor or a concrete support pier.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 8 (DN 200)
Risers		
Type 8	Riser clamp.	All sizes

B. Insulated hot applications: Applications include, but are not limited to domestic hot water and domestic hot water return systems.

HANGERS & SUPPORTS FOR INSULATED HOT APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Types 1 & 40	Clevis hanger & pipe covering protection shield.	NPS 0.5 (DN 15) through NPS 2 (DN 50)
Types 1 & 40 (with structural insulation insert)	Clevis hanger & pipe covering protection shield, with structural insulation insert.	NPS 2.5 (DN 65) to NPS 6 (DN 150)
Type 59 (with combination insulating insert and insulation protection shield)	Trapeze pipe hanger with pipe saddles & U-bolts (with combination insulating insert and insulation protection shield).	NPS 0.5 (DN 15) through NPS 4 (DN 100)
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37 (with combination insulating insert and insulation protection shield)	Adjustable pipe stanchion saddle with U-bolt and floor flange anchored to floor (with combination insulating insert and insulation protection shield).	All sizes where supported from the floor or a concrete support pier. Use only where no significant horizontal pipe movement is anticipated.
Types 41 & 39	Adjustable roller support & pipe covering protection saddle (cast-iron roll and sockets, steel roll rod, supported from below with threaded rods).	All sizes where supported from racks, fixed structural supports, or brackets where vertical adjustment is required.
Types 44 & 39	Roller chair & pipe covering protection saddle (Cast-iron roll, steel roll rod, steel chair, bolts, and hex nuts).	All sizes where supported from racks, fixed structural supports, or brackets where vertical adjustment is not required.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 6 (DN 150)
Risers		
Type 8	Riser clamp.	All sizes

C. Uninsulated applications: Applications include, but are not limited to uninsulated storm water, sanitary, vent, compressed air, and laboratory gas systems.

HANGERS & SUPPORTS FOR UNINSULATED APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Type 1	Clevis hanger	All sizes
Type 10	Adjustable swivel ring	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Type 59	Trapeze pipe hanger with pipe saddles & U-bolts.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
N/A	Metal framing system with metal framing system pipe clamps for uninsulated piping.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37	Adjustable pipe stanchion saddle with U-bolt, with floor flange and base anchored to floor.	All sizes where supported from the floor or a concrete support pier.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 8 (DN 200)
Risers		
Type 8	Riser clamp.	All sizes

D. Minimum threaded rod sizes: Provide at least the following minimum rod diameters for single rods supporting a single pipe hanger.

Pipe Size	Minimum Rod Diameter
NPS 2 (DN 50) and below	0.375 inches (10 mm)
NPS 2.5 and NPS 3 (DN 65 and DN 75)	0.5 inches (15 mm)
NPS 4 and NPS 5 (DN 100 and DN 125)	0.625 inches (16 mm)
NPS 6 and NPS 8 (DN150 and DN 200)	0.75 inches (20 mm)
NPS 10 to NPS 12 (DN 250 to DN 300)	0.875 inches (22 mm)
NPS 14 to NPS 18 (DN 350 to DN 450)	1.0 inch (25 mm)
NPS 20 (DN 500) and above	1.25 inch (35 mm)

E. Maximum hanger and support spacing for pressurized piping: Provide additional hangers or supports for concentrated loads such as flanges, valves, expansion compensators, fittings, and other specialties.

1. Horizontal spacing:

Pipe Size	Copper Piping
NPS 0.75 (DN 20) and below	5 feet (1.5 m)
NPS 1 (DN 25)	6 feet (1.8 m)
NPS 1.25 (DN 32)	7 feet (2.1 m)
NPS 1.5 (DN 40)	8 feet (2.4 m)
NPS 2 (DN 50)	
NPS 2.5 (DN 65)	9 feet (2.7 m)
NPS 3 (DN 75)	10 feet (3 m)
NPS 4 (DN 100)	12 feet (3.7 m)
NPS 5 (DN 125)	
NPS 6 (DN 150)	
NPS 8 (DN 200)	

2. Vertical spacing:

Copper Piping
10 feet (3 m)

3. Provide hanger spacing to meet manufacturer’s recommendations and MSS SP-58 for stainless steel piping.

F. Maximum hanger and support spacing for metal gravity piping: Provide additional hangers or supports for concentrated loads such as fittings, and other specialties.

1. Horizontal spacing:

<table>
<tr><th>Pipe Size</th><th>Copper DWV Tubing</th><th>Cast-iron (Hub & Spigot)</th><th>Cast-iron (No-hub)</th></tr>
<tr><td>1.5 inches (40 mm)</td><td rowspan="2">8 feet (2.4 m)</td><td>N/A</td><td rowspan="13">5 feet (1.5 m)</td></tr>
<tr><td>2 inches (50 mm)</td><td rowspan="11">5 feet (1.5 m)</td></tr>
<tr><td>3 inches (75 mm)</td><td rowspan="5">10 feet (3 m)</td></tr>
<tr><td>4 inches (100 mm)</td></tr>
<tr><td>5 inches (125 mm)</td></tr>
<tr><td>6 inches (150 mm)</td></tr>
<tr><td>8 inches (200 mm)</td></tr>
<tr><td>10 inches (250 mm)</td><td rowspan="3">N/A</td></tr>
<tr><td>12 inches (300 mm)</td></tr>
<tr><td>15 inches (350 mm)</td></tr>
</table>

2. Vertical spacing:

Copper DWV Tubing	Cast-iron (Hub & Spigot)	Cast-iron (No-hub)
10 feet (3 m)	15 feet (4.5 m)	15 feet (4.5 m)

END OF SECTION 220529

SECTION 220700 - PLUMBING 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. Plumbing piping insulation: Section 220719.

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. Concealed insulation shall include work:

1. Above ceilings.
2. Where furred in and in pipe chases.

B. 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.

C. 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 220700

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing piping insulation for the interior piping systems listed in the minimum insulation thickness schedule at the end of this section.

B. Work of this section includes:

1. Insulation for new piping installed under this contract.
2. Patching existing insulation where removed to make connections to existing piping.
3. Patching existing insulation damaged during demolition and construction.

1.2 RELATED SECTIONS

A. Firestopping: Division 07.

B. Definitions and general insulation requirements: Section 220700.

C. Pipe hangers and protection shields: Section 220529.

1.3 REFERENCES

A. American Society of Testing and Materials

1. Standards for mineral fiber insulation materials

a. ASTM C 449: Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
b. ASTM C 547: Mineral Fiber Pipe Insulation.
c. ASTM C 553: Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
d. ASTM C 1136: Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

2. Standards for flexible elastomeric insulation materials

a. ASTM C 534: Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

3. Standards for all insulation materials

a. ASTM C 450: Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
b. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

4. Standards for field applied jackets and accessories

a. ASTM C 1729: Standard Specification for Aluminum Jacketing for Insulation
b. ASTM D 1784: Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
c. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.4 QUALITY CONTROL SUBMITTALS

A. Manufacturer's instructions: Recommended accessory materials and products; installation instructions.

1.5 QUALITY ASSURANCE

A. Installers shall be mechanics skilled in this trade, employed with a firm that has a minimum of five years of experience installing mechanical insulation.

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 01and the article "Product Options" in Section 220101.

B. Mineral fiber insulation:

1. CertainTeed Corporation.
2. Johns Manville
3. Knauf Insulation
4. Manson Insulation
5. Owens-Corning

C. Flexible elastomeric insulation:
1. Aeroflex USA

2. Armacell LLC
3. K-Flex USA
4. Rubatex

D. 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. Mineral fiber preformed pipe insulation: Glass fibers bonded with a thermosetting resin, ASTM C 547 Type I, with factory-applied ASJ-SSL jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

B. ASJ-SSL jacket:

1. All service jacket with self-sealing lap.
2. White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
3. Complying with ASTM C 1136, Type I.

C. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, pressure sensitive, complying with ASTM C 1136; 3 inch (75 mm) width. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

D. Mineral fiber preformed fitting and valve covers: Glass fibers bonded with a thermosetting resin, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

E. Mineral fiber insulation adhesive:

1. Solvent free, low VOC, water-based adhesive designed for bonding mineral fiber insulation to steel or aluminum surfaces, and compatible with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Foster 85-60 “Quick-Tack”.

F. Mineral fiber insulation vapor barrier mastic:

1. 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.
2. Basis of design: Foster 30-65 “Vapor-Fas”.

G. Insulating cement: Mineral fiber cement with a hydraulic-setting binder, conforming to ASTM C 449. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

2.3 FLEXIBLE ELASTOMERIC INSULATION MATERIALS

A. Flexible elastomeric preformed pipe insulation: Closed-cell, sponge- or expanded-rubber, ASTM C 534, Type I for tubular materials. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

B. Flexible elastomeric preformed fitting and valve covers: Closed-cell, sponge- or expanded-rubber, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

C. Flexible elastomeric insulation adhesive:

1. Water resistant contact cement designed especially suited for bonding two impermeable surfaces and recommended for rubber foam, steel, or aluminum surfaces, and compatible with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Foster 85-75 “Drion”.

D. Flexible Elastomeric Tape: Black, closed cell, self-adhering, elastomeric thermal insulation tape for insulating pipes and fittings, 0.125 inch (3 mm) thick, 2 inches (50 mm) wide, ASTM C 534, Type I — Grade 1. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

E. Flexible elastomeric insulation vapor barrier coating:

1. Water-based latex enamel coating for use over flexible elastomeric insulation, providing a moisture-resistant protective finish suitable for both indoor and outdoor applications. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Basis of design: Armacell “WB Armaflex” latex enamel.

2.4 FIELD-APPLIED JACKETS

A. Polyvinyl chloride (PVC) jacket:

1. Jacket material: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Color: White
3. Adhesive: As recommended by jacket material manufacturer. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
4. Fitting covers: Manufacturer’s factory-fabricated fitting covers made from the same material, finish, and thickness as the jacket, suitable to the size of fittings and thickness of insulation. Provide factory fabricated fitting covers for elbows, tees, flanges, unions, reducers, end caps, valves, and other fittings. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
5. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket and fitting covers with acrylic adhesive; suitable for indoor and outdoor applications, 2 inch (50 mm) width, 6 mil (0.15 mm) thickness. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

B. 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 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”.

2.5 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Fabric-reinforcing mesh:

1. Woven Glass-Fiber Fabric: Approximately 2 ounces per square yard (68 grams per square meter) for covering pipe and pipe fittings.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide interior piping insulation in accordance with the Minimum Insulation Thickness Schedule for Interior Applications at the end of this section, as modified by specifications for each location and type.

B. Provide field applied jackets in accordance with the Field-Applied Jacket Schedule at the end of this section, as modified by specifications for each location and type.

C. Provide mineral fiber insulation unless otherwise indicated.

D. Apply insulation in a neat and workmanlike manner and in accordance with manufacturer’s printed instructions.

E. Maintain a continuous vapor barrier on systems that convey fluid at below-ambient temperatures, including the following applications:

1. Domestic cold-water piping
2. Sanitary piping conveying equipment condensate

F. Where a continuous vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

G. Installation at pipe hangers:

1. Insulation shall be continuous through hangers for all piping systems.
2. Install pipe covering protection shields with thickness of structural insulation inserts equal, under load, to that of adjoining insulation.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
5. Shields and structural insulation inserts are specified in Section 220529, Hangers and Supports for Plumbing Piping and Equipment.

H. Where insulated piping systems pass through sleeves or openings in partitions and floors, the insulation shall be continuous through the sleeves and openings. See Firestopping specifications for coordinating insulation and firestopping.

I. Do not insulate chrome-plated piping connections to plumbing fixtures, except wheelchair-accessible lavatories shall be insulated with special insulation and finish assemblies specified in Section 224200.

J. Do not insulate exposed piping in kitchen areas.

K. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

L. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

M. Install insulation with longitudinal seams at top and bottom of horizontal runs.

N. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

O. Install insulation with least number of joints practical.

P. Finish installation with systems at operating conditions. Repair separations and cracking caused by thermal movement.

3.2 INSTALLING MINERAL FIBER INSULATION

A. Install insulation with factory-applied jackets as follows:

1. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive.

2. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.
3. Cover circumferential joints and longitudinal seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
4. Where a continuous vapor barrier is indicated, apply vapor-barrier mastic on longitudinal seams and circumferential joints and at ends adjacent to pipe flanges and fittings.
5. Repair damaged insulation jackets by applying same jacket material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere and seal patches.

B. Installation on fittings, valves, strainers, flanges, and unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate using mineral fiber preformed fitting and valve covers whenever possible. Install preformed fittings with adhesive.
3. Where mineral fiber preformed fitting and valve covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation. Coat with mastic. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
4. Valves: Insulate up to and including the bonnets, stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
5. Strainers: Insulate so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover.
6. Flanges and unions: Install preformed pipe insulation to outer diameter of flange or union. Make width of insulation section same as overall width of union or flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange or union insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
7. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

3.3 INSTALLING FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and circumferential joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Installation on fittings and flanges:

1. Install insulation over fittings and flanges with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate using flexible elastomeric preformed fitting covers whenever possible. Install preformed fittings with adhesive. Tape and seal with vapor barrier coating.
3. Where flexible elastomeric preformed fitting covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces and bonded with adhesive. Tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.
4. Flanges: Install pre-formed pipe insulation to outer diameter of pipe flange. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation. Secure insulation to flanges and tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.
5. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

3.4 INSTALLING FIELD-APPLIED JACKETS

A. Installing PVC jacket:

1. Provide jacket tight to insulation.
2. Provide with 1-inch (25-mm) overlap at longitudinal seams and circumferential joints.
3. For horizontal applications, install with longitudinal seams along top and bottom of pipes.
4. Seal with manufacturer’s recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under the jacket lap and another finish bead along each seam and joint edge.
5. Seams and joints shall completely prevent the entrance of water.

B. Installing canvas jacket: Adhere canvas jacket with lagging adhesive. Finish with lagging finish coating, ready for painting.

3.5 SCHEDULES

A. Minimum insulation thickness schedule for interior applications:

MINIMUM INSULATION THICKNESS SCHEDULE FOR INTERIOR APPLICATIONS (3)		
Application	Fluid Temperature Range	All Pipe Sizes
Domestic Hot Water & Domestic Hot Water Return Piping (2)	105F to 140F (40C to 60C)	1.5-inch (38 mm)
Domestic Cold OR Tempered Water Piping (1)	--	1-inch (25 mm)
Trap Priming Piping	--	1-inch (25 mm)
Sanitary Piping Conveying Water Below Ambient (1)	--	1-inch (25 mm)
(1) Contractor's Option within partitions only: 0.5-inch (13mm) flexible elastomeric insulation. (2) Contractor's Option within partitions only: 1-inch (25 mm) flexible elastomeric insulation for piping NPS 1.25 (DN 32) and smaller. (3) See additional specified thickness requirements for exterior applications.		

B. Field-applied jacket schedule:

Application	PVC Jacket	Canvas Jacket
Pipe insulation exposed in finished areas within 8 feet (2440 mm) of the finished floor	-	-
Pipe insulation exposed in finished areas more than 8 feet (2440 mm) above the finished floor	X	X
Pipe insulation exposed in mechanical rooms, penthouses, and other service areas not accessible to the public.	X	X

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Domestic cold water piping.

B. Domestic hot water piping.

C. Recirculated hot water piping.

D. Reverse osmosis water piping.

1.2 RELATED SECTIONS

A. Piping installation and testing: Section 220500.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings
2. ASME B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
3. ASME B16.24: Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500

B. American Society of Mechanical Engineers/American National Standards Institute

1. ASME/ANSI B16.1: Cast iron pipe flanges and flanged fittings
2. ASME/ANSI B16.5: Pipe flanges and flanged fittings

C. American Society of Testing and Materials

1. ASTM A 182: Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
2. ASTM A 240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
3. ASTM A 312: Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
4. ASTM A 403: Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
5. ASTM A 536: Standard Specification for Ductile Iron Castings

6. ASTM B 75: Standard Specification for Seamless Copper Tube
7. ASTM B 88: Standard Specification for Seamless Copper Water Tube
8. ASTM B 584: Standard Specification for Copper Alloy Sand Castings for General Applications

D. National Sanitation Foundation/American National Standards Institute

1. NSF/ANSI 61: Drinking Water System Components – Health Effects
2. NSF/ANSI 372: Drinking Water System Components – Lead Content

1.4 DEFINITIONS

A. Domestic water system: Potable water system for general human use, including hot and cold water supply and return.

1.5 SUBMITTALS

A. Product data: Each type of pipe and fitting included in the project.

1. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.

B. Certifications: Disinfection test report

C. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

1.6 QUALITY ASSURANCE

A. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61, NSF/ANSI 372 with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.

B. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.

C. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

D. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label directly on the pipe, indicating compliance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SUPPLIERS

A. Disinfection of domestic water system:

1. ARC Water Treatment Company, Inc.
2. Ecolab
3. Water Chemical Services, Inc.
4. Olin Water Services

2.2 ABOVE GROUND PIPE

A. Copper: ASTM B 88, Type L hard drawn.

B. Stainless steel: ASTM A 312, Type 304L, Schedule 10S.

2.3 ABOVE GROUND FITTINGS

A. General requirements for fittings:

1. Elbows in piping NPS 4 (DN 100) and larger shall be long radius type.

B. Rolled groove mechanical couplings and fittings for stainless steel pipe:

1. General:

a. UL classified in accordance with ANSI/NSF 61 for potable water service.
b. Capable of withstanding 300 psi (2,068 kPa) working pressure for NPS 8 (DN 200) and smaller piping at 180 degrees F (82 degrees C).
c. Manufactured in ASTM A 312 stainless steel pipe sizes.
d. Mechanical-T outlets are not permitted.

2. Grooved-end fittings:

a. Schedule 10S, Type 304L stainless steel roll grooved from material conforming to ASTM A 403, or pipe conforming to ASTM A 312, or sheet conforming to ASTM A 240.
b. Construct to accept grooved-end couplings of same manufacturer.
c. Reducing couplings not permitted; use reducing fittings at changes in pipe size.
d. Basis of design: Victaulic stainless steel OGS fittings.

3. Rigid type couplings:

    a. Housing: ASTM A 536 ductile iron two-piece cast housing, secured with carbon steel nuts and bolts, coated with blue colored alkyd enamel.
    b. Gasket: Fluoroelastomer blend suitable for potable water service.
    c. Basis of design: Victaulic Style 807.

4. Mechanical flange adapter nipples:

    a. Pipe nipple: ASTM A 312 Schedule 10S Type 304L stainless steel.
    b. Flange: ASTM A 182, Type 304L stainless steel, raised face, ASME/ANSI B16.5 Class 150.
    c. Gasket: Fluoroelastomer blend suitable for potable water service.
    d. Basis of design: Victaulic Style 445R.

C. Cast or wrought fittings for copper pipe:

1. General: Solder joint, cast brass, ASME B16.18; or wrought copper, ASME B16.22.
2. Flanges: Bronze, solder type, ASME B16.24, Class 150.

D. Rolled groove mechanical couplings and fittings for copper pipe:

1. General:

    a. UL classified in accordance with ANSI/NSF 61 for potable water service.
    b. Capable of withstanding 300 psi (2,070 kPa) working pressure at 180 degrees F (82 degrees C).
    c. Manufactured in copper tube sizes.
    d. Mechanical-T outlets are not permitted.

2. Grooved-end fittings:

    a. ASME B 16.22 wrought copper and ASTM B 75 copper tube, or ASTM B 16.18 and ASTM B 584 bronze casting.
    b. Construct to accept grooved-end couplings of same manufacturer.
    c. Reducing couplings not permitted; use reducing fittings at changes in pipe size.
    d. Basis of design: Victaulic grooved fittings for copper.

3. Rigid type couplings:

    a. Housing: ASTM A 536 ductile iron two-piece cast housing, secured with carbon steel nuts and bolts, coated with copper colored alkyd enamel.

b. Gasket: Fluoroelastomer blend suitable for potable water service.
c. Basis of design: Victaulic Style 607.

4. Mechanical flange adapters:

a. Flange adapter: ASTM A 536 ductile iron, hinged two-piece design with electroplated steel bushing, ASME/ANSI B16.1 Class 125 and ASME/ANSI B16.5 Class 150, coated with copper colored alkyd enamel.
b. Gasket: Fluoroelastomer blend suitable for potable water service.
c. Basis of design: Victaulic Style 641.

PART 3 - EXECUTION

3.1 GENERAL

A. Install domestic water piping as shown on the drawings and in accordance with the provisions of Section 220500, Common Work Results for Plumbing.

B. Install piping in accordance with the Schedule of Pipe Systems, Sizes, and Materials at the end of this section.

C. Provide drain valves at low points of domestic water system for drainage.

3.2 INSTALLING DIELECTRIC ISOLATION

A. Provide dielectric flanges with isolation sleeves for bolts and isolation washers on each side of flanged connection at flanged points of connection between ferrous piping and copper piping.

3.3 INSTALLING GROOVED JOINTS

A. Install grooved joints in accordance with the manufacturer’s latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks. Gaskets shall be molded and produced by the coupling manufacturer, and shall be verified as suitable for the intended service.

B. A factory-trained field representative (direct employee) of the mechanical joint manufacturer shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. The factory-trained representative shall periodically review the product installation and ensure best practices are being followed. Contractor shall remove and replace any improperly installed products. A distributor’s representative is not considered qualified to conduct the training.

3.4 TESTING OF DOMESTIC WATER SYSTEM

A. When domestic water piping is completed, and before strainer baskets are installed, pressure test at the pressure shown in Piping Test Table in Section 220500.

3.5 CLEANING OF DOMESTIC WATER SYSTEM

A. Flushing of new piping segments:

1. Flush new domestic cold water, domestic hot water, recirculated hot water, and tempered water piping before using. Unless prescribed otherwise by the county or state health department, the method of flushing shall be as follows:
2. Do not allow flushing water for piping to travel through plumbing equipment. Isolate equipment by closing isolation valves and opening bypass valves or by leaving piping disconnected from equipment.
3. Flush new piping after new piping has been completed and prior to connection to existing building systems.
4. Flush new piping segments as the work progresses.
5. Provide temporary domestic water and drain piping as needed. Remove when flushing is complete.
6. Drain water from the segment low point to a safe location and replace water at the same rate.
7. Continue until drain water is free from sediment, scale, rust and other foreign substances.
8. Flush every new branch of piping, for a minimum of 15 minutes after running clean.
9. Install strainer baskets.
10. Disinfect piping segment as described below.

B. Disinfection of new piping segments:

1. Disinfect domestic cold water, domestic hot water, recirculated hot water, and tempered water piping before using. Unless prescribed otherwise by the county or state health department, the method of flushing shall be as follows:
2. Disinfect new piping after new piping has been completed and flushed, and prior to connection to existing building systems.
3. Provide temporary domestic water and drain piping as needed. Remove when disinfection is complete.
4. Through NPS 0.75 (DN 20) hose connections in the main or mains, pump in sodium hypochlorite to produce a free available chlorine residual of not less than 200 ppm. Provide plumbing connections and power for pumping chlorine into the system.

5. Fill all piping systems with chlorinated water. If water used to fill new piping comes from the existing building, provide temporary reduced pressure principal backflow prevention or an air gap to keep the systems isolated.
6. Proceed downstream from the point of chlorine application, opening each water source for each faucet and outlet until chlorine is detected at a concentration of 200 ppm. Close each water source for each faucet and outlet when chlorine is evident at the required concentration.
7. Provide a means of filling domestic hot water return piping with chlorinated water at a concentration of 200 ppm.
8. Retain this water in the system for at least three hours, but no more than 3.5 hours.
9. At the end of the retention period, verify that no less than 100 ppm of chlorine are present at the most remote end of the system.
10. Open all faucets and outlets and flush all piping until the chlorine residual in the water is less than 1 ppm.
11. Obtain a representative water sample from the system for analysis by a recognized bacteriological testing laboratory.
12. If the sample tested for coliform organisms is negative, the testing organization shall submit a letter and laboratory report to the Contractor, certifying successful completion of the disinfection. Submit the letter and report.
13. If any samples tested indicate the presence of coliform organisms, repeat the entire disinfection procedure.

3.6 SCHEDULE OF PIPE SYSTEMS, SIZES AND MATERIALS

A. Pipe schedules apply to domestic cold water, domestic hot water, domestic hot water return, and domestic temper water piping.

B. Above ground piping:

	Copper Type L cast or wrought fittings	Stainless steel
NPS 2.5 (DN 65) and smaller	X	
All downstream piping associated with RO system		X

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Backflow preventers.

B. Strainers.

C. Trap primers.

D. Water hammer arrestors (shock absorbers).

E. Thermostatic water temperature controllers.

1.2 RELATED SECTIONS

A. Piping:

1. Domestic water piping: Section 221116.

B. Insulation: Section 220719.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI B1.20.1: Pipe Threads, General Purpose, Inch.
2. ANSI B 16.22: Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
3. ANSI Z21.22: Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:

1. ASME A112.1.2: Air Gaps in Plumbing Systems (For Plumbing Fixtures and
2. Water-Connected Receptors).
3. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.
4. ASME B16.22: Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. American Society of Sanitary Engineering:

1. ASSE 1001: Performance Requirements for Atmospheric Type Vacuum Breakers.
2. ASSE 1010: Performance Requirements for Water Hammer Arresters.

3. ASSE 1011: Performance Requirements for Hose Connection Vacuum Breakers
4. ASSE 1015: Performance Requirements for Double Check Backflow Prevention Assemblies.
5. ASSE 1024: Performance Requirements for Dual Check Backflow Prevention Assemblies.
6. ASSE 1017: Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
7. ASSE 1044: Performance Requirements for Trap Seal Primer – Drainage Types and Electric Design Types.
8. ASSE 1052: Performance Requirements for Hose Connection Backflow Preventers
9. ASSE 1070: Performance Requirements for Water Temperature Limiting Devices.
10. ASSE 1071: Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment.

D. American Society for Testing and Materials:

1. ASTM B88: Standard Specification for Seamless Copper Water Tube.
2. ASTM B584: Standard Specification for Copper Alloy Sand Castings for General Applications.

E. PDI-WH 201: Water Hammer Arresters.

F. NSF/ANSI 61: Drinking Water System Components – Health Effects.

1.4 SUBMITTALS

A. Product data: Each specialty device or equipment, with installation instructions.

B. Certification that products comply with NSF/ANSI 61.

1.5 QUALITY ASSURANCE

A. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.

B. Acceptance product marking: NSF®-61.

C. Minimum working pressure: 125 psi (860 kPa) unless otherwise indicated.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Acceptable Manufacturers

1. Ames
2. Febco
3. Watts Industries
4. Zurn-Wilkins

2.2 STRAINERS

A. Acceptable Manufacturers

1. Keckley
2. Mueller Steam Specialty
3. Spirax Sarco Inc.
4. Tate Andale, Inc. “Guardian”
5. Watts Industries, Inc.

B. Minimum pressure rating: 125 psi (860 kPa)

C. Y-type strainers: Include with plugged blow-down connections and stainless-steel strainers with maximum 0.045-inch (1.2-mm) perforations.

1. Pipe sizes NPS 2.0 (DN 50) and smaller: Brass body, threaded ends.

a. Basis of design: Watts Series LF777SI.

2. Pipe sizes NPS 2.5 (DN 65) and larger: Stainless steel body, flanged ends.

a. Basis of design: Watts Series 77F-CSSI.

2.3 TRAP PRIMERS

A. Automatic inline trap primers:

1. Acceptable Manufacturers:

a. Jay R. Smith Manufacturing Company
b. MIFAB Inc.
c. Precision Plumbing Products

d. Sloan Valve
e. Watts Industries
f. Zurn Plumbing Products

2. Automatic inline Trap primer valve: ASSE 1044, equal to Precision Plumbing Products "Mini-Prime Electronic Trap Priming System," factory assembled unit consisting of the following:

a. Pre-set 24-hour timer that actuates a solenoid valve 6 seconds every 24 hours providing 2.0 ounces discharge at 20 psi inlet pressure.
b. NPS 0.50 (DN 15) copper inlet connection.
c. NPS 0.50 (DN 15) copper outlet connection.
d. Distribution Unit: Connects directly to the primer valve with up to four 0.375-inch compression outlet fittings for NPS 0.50 (DN 15) copper tubing.
e. Provide a steel box and accessible cover.
f. Electrical: 120 volt, single phase, 60 Hertz, single-point power supply, circuit breaker, manual override switch and test button.

B. Trap primer piping:

1. Above grade piping exposed in bathrooms and finished areas: Chrome-plated copper tubing and fittings.
2. Above grade piping concealed or exposed in mechanical rooms or mechanical closets: Soft copper tube, ASTM B 88, Type L with ASME B16.18 cast copper or ASME B16.22 wrought copper fittings, solder joints.

2.4 WATER HAMMER ARRESTORS

A. Acceptable Manufacturers:

1. MIFAB, Inc.
2. Josam Company
3. Jay R. Smith Manufacturing Company
4. Wade
5. Watts Drainage
6. Zurn Plumbing Products

B. ASSE 1010 or PDI-WH 201 certified:
1. Construction: Metal bellows or copper tube with piston.
2. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.5 THERMOSTATIC WATER TEMPERATURE CONTROLLERS

A. Acceptable manufacturers:

1. Powers Regulator Company
2. Lawler Manufacturing Company, Inc.
3. Leonard Valve Company
4. Symmons Industries, Inc.

B. General:

1. Provide units of sizes, capacities, and piping arrangements as indicated on the drawings.
2. Construction: Copper or bronze body with corrosion-resistant interior components.
3. Minimum pressure rating: 125 psi (860 kPa).
4. Paraffin-based thermal actuation technology to sense and adjust outlet temperature with vandal-resistant locking mechanism to secure temperature setting.
5. Maximum water pressure drop at design flow rate: 10 psi (70 kPa).
6. Set units for the discharge temperatures specified below unless otherwise indicated on the drawings.

C. Master thermostatic water tempering valves:

1. ASSE 1017 listed.
2. Union and check stop at each inlet.
3. Discharge temperature adjustment range: 90 - 160 degrees F. Set at 120 degrees F.
4. Rigid bulb indicating thermometer at supply outlet; 3-inch dial graduated 30 degrees to 130 degrees F, stainless-steel, hermetically-sealed with external calibration screw.
5. Minimum controllable flow rate without recirculation: 3.0 gpm (11.4 l/m).
6. Rough bronze finish.
7. Basis of design: Lawler Manufacturing Company Inc. Model 801.

PART 3 - EXECUTION

3.1 INSTALLING BACKFLOW PREVENTERS

A. Install backflow preventers in the building water supply piping where indicated. Comply with requirements of authorities having jurisdiction.

B. Do not install bypass piping around backflow preventers.

3.2 INSTALLING STRAINERS

A. Install Y-pattern strainers on the supply side of each control valve, water pressure reducing valve, solenoid valve, pump, and where indicated on the drawings.

3.3 INSTALLING TRAP PRIMERS

A. Automatic inline trap primers:

1. Install level and plumb to ensure equal flow distribution to all primer lines.
2. Install automatic trap primers where indicated on drawings.
3. Locate trap primers above the floor level of the drains they serve.
4. Locate trap primers in janitor's closets, storage rooms, or other spaces accessible to maintenance personnel. If these locations are not possible, mount in accessible locations concealed above ceilings or, where indicated, provide chrome-plated primers below lavatories.

B. Trap primer piping:

1. Provide trap primer piping full size of trap primer outlet connection or larger. Provide a union at the connection.
2. Provide trap primer piping concealed wherever possible.
3. Pitch piping continuously down toward drains at minimum 1.0 percent slope.
4. Connect to floor drain trap primer fittings. Transition to full size of floor drain connection.
5. Replace kinked piping.
6. Sleeve and seal piping at floor penetrations.

3.4 INSTALLING WATER HAMMER ARRESTORS

A. Size and locate water hammer arrestors as recommended by the Plumbing and Drainage Institute Standard PDI-WH 201 or ASSE 1010.

1. Install water hammer arrestors in each branch domestic water pipe (hot and cold) which feeds either a battery of fixtures or a single fixture.
2. Install water hammer arrestors upstream of quick-closure valves.
3. Install water hammer arrestor in accessible locations.

3.5 INSTALLING WATER TEMPERATURE CONTROLLERS

A. Install and connect controllers as shown on the drawings and in compliance with the manufacturer's recommendations.

B. Adjust controllers to specified supply temperatures or as indicated on the drawings.

END OF SECTION 221119

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. In-line circulator pumps.

1.2 RELATED SECTIONS

A. UL label, demonstration, training, and equipment installation: Section 220500.

B. Motors: Section 220513.

C. Equipment supports: Section 220529.

1.3 SUBMITTALS

A. Product data: Include certified performance curves and rated capacities of selected models; shipping, installed, and operating weights; furnished specialties; and accessories for each type and size of pump specified. Indicate pumps' operating point on curves.

1. Certification that products comply with NSF/ANSI 61 and NSF/ANSI 372.

B. Shop drawings: Show layout and connections for pumps. Include setting drawings with templates, directions for installation of foundation and anchor bolts, and other anchorages.

1. Wiring diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance data: For each pump specified, to include in maintenance manuals specified in Division 01 and Section 220101

1.4 REFERENCES

A. American Society of Mechanical Engineers/American National Standards Institute

1. ASME/ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

B. American National Standards Institute/ American Society of Heating, Refrigerating, and Air-Conditioning Engineers/ Illuminating Engineers Society

1. ANSI/ASHRAE/IES Standard 90.1-2016 -- Energy Standard for Buildings Except Low-Rise Residential Buildings

C. NSF International/American National Standards Institute

1. NSF/ANSI 61 - Drinking Water System Components – Health Effects
2. NSF/ANSI 372 - Drinking Water System Components, Lead Content

D. Underwriters Laboratories

1. UL 508 - Standard for Industrial Control Equipment
2. UL 778 - Standard for Motor-Operated Water Pumps

1.5 QUALITY ASSURANCE

A. UL label: As specified in Section 220500, Common Work Results for Plumbing.

B. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 and NSF/ANSI 372 with requirements for "lead-free" plumbing as defined by state laws and U.S. Safe Drinking Act.

C. Acceptance product marking: NSF®-61 and NSF®-372 (or NSF®-61-G) or other accepted certifier marks demonstrating third party certification with these requirements.

D. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

E. Comply with the most recent version of ANSI/ASHRAE/IES Standard 90.

F. Department of Energy (DOE) compliance: Pump manufactures shall comply with US Department of Energy (DOE) energy conservation standard that pertains to applicable pumps with 1 horsepower or greater. These pumps shall be evaluated using the Pump Energy Index (PEI) that determines the efficiency rating and DOE compliance. The lower the number the higher the efficiency.

1. Pumps shall have a PEI rating of 1 or less to comply with the standard.
2. The PEI compliant rating shall appear on the pumps permanent nameplate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specified 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 220101, and submit shop drawings as specified in the “Submittals” article above.

B. In-line circulator pumps:

1. Armstrong Fluid Technology
2. Bell and Gossett, a xylem brand
3. Crane Pumps and Systems
4. Grundfos Pumps Corporation
5. Taco Comfort Solutions

2.2 PUMPS, GENERAL

A. Pumps shall comply with the DOE Energy Conservation Standard with a PEI rating of 1 or less.

2.3 IN-LINE CIRCULATOR PUMP

A. Provide a cartridge type circulator of size scheduled on the drawings. “Low lead” bronze or stainless-steel body, stainless-steel cartridge with non-metallic impeller, ceramic shaft, carbon bearings and EPDM seals.

1. Basis of design: Taco Comfort Solutions Series 00.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install equipment as indicated on the drawings. Comply with requirements in Section 220500.

3.2 INSTALLING IN-LINE CIRCULATOR PUMP

A. Support:

1. Support in line circulator pumps from piping.

2. Provide support for piping near the pump inlet and the pump outlet.
3. Provide hangers with sufficient capacity to support the piping and the pump.
4. Provide additional support for pump and motor where required by the manufacturer's recommendations.

B. Provide center-guided, spring-loaded silent-action check valves in discharge piping.

C. Provide valves for pump isolation on the suction and discharge side of each pump.

D. Provide gauge taps in the piping at the inlet and outlet of each pump.

3.3 OPERATING INSTRUCTIONS

A. As specified in Section 220500, provide operating instructions.

END OF SECTION 221123

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary piping

B. Equipment drains

1.2 RELATED SECTIONS

A. Piping installation and testing: Section 220500.

B. Sanitary waste piping specialties: Section 221319.

1.3 REFERENCES

A. Cast iron piping standards

1. ASTM A 74: Standard Specification for Cast Iron Soil Pipe and Fittings
2. ASTM A 283: Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
3. CISPI 301: Standard Specification for hubless cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications

B. Copper (DWV) piping standards

1. ANSI/ASME B16.29: Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fitting: DWV
2. ASME/ANSI B16.23: Cast Copper Alloy Solder Joint Drainage Fittings: DWV
3. ASTM B 306: Standard Specification for Copper Drainage Tube (DWV)

C. Copper Type L and M piping standards

1. ASME/ANSI B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings
2. ASME/ANSI B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
3. ASTM B 88: Standard Specification for Seamless Copper Water Tube

1.4 SUBMITTALS

A. Product data: Each specified material and product.

B. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

1.5 QUALITY ASSURANCE

A. Cast iron pipe and fittings shall be marked with the collective trademarks of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.

B. Prior to any new piping installation, verify the inverts of piping to which new work is to be attached. Demonstrate to the satisfaction of the construction manager and/or COTR, that the connections to existing sanitary pipes meet the intent of the contract.

C. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label, directly on the pipe, indicating compliance.

D. Clean, rod, and flush existing sanitary piping as necessary to maintain gravity flow.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Install each type of pipe and fittings in locations required or permitted in Part 3, including the Pipe Installation Schedule at the end of the section.

B. Cast-iron no-hub pipe and fittings:

1. Pipe and fittings: Cast Iron Soil Pipe Institute Standard 301.
2. Joints: Use one of the no-hub coupling options below

a. Hymax 2 Coupling

(1) Exceeds AWWA C-219, NSF61 and NSF 372 compliant.
(2) ASTM A283 end rings.
(3) ASTM A53 Grade A steel center ring.
(4) EPDM gaskets compounded for gravity water and sewage, meets international standards for contact with drinking water.
(5) SS316 stainless steel bridge.
(6) SS316 stainless steel spherical spacers.
(7) Final fusion bonded epoxy for enhanced corrosion protection coating.
(8) SS316 stainless steel, rolled thread and anti-galling coating nuts and bolts.

C. Copper tube (DWV) pipe and fittings:

1. Pipe: copper tubing Type DWV, ASTM B 306
2. Fittings: Wrought copper drainage fittings and soldered joints conforming to ASME/ANSI B16.29 or cast-brass fittings conforming to ASME/ANSI B16.23.

D. Copper Type L and M pipe and fittings:

1. Pipe: ASTM B 88, Type L or M, hard drawn.
2. Fittings: Solder joint, cast brass, ASME B16.18; or wrought copper, ASME B16.22.

PART 3 - EXECUTION

3.1 PREPARATION

A. Connect piping as shown on the drawings. Check elevations of connection points before installing new work.

3.2 INSTALLATION, GENERAL

A. Use suitable tools and appliances for the safe and convenient handling and laying of pipe. Examine each section of pipe for defects. Do not lay any piece that is known to be defective. If any defective piece should be discovered after having been laid, remove and replace it at no change to the contract price.

B. Install piping in accordance with the Pipe Installation Schedule at the end of this section, as indicated on the drawings, and in accordance with Section 220500, Common Work Results for Plumbing. Materials and work shall conform to local plumbing codes and health department regulations.

C. Thoroughly clean all pipe and fittings before installing them, and keep them clean until the acceptance of the completed work. Cap or plug ends of lines to prevent debris from entering during construction.

3.3 INSTALLING CAST-IRON PIPING

A. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings." Install restraint assemblies at pipe couplings and fittings for piping NPS 5 (DN 125) and larger.

3.4 INSTALLING COPPER PIPING

A. Install aboveground copper tubing according to Copper Development Association, Inc. (CDA) "Copper Tube Handbook."

3.5 INSTALLING SANITARY AND VENT PIPING

A. Make changes in direction of sanitary piping with approved sanitary fittings, Y branches, 1/8 or 1/16 bends.

B. In soil, waste, and vent stacks where branches occur that are smaller than stacks, provide properly sized reducing fittings.

C. Provide sanitary piping at a 2 percent minimum downward slope in the direction of flow unless otherwise indicated.

D. Provide vent piping at a 1 percent minimum downward slope toward vertical fixture vent or toward vent stack.

E. Provide sanitary vent termination height above the finished roof level at the minimum required per the applicable plumbing code, or as directed by the building inspector.

F. Provide sanitary vent terminations a minimum of 10 feet (3 meters) away from outside air intakes, or further where indicated on drawings.

3.6 CONNECTING TO EXISTING PIPING

A. Clean the inside of existing piping at connections to new piping using a water blasting device.

B. Blasting device: Flexible high-pressure hose with self-propelling nozzle which blasts to front, sides, and rear (propulsion).

C. Operation: Blasting device is operated with water at 15,000 psi (10^7 kPa). The piping system being cleaned is not pressurized.

D. Clean from the connection point to at least 5 feet (1.5 m) outside the exterior building wall.

3.7 SCHEDULES

A. Sanitary pipe installation schedule.

SANITARY PIPE INSTALLATION SCHEDULE Contractor has option where more than one x appears on a line			
MATERIAL TYPE			
Application	Cast-iron no-hub	Copper tube (DWV)	Copper type L or M
Sanitary, concealed within walls, partitions, or ceiling space	X		
Sanitary, interior exposed	X		
Sanitary, accessible pipe or crawl space	X		
Indirect waste piping		X	X
Miscellaneous drains from equipment		X	X
All information in this schedule is subject to local plumbing code and health department requirements.			

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Drains and cleanouts.

B. Flashing material.

C. Automatic Fats/Oils/Grease Interceptor.

D. Air admittance valve.

1.2 RELATED SECTIONS

A. Piping: Section 221316.

B. Insulation: Section 220719.

1.3 SUBMITTALS

A. Product data: Each specialty device or equipment, with installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Model numbers are provided 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 the acceptable manufacturers listed.

B. Drains and cleanouts:

1. Josam Company
2. Jay R. Smith Manufacturing Company
3. MIFAB, Inc.
4. Wade
5. Watts Drainage
6. Zurn Plumbing Products

C. Automatic Fats/Oils/Grease interceptors:

1. Thermaco Inc.
2. Environmental Products and Services Ltd.
3. Grease Guardian

D. Air Admittance Valve

1. IPS Corporation Studor
2. Oatey Company
3. Sioux Chief

2.2 FLOOR DRAINS AND FLOOR SINKS

A. Those installed in slabs on grade and above crawl space do not require flashing clamp devices. All others shall have flashing clamp devices.

1. Equal to the Zurn catalog numbers noted on drawings.

B. Floor drain P traps shall be deep seal type where trap primers are not installed.

C. Floor sinks shall have acid-resistant porcelain enamel interior finish with internal aluminum dome strainers.

2.3 FLEXIBLE FLASHING

A. Polyvinyl chloride sheet, flexible, waterproof, unreinforced, 40 mil minimum thickness, intended for use as a drain flashing.

2.4 CLEANOUTS

A. Cleanouts: Those installed in slab on grade and in slab above crawl spaces do not require membrane flashing device. All others shall have flashing devices.

B. In sanitary lines:

1. Exposed piping:

a. Coated cast-iron cleanout tee with slotted ABS cleanout plug.
b. Basis of design: Zurn Z-1445.

2. Concealed piping:

a. Coated cast-iron cleanout tee with slotted ABS cleanout plug and polished bronze cover.
b. Basis of design: Zurn ZB-1446.

3. Concealed piping where more than 8 inches (205 mm) back from finished wall line: Install a sanitary 90 degrees long turn Y fitting with slotted ABS cleanout plug extended out to finish 1 inch (25 mm) behind finished wall.

a. Provide with 9 by 9 inch cover plate (access panel) with vandal-proof screws.

(1) Basis of design: Zurn Z-1460.

C. In underfloor sanitary lines: (See Floor Finish Schedule) All units complete with adjustable floor cleanout, coated cast-iron body, and slotted ABS threaded plug.

1. In storage areas with plain or painted concrete floors: Polished bronze light-duty top.

a. Basis of design: Zurn ZB-1400.

2. In exposed areas with plain or painted concrete floors: Polished nickel bronze light-duty top.

a. Basis of design: Zurn ZN-1400.

3. In resilient tile floors: Polished nickel bronze light-duty square top recessed for 1/8-inch tile.

a. Basis of design: Zurn ZN-1400-TX.

4. In ceramic tile floors: Polished nickel bronze light-duty square top.

a. Basis of design: Zurn ZN-1400-T.

2.5 AUTOMATIC FATS/OILS/GREASE INTERCEPTOR

A. Stainless-steel fats/oils/grease recovery system, tested and certified in accordance with PDI G101 as a fats, oils, and grease (FOG) disposal system discharging 100 mg/1 or less of FOG.

B. Performance and Capacity: As noted on drawings.

C. Fully constructed of corrosion resistant materials.

D. Integrated motor/grease outlet/heater/lid enables fast, do it yourself unit operation reversal.

E. Advanced odor protection. Quick release stainless steel lid clamps, fully removeable integral polymer/304 grade stainless steel lid with magnetic lid tensioners, internal stainless steel strainer basket for collection of coarse solids. Carbon vent filter, furnish initial filter and three replacements.

F. Construction:

1. Exterior – stainless steel, bright finish, injection molded polymer.
2. Interior – rotationally molded polyethylene.

G. Electrical:

1. 115 VAC, 60 HZ, 1173 Watts (10.2 amps)
2. 8-foot long electrical cord with three prong grounding plug.

H. Operation:

1. One rotating gear oleophilic/hydrophobic skimming wheel assembly for automatic fats/oils/grease removal with flow control device, self-regulating electric immersion heater with thermostat control. Wheel skims fats/oils/grease from surface and transports it to a unit mounted collection container.

I. Standards:

1. Plumbing and Drainage Institute PDI-G-101.
2. ASME A112.14.3.

J. Basis of Design: Thermaco Big Dipper Model No. W-500-IS.

2.6 AIR ADMITTANCE VALVE

A. Air admittance valve shall be designed for single fixture Type A or branch piping Type B, ASSE 1051, plastic housing, mechanical sealing diaphragm, same size as connected fixture, or branch vent piping.

PART 3 - EXECUTION

3.1 INSTALLING FLOOR DRAINS AND FLOOR SINKS

A. Where floor drains are over occupied areas, flash them with flashing specified in this section, single piece for each drain, 30 by 30 inches (762 by 762 mm) with opening cut in center to suit clamping device of drain. Adhere flashing to substrate with adhesive and secure to clamping device of drain. Ascertain that weep holes from drainage pan are open.

B. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated. See architectural plans for additional information about slopes of floors.

C. Floor drains and floor sinks shall be provided with standard cast-iron P traps with primer connections. Except where floor drain or floor sink p-trap is not primed provide deep seal p-trap.

D. Floor drains and floor sinks shall be provided with trap primers where indicated on drawings.

1. Refer to Section 221119, Domestic Water Piping Specialties, for trap primers.

E. Floor drains shall be covered until placed in service to prevent the entrance of any foreign matter.

3.2 INSTALLING CLEANOUTS

A. Install cleanouts at base of each vertical, soil, waste, and vent stack, in the vertical piping.

B. Cleanouts shall be the same size as the pipe into which they are installed, except no cleanout shall be larger than NPS 4 (DN 100).

C. Install cleanouts in horizontal piping where indicated on drawings. Where cleanouts occur directly below a floor, the cleanout shall terminate with top flush with floor. Provide for the floor finish to be installed on the cleanout cover, and separated from surrounding material. Install carpet markers after carpet installation is completed. Install ceramic tile and terrazzo per manufacturer’s instructions.

D. Where cleanouts are over occupied areas, flash them with flashing specified in this section, single piece for each cleanout, 30 by 30 inches with opening cut in center to suit clamping device of cleanout. Adhere flashing to substrate with adhesive and secure to clamping device of cleanout by the same method specified for floor drains.

3.3 INSTALLING AUTOMATIC FATS/OILS/GREASE INTERCEPTORS

A. Install between waste lines and sanitary sewer connection as shown on the drawings.

B. Install automatic fats/oils/grease interceptor in accordance with manufacturer's instructions and as indicated on the drawings. Mount approved operating and maintenance instructions in a frame with clear plastic protection cover securely to wall beside unit with four tamperproof screws.

END OF SECTION 221319

SECTION 223300 - STORAGE ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Commercial, storage electric domestic water heaters.

1.2 RELATED SECTIONS

A. UL label, demonstration, training, and equipment installation: Section 220500.

B. Expansion tanks: Section 220509.

C. Equipment supports: Section 220529.

1.3 REFERENCES

A. ANSI Z21.22: Relief Valves for Hot Water Supply Systems.

B. ASHRAE 90.1: Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings.

C. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

D. NSF/ANSI 61: Drinking Water System Components – Health Effects.

E. UL 174: UL Standard for Safety Household Electric Storage Tank Water Heaters.

F. UL 1453: UL Standard for Safety Electric Booster and Commercial Storage Tank Water Heaters.

1.4 SUBMITTALS

A. Product data: Each type and size water heater. Include nominal capacity and pressure rating; shipping, installed, and operating weights; and specialties and accessories furnished for this project. Indicate dimensions, wall thicknesses, required clearances, method of assembly, and piping connections.

B. Certification that the water heater and fittings comply with NSF/ANSI 61.

C. Include product data which verifies compliance with the energy performance requirements of ASHRAE 90.1,

D. Include operation and maintenance instructions and parts list for each type of water heater.

1.5 QUALITY ASSURANCE

A. UL label: As specified in Section 220500, Common Work Results for Plumbing.

B. Each water heater shall meet the energy performance requirements of ASHRAE 90.1.

C. ASME compliance: Fabricate and label water heater, hot-water storage tanks to comply with ASME Boiler and Pressure Vessel Code.

D. Potable water system components intended to dispense water for human consumption, including pipe and joining materials, shall comply with NSF/ANSI 61 with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.

E. Acceptance product marking: NSF®-61.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the scheduled products, or comparable product by of the following:

B. Storage domestic electric water heaters:

1. A.O. Smith Corporation
2. Hubbell
3. State Industries, Inc.

2.2 STORAGE ELECTRIC DOMESTIC WATER HEATER

A. Provide unit of size, input, and recovery ratings shown on the drawings.

B. Unit construction:

1. Maximum working pressure: 150 psi (1034 kPa).
2. Ball-type drain valve.
3. Listed and labeled in accordance with UL 174.

4. Control compartments for service and maintenance through front.
5. Inlet carries entering cold water to bottom of tank.

C. Performance requirements:

1. Meet or exceed the energy performance requirements of ASHRAE 90.1.

D. Tank interior:

1. All internal surfaces exposed to water protected with glass heat-fused to the steel.
2. Provide anode rods for cathodic protection.

E. Insulation: Manufacturer's standard fiberglass or foam insulation.

F. Exterior jacket: Steel with manufacturer's standard baked enamel finish over bonderized undercoating.

G. ASME-rated temperature and pressure relief valve set at 125 psi (862 kPa) and 210 degrees F (98.9 degrees C) unless otherwise noted and capacity compatible with the water heater provided.

H. Heating element and controls:

1. Combination thermostat and high-temperature-limit control.
2. Copper heating elements.

I. Basis of design: A.O. Smith DEL.

2.3 WATER HEATER SPECIALTIES

A. Vacuum relief valve: Designed for vacuum relief in hot water tanks and heaters, ANSI Z21.22, brass body, high-heat-resisting disk.

1. Working pressure: At least 200 psi (1379 kPa).
2. Temperature rating: At least 250 degrees F (121.1 degrees C).
3. Operation: Closes under pressure and opens on a vacuum of not more than 0.5 inches of mercury (1.7 kPa).
4. Basis of design: Watts No. LFN36.

B. Water heater drain pan: Designed for emergency leak of water heater tank and discharge of temperature and pressure relief valve.

1. Material: Aluminum alloy, 0.0255 inches thick.

2. Diameter: 30-inches.
3. Depth: 2.5-inches.
4. Drain body adapter configuration: CPVC, 1-inch by 1-inch IPS hub.
5. Lock nut: Steel, zinc plated.
6. Flange gasket: Neoprene
7. Basis of design: Holdrite QP-30.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment as indicated on the drawings. Comply with requirements in Section 220500.

B. Plug all unused tappings.

C. Provide temperature and pressure relief valves. Extend relief valve outlet with water piping in continuous downward pitch and discharge to water heater drain pan.

D. Provide vacuum relief valves.

E. Provide drain piping.

F. Where water heaters are installed above space occupied by other tenants of a building or where a water heater leak could cause extensive damage, provide the following as detailed on the drawings:

1. A drip pan.
2. A moisture detector with connections to domestic water solenoid valves and a building automation system alarm.
3. Solenoid valves in the domestic water connections to the water heater.

3.2 MANUFACTURER'S FIELD SERVICE

A. Provide manufacturer's startup and adjustment for water heaters.

3.3 OPERATING INSTRUCTIONS

A. As specified in Section 220500, provide operating instructions.

END OF SECTION 223300

SECTION 224200.09 - PLUMBING FIXTURES – EMERGENCY FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Emergency plumbing fixtures and trim, fittings, and related components.

1.2 RELATED SECTIONS

A. Piping:

1. Shut-off valves: Section 220523.
2. Domestic water piping: Section 221116.
3. Strainers: Section 221119.
4. Sanitary waste and vent piping: Section 221316.

1.3 SUBMITTALS

A. Product data: For each type of plumbing fixture specified, including fixture, trim, fittings, accessories, appurtenances, supports, construction details, dimensions of components, and finishes.

B. Certification that products comply with NSF/ANSI 61.

C. Shop drawings: A schedule of proposed fixtures and trim, in the order listed in the specification.

1.4 QUALITY ASSURANCE

A. Lead free requirements:

1. Potable water system components, including pipe and joining materials, shall comply with NSF/ANSI 61 and with requirements for “lead-free” plumbing as defined by state laws and U.S. Safe Drinking Act.
2. Acceptance product marking: NSF®-61.

B. Fixtures shall be of the best commercial grade of their respective kinds, free from flaws, cracks, craze or other imperfections, complete with fittings and connections. Residential grade fixtures shall not be acceptable. Fixtures manufactured by acceptable manufacturers are acceptable provided they meet specified requirements and are similar to the basis of design.

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. Emergency fixtures:

a. Bradley Corporation
b. Encon Safety Products
c. Guardian Equipment
d. Haws Corp.
e. Speakman Co.

2. Supplies, traps, and miscellaneous trim:

a. Bradley Corporation
b. Brass-Craft Manufacturing Co.
c. Chicago Faucet Co.
d. Engineered Brass Co.
e. Haws Corp.
f. McGuire Manufacturing Co.
g. T & S Brass and Bronze Works, Inc.

2.2 EMERGENCY FIXTURES

A. Wall-mounted emergency eye and face wash unit:

1. Fixture:

a. Applicable standard: ANSI Z358.1.
b. Capacity: Flow control maintains at least 3 GPM (11.4 liters per minute) under varying pressures.
c. Mounting: Wall mounted via a bracket provided with the unit.
d. Water connection: 0.5-inch (DN 15) IPS from wall rough in.
e. Exposed pipe and fittings: Chrome-plated brass or stainless steel.
f. Operator: Push flag with sign showing operation.
g. Valve: Chrome-plated brass ball valve with stainless steel ball, instant-action, stay-open.
h. Strainer: Chrome-plated brass in-line mesh strainer.
i. Head: Eye/face wash assembly, stainless steel mounted on chrome-plated brass supply, with dust covers which automatically release with water pressure.
j. Receptor: 11-inch (279-mm) round stainless steel with No. 2L bright finish.
k. Waste:

(1) 1.25-inch (DN 32) chrome-plated brass tailpiece.

(2) 1.5-inch (DN 40) chrome-plated brass trap with 1.5-inch (DN 40) NPT waste connection.

l. Basis of design: Haws 7460BT.

2. Chrome-plated brass escutcheon for wall penetrations.
3. Emergency fixture thermostatic mixing valve:

a. ANSI Z358.1, vandal-resistant temperature adjustment, bronze body, check stop on inlets, liquid-filled motor, operating pressure 125 psi (860 kPa), rough bronze finish. Temperature control shall be accurate to plus or minus 3 degrees F (1.5 degrees C) of the setpoint. Hot water shall be shut off if cold water supply should fail; cold water shall flow if hot water supply should fail.
b. Flow rate: 8 GPM (30.3 liters per minute).
c. Basis of design: Bradley S19-2000 or mixing valve provided with fixture by fixture manufacturer.

B. Sink-mounted swing-down emergency eye and face wash unit:

1. Fixture:

a. Applicable standard: ANSI Z358.1.
b. Chrome-plated brass or stainless steel construction.
c. Capacity: Flow control maintains at least 4.2 GPM (15.9 liters per minute) under varying pressures.
d. Mounting: Sink backsplash mounted with flange next to laboratory sink faucet.
e. Water connection: 0.5-inch (DN 15) NPT under countertop.
f. Operator: Fixture arm swings down over sink to actuate valve.
g. Basis of design: Guardian Model G1848LH-L.

2. Emergency fixture thermostatic mixing valve:

a. ANSI Z358.1, vandal-resistant temperature adjustment, bronze body, check stop on inlets, liquid-filled motor, operating pressure 125 psi (860 kPa), rough bronze finish. Temperature control shall be accurate to plus or minus 3 degrees F (1.5 degrees C) of the setpoint. Hot water shall be shut off if cold water supply should fail; cold water shall flow if hot water supply should fail.
b. Flow rate: 8 GPM (30.3 liters per minute).
c. Basis of design: Bradley S19-2000 or mixing valve provided with fixture by fixture manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish, provide rough-in for, and set fixtures to extent and number indicated on drawings. The fixtures shall be left in first class condition, properly adjusted, cleaned and ready for satisfactory operation.

B. Provide all parts, fittings, escutcheons, and appurtenances regularly required for each fixture.

C. Protect and cover fixtures so they cannot be used until final work acceptance.

D. Wall-mounted emergency eye and face wash unit:

1. Provide domestic hot water and domestic cold water piping to mixing valve with shut-off valves that are lockable open, and provide strainers in each line.
2. Provide domestic tempered water piping from mixing valve to fixture supply wall rough in.
3. Brace piping securely for fixture support.

E. Sink-mounted swing-down emergency eye and face wash unit:

1. Provide domestic hot water and domestic cold water piping to mixing valve with shut-off valves that are lockable open, and provide strainers in each line under countertop.
2. Provide domestic tempered water piping from mixing valve to fixture supply.

END OF SECTION 224200.09

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. Commissioning requirements: 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 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. Pre-demo TAB to determine existing airflows.
2. Low pressure duct distribution modifications.
3. Exhaust system balancing.
4. New exhaust infrastructure to support the kitchen spaces.

5. The project includes commissioning under the direction of a Commissioning Agent (CxA).

F. See Division 01 for requirements related to SI'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, the following options apply to Division 23 specifications.

1. Products specified by reference standards or by description only: Any product meeting those standards or description.
2. 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.
3. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

B. 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.

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 the SI.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse SI 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 Architect.

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 Architect 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 Architect 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 Architect 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 Architect 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. 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 Contracting Officer's Technical Representative (COTR), 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 Architect 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. Lubrication charts: Prepare lubrication charts for each piece of mechanical equipment that requires grease or oil.

   a. Include the following:

      1) Types of lubricants required.
      2) Locations of lubrication points.
      3) Frequency of lubrication.

   b. Provide one extra set of lubrication charts mounted in plastic covers, besides those required in Operating and Maintenance Manuals.

3. 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.
4. 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.
5. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
6. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.

7. Part 1: Directory, listing names, addresses, and telephone numbers of mechanical engineers; Contractor; mechanical subcontractors; and major mechanical equipment suppliers.
8. 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 pump and 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.
    g. Valve charts, including locations of flow fittings.

9. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data.
    b. Air 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.

10. 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.
11. 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, Heating, and Refrigeration Institute (AHRI)
5. Air Movement and Control Association (AMCA)
6. Associated Air Balance Council (AABC)
7. American National Standards Institute (ANSI)
8. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
9. ASME International (ASME)
10. American Society for Testing and Materials (ASTM)
11. International Code Council (ICC)
12. Manufacturer’s Standardization Society of the Valve and Fittings Industry Inc. (MSS)
13. National Electrical Code, NFPA 70 (NEC)
14. National Electrical Manufacturer’s Association (NEMA)
15. National Fire Protection Association (NFPA)
16. National Fuel Gas Code, NFPA 54
17. The Occupational Safety and Health Act (OSHA)
18. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
19. Underwriters Laboratory Inc. (UL)
20. 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. Maintain the area and return it to its original condition at project completion.

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 Smithsonian 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 Architect; 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. Follow the requirements listed in Division 01.

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 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 SI 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 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 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 Architect.

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 Architect 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, SI 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. Equipment installation requirements.

C. Basic materials and installation requirements for HVAC piping.

D. Identification of HVAC systems and equipment.

E. Cleaning and painting.

F. 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. Commissioning requirements: Division 01.

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.
3. ASME B1.20.1: Pipe Threads, General Purpose, Inch.
4. ASME B 31.1: Power Piping.
5. ASME B 31.9: Building Services Piping.

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 D10.12: Guide for Welding Mild Steel Pipe.
5. AWS QC1: Specification for AWS Certification of Welding Inspectors

D. 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 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. Shop drawings:

1. Schedule of welding and brazing procedures proposed for each piping system in the project.
2. Shop drawings of backboards for piping specialties.

B. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in the article "Quality Assurance" below.

C. Test reports: Field test results for each piping system as specified in Part 3 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. Welding, brazing, and soldering procedures and operator qualifications for building systems piping:

1. AWS D10.9, Qualification of Welding Procedures and Welders for Piping and Tubing.
2. ASME B31.9, Building Services Piping.
3. Copper Development Association "Copper Tube Handbook."

D. UL label:

1. Electrical control panels, equipment, materials and devices provided or installed as work of Division 23 shall be UL listed and shall bear a UL label.
2. Equipment, including custom assemblies, shall be listed and labeled as an assembly.
3. If a UL label is not available, the item shall be tested and labeled by a qualified nationally recognized testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70 (NEC).
4. Provide testing, if required, without addition to the contract sum.

1.8 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent. Contractors' and subcontractors' responsibilities are described in Division 01.

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.

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.

F. Provide equipment and installations compliant with NFPA 70.

3.2 IDENTIFICATION

A. General: Do not apply identification until insulation and finish painting work is complete.

B. 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.

C. Ceiling identification tags: Provide on access doors or, in suspended ceilings, on the ceiling support grid near the item identified.

1. Valves: Identify with the same number shown on the valve tag.
2. Terminal units above ceilings: Identify with unit description and number.

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. 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.

END OF SECTION 230500

SECTION 230504 - HVAC DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Demolition.

B. Disposal.

C. Protection

1.2 RELATED SECTIONS

A. Unit price: Bidding Documents and Division 01.

B. Demolition: Division 02.

1.3 REFERENCES

A. ANSI/ASHRAE Standard 147: Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Extent and location of demolition is indicated on the drawings.

B. Comply with demolition and disposal requirements of Division 02.

C. Perform demolition operations expeditiously and in accordance with accepted practice and applicable building code provisions. Perform demolition operations neatly and with the least possible disturbance to the building.

D. If, in the course of the work, workers encounter a material they suspect to be hazardous:

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.

E. Provide temporary barriers, danger signals, and appurtenances for protection of personnel and equipment during demolition operations.

F. Demolish, remove, demount, and disconnect inactive and obsolete piping, fittings, specialties, equipment, ductwork, controls, fixtures, insulation, and associated appurtenances.

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 (25 mm) below the 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.

G. Remove supports, hangers, anchors, and fasteners associated with piping and equipment being removed.

3.2 DISPOSAL

A. Dispose of equipment and materials removed, and other waste material, as work progresses.

B. Do not allow demolition debris to accumulate on site. Remove products of demolition from the building daily as a minimum.

3.3 PROTECTION

A. Protect existing materials that will remain. 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.

B. Provide and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Keep standby patching materials on hand to patch and maintain protection as required. Remove protection and barriers after demolition operations are complete.

C. Ensure weathertightness at all times. Prevent the entry of dust or water.

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 qualifications of testing and balancing subcontractor, as required in article “Quality Assurance” below.

B. Submit certified balance report. In addition to general requirements for submittals, submit three copies of final reports and certificates, bound into a booklet.

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 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.

3.2 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.

3.3 AIR SYSTEMS BALANCING

A. Balance all air distribution, supply, return, exhaust, and outdoor 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 adjusting adjustable sheaves, changing sheaves and associated belts, 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, and exhaust: (design to plus 10 percent).
2. Outdoor air: (minus 5 percent to plus 5 percent).
3. Total supply, return, and exhaust for a room or space: (minus 5 percent to plus 5 percent).
4. 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. Check position of deflection blades in return air lighting fixtures to ascertain uniform air return into ceiling plenum.
5. Adjust linear slot diffusers to provide throw direction as indicated on the drawings. Unless otherwise noted, discharge pattern shall be horizontal. Where two-way throw is indicated, divide the number of slots equally for each direction.

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.

3.4 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. Roof space: The space between the ceiling and the roof, where building insulation is located at the roof level or the space between the ceiling and the floor of a non-air conditioned space above.

C. Attic space: The space between the ceiling and the roof, where building insulation is located at the ceiling level.

D. 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).

E. Concealed insulation shall include work:

1. Above ceilings.
2. In crawl spaces and tunnels.
3. Where furred in and in pipe chases.

F. 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.

G. Unconditioned areas: Areas outside of the insulated envelope.

H. 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 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.

D. Installer qualifications.

1.5 QUALITY CONTROL SUBMITTALS

A. Manufacturer's instructions: Recommended accessory materials and products; installation instructions.

1.6 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.

1.7 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 Insulation
4. Manson Insulation
5. 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 1.5 inches (38 mm) of thickness with R-value of R-4.5 (RSI-0.79) in the installed condition with 25% compression.
2. Minimum 2 inches (50 mm) of thickness with R-value of R-6 (RSI-1.06) in the installed condition with 25% compression.

B. 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.

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. Ductwork which transmits air that may be either cooled or heated, or untempered air, shall be insulated as specified below for cooling systems.

D. Where necessary to conceal the standing seams and reinforcing angles on exposed ducts, increase insulation thickness to 2 inches (50 mm).

E. Casings and headers of reheat coils shall be insulated with the same thickness as adjacent ductwork.

3.3 SCHEDULES

Minimum Insulation Thickness and R-Value for Duct Insulation Inside Buildings[1]						
	Default Unless Otherwise Noted	Exposed in Area Served	Ceiling, Chase, or Shaft Space in Air-Conditioned Area	Roof Space[3]	Roof Space[3] Return Plenum of Air-Conditioned Area	Attic Space[3] and other Unconditioned Space
Outside Air and Exhaust Air						
Exhaust air from air-conditioned areas	Not required	Not required	Not required	1.5 inches (38 mm)	Not required	1.5 inch (38 mm) R-4.5 (RSI 0.79)
Cooling Systems						
Supply air	1.5 inch (38 mm)	Not required	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)	2 inch (50 mm) R-6 (RSI 1.06)
Lined supply air	1.5 inch (38 mm)	Not required	Not required	1.5 inch (38 mm)	Not required	2 inch (50 mm) R-6 (RSI 1.06)
Return air and transfer	1.5 inch (38 mm)	Not required	Not required	1.5 inch (38 mm)	Not required	2 inch (50 mm) R-6 (RSI 1.06)
Lined return air and transfer	Not required	Not required	Not required	Not required	Not required	1.5 inch (38 mm) R-4.5 (RSI 0.79)[2]
Heating Systems						
Supply air	1.5 inch (38 mm)	Not required	1.5 inch (38 mm)	1.5 inch (38 mm)	1.5 inch (38 mm)	2 inches (50 mm) R-6 (RSI 1.06)
Lined supply air	Not required	Not required	Not required	Not required	Not required	2 inches (50 mm) R-6 (RSI 1.06)
Return air and transfer	Not required	Not required	Not required	Not required	Not required	2 inches (50 mm) R-6 (RSI 1.06)
Lined return air and transfer	Not required	Not required	Not required	Not required	Not required	2 inches (50 mm) R-6 (RSI 1.06)

Notes:
1: Insulation thickness shall be increased to 2 inches (50 mm) where necessary to conceal standing seams and reinforcing angles on exposed ducts.
2: Insulation R-value added to the R-value of lined or pre-insulated duct exceeds R-6 (RSI 1.06).
3: See Section 230700 for definitions of “Roof Space” and “Attic Space.”

END OF SECTION 230713

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:

1. 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. Balancing: Section 230593.

C. Insulation: Section 230713.

D. Duct hanging: Section 233114.

E. Duct accessories: Section 233300.

F. Flexible ducts: Section 233346.

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. 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).
2. Carbon steel sheets: Cold-rolled, ASTM A 366/A 366M, oiled matte finish.
3. Aluminum sheets: ASTM B 209, alloy 3003, temper H14.

a. Ducts exposed to view: Standard one-side bright finish.
b. Concealed ducts: Mill finish.

4. Stainless steel sheets: ASTM A 480/A 480M, Type 304.

a. Ducts exposed to view: No. 4 finish on exposed surface.
b. Concealed ducts: No. 2B finish.

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).

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, backdraft dampers, smoke 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, and floor 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.
4. Fire suppression systems: Coordinate with fire suppression system sprinkler systems where required in dust collecting, paint spray booth exhaust, and Type I kitchen hood exhaust systems.

D. Remove, add, and modify existing hangers and supports to coordinate with new work and support existing to remain elements.

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. 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.

J. 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.

K. Brace large ductwork connected to fans and air handling units with metal angles to prevent vibration and duct damage, and to reduce noise.

L. 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.

M. Cross break or bead ducts of dimensions of 12 inches (305 mm) and over in pressure classes under 2 inches (500 Pa).

N. Where ducts will be exposed, remove labels and clean surfaces. Where required, prepare surface for painting.

O. Single-wall plenums, casings, and access doors: Construct in accordance with SMACNA HVAC DCS.

3.3 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.
2. Aluminum ductwork: Silicone sealant.
3. Stainless steel and carbon steel ductwork: Not applicable.

3.4 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.
2. Stainless steel for outdoor and corrosive 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. Steel cables:

1. Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
2. Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.
3. Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum, or galvanized steel coated with zinc chromate, shapes and plates.

G. 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.
6. Stainless steel for outdoor and corrosive applications.

H. Duct attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

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. Fasteners to wood construction: Lag bolts.

C. 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.

2. Ducts over 54 inches (1370 mm) wide: Support with trapeze hangers.

G. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

H. Fabricate wall-mounted and floor-mounted supports using metal framing systems or structural steel where required.

I. 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.

J. Install lateral bracing to prevent swaying.

K. Install supports so that duct loads not be transmitted to connected equipment.

L. 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.

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.

D. Attaching to precast concrete hollow core plank:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting ductwork from precast concrete plank.
2. Floor construction with topping slab:

    a. Threaded rods shall pass through the plank and be secured on topside with nut, locknut, and plate washer.
    b. Plate washers: 4 by 8 inches by 0.125 inch thick (100 mm by 200 mm by 6 mm) thick for 0.375-inch and 0.5-inch (10-mm and 15-mm) rods; 6 by 12 inches by 0.187 inch thick (150 by 305 by 5 mm) for 0.625-inch (16-mm) and larger rods.
    c. Top of hanger assembly shall be concealed below surface of topping slab.
    d. Drill openings through precast planks for the passage of threaded rods with power-driven carbide-tip drills, in accordance with Architect's instructions. Do not cut reinforcing bar without specific approval of the Structural Engineer.

3. Existing floor construction:

    a. Provide toggle bolts, or remove and repair topping slab and support ductwork as indicated above.

4. Roof construction:

    a. Provide toggle bolts.

5. Provide supplemental steel with connections to multiple planks where required to spread a load among multiple planks.

E. Attaching to precast concrete tees:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting ductwork from concrete tees. Support piping according to the tee manufacturer's recommendations.

F. Attaching to steel decks:

1. Obtain approval from the structural engineer and confirm allowable loads prior to supporting ductwork from steel decks. Where approved, provide screws in the lower plane of corrugated steel decks.

END OF SECTION 233114

SECTION 233300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Flexible joint fabric.

B. Bird screen.

C. Air turning vanes.

D. Spin-in fittings.

E. Duct access doors.

F. Dampers.

G. Fire dampers.

H. 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.

I. UL 555: Fire Dampers.

J. UL 555C: Ceiling Dampers.

K. UL 555S: Smoke Dampers.

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. Shop drawings: Detail equipment assemblies and indicate dimensions, loadings, required clearances, method of field assembly, components, locations, and size of each field connection. Detail these accessories:

1. Special fittings and manual and automatic volume damper installations.
2. Fire, combination fire/smoke, and smoke damper installations, including sleeves and duct access doors.

C. 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.

1.6 EXTRA MATERIALS

A. Provide one spare link for every four fire dampers installed in the project, with a minimum of two of each type.

B. Deliver and store spare links in the cabinet for spare automatic sprinklers, or as directed by the COTR.

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 FLEXIBLE CONNECTIONS

A. Flexible joint fabric: Woven glass fabric with coating, complying with NFPA 701 for fire retardance and NFPA 90A for use in duct systems.

1. For use indoors:

a. Coated with polychloroprene (DuPont "Neoprene"), 30 ounces per square yard (850 g per 0.8 square meter).
b. Basis of design: Ventfabrics "Ventglas."

2. For use outdoors:

a. Coated with DuPont weather-, sunlight- and ozone-resistant "Hypalon," 26 ounces per square yard (732 g per 0.8 square meter).
b. Basis of design: Ventfabrics "Ventlon,"

2.3 SCREENS

A. Bird screen: ASTM E 2016, general industrial-use wire cloth, Grade C, medium light or heavier, nominal 0.5-inch (13-mm) mesh and 0.063-inch (1.6-mm) wire diameter, aluminum or stainless steel.

1. Frame: Removable, rewirable, of same material and finish as the duct or accessory to which it is installed.

2. Frame and fasteners: Removable, same material and finish as louver or accessory to which it is installed, and capable of screen replacements.

2.4 MANUFACTURED UNITS

A. Air turning vanes: Double vane type, constructed in accordance with SMACNA HVAC DCS, from the same material as the duct.

B. 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.

2.5 DUCT ACCESS DOORS

A. Duct access doors for rectangular ducts:

1. Construction: Comply with SMACNA construction standards as a minimum.
2. Door and frame material:

    a. Galvanized steel duct applications: 24-gauge minimum galvanized steel.
    b. Aluminum duct applications: 20-gauge minimum aluminum.
    c. Stainless steel duct applications: 24-gauge minimum stainless steel.

3. Size:

    a. Duct dimension is 18 inches (457 mm) or more: Minimum 16 inches by 16 inches (406 mm by 406 mm).
    b. Duct dimension is less than 18 inches (457 mm): 16 inches (406 mm) by duct size.

4. 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 and compressed into the pan.
5. Perimeter gaskets sealing frame to duct and door to frame, neoprene or foam rubber.
6. As an option, provide round access doors, complete with safety holding cable, 12 inches (305 mm) diameter minimum.
7. Access doors to fire protection devices shall comply with NFPA 90A.
8. Basis of design:

    a. Square or rectangular access doors: Air Balance, Inc., Model FSA or equal by Ruskin, Inc., Airstream Products Company, Inc., or Commercial Acoustics.
    b. Round access doors: Ventfabrics "Ventlok Twist-In."

B. Duct access doors for round and oval ducts:

1. Sandwich style access door, insulated or uninsulated to match ductwork, metal material to match ductwork interior and exterior, rated for operation at pressures up to positive 20 inches w.g. (5,000 Pa) and down to negative 10 inches w.g. (2,500 Pa), threaded fasteners with rotating handles to draw inner and outer pieces of the door together.

2.6 DAMPERS

A. Material:

1. Where aluminum duct is required by the specifications, dampers shall be all aluminum construction in lieu of galvanized steel.
2. Where stainless steel duct is required by the specifications, dampers shall be all stainless steel construction in lieu of galvanized steel.

B. Manual volume dampers:

1. 13 inches (330 mm) and larger in height:

   a. Balanced multi-louver, opposed blade with maximum blade width of 8 inches (205 mm), rated for a 1500 feet per minute (7.6 meters per second) minimum duct velocity.
   b. Bearing: Corrosion resistant, molded synthetic sleeve type bearing.
   c. Control shaft: 0.375-inch (9.5-mm) square minimum.
   d. Regulator: Locking type, provide with 2-inch-high (50 mm) minimum base for mounting on externally insulated duct. Where duct insulation is thicker than 2 inches (50 mm), provided a taller base coordinated with the duct insulation.
   e. Basis of design:

      (1) Damper: Ruskin Model MD 35.
      (2) Regulator: Young Regulator Co. Model No. 443B.

2. 12 inches (305 mm) or less in height:

   a. Constructed from 16-gauge metal with hemmed edges, 0.125-inch (3-mm) maximum gap between duct and damper all around.
   b. Control shaft: 0.375-inch (9.5-mm) square minimum.
   c. Regulator: Locking type, provide with 2-inch-high (50 mm) minimum base for mounting on externally insulated duct. Where duct insulation is thicker than 2 inches (50 mm), provided a taller base coordinated with the duct insulation.
   d. End bearing: Fastens to the outside of the duct with screws and prevents air leakage by encasing the rod and bearing with a metal cover and neoprene gasket.
   e. Basis of design:

      (1) Regulator: Young Regulator Co. Model No. 443B.
      (2) End bearing: Young Regulator Co. Model No. 429 FD.

C. Remote cable operated damper control.

1. Slot diffuser type control: Remote damper controller mounts inside the plenum of a slot diffuser. Control system shall provide up to 35 inch-pounds of push/pull torque:

    a. Controller: 14-gauge galvanized-steel rack and pinion controller with positive lock graduations.
    b. Cable: Tensile strength of 265,000 pounds:

        (1) Inner wire: Type 302 stainless-steel wire 0.054 inches in diameter, comply with AMS 5688 J and ASTM A 313.
        (2) Outer wire: 3/16 galvanized steel.

    c. Mounting bracket: 18-gauge galvanized-steel with heat-treated steel self-clinching pem fastener.
    d. Damper cable control: Provide external-mounted damper controller with cable and adjustable lever arm operation, suitable for commercial grade damper.
    e. Basis of design: Young Regulator.

2. Concealed ceiling type control: Remote damper controller with access through a 2.5-inch hole in the ceiling concealed with a cover plate. Finish on cover plate to match existing adjacent finish. Control system shall provide up to 35 inch-pounds of push/pull torque:

    a. Controller: 14-gauge galvanized-steel rack and pinion controller with positive lock graduations.
    b. Cable: Tensile strength of 265,000 pounds:

        (1) Inner wire: Type 302 stainless-steel wire 0.054 inches in diameter, comply with AMS 5688 J and ASTM-313-98.
        (2) Outer wire: 3/16 galvanized steel.

    c. Mounting cup and cover plate: 301 zinc cup mounted to ceiling framing member with 3-inch zinc plated cover to be held in by 3/4-inch stainless-steel screws.
    d. Damper cable control: Provide external-mounted damper controller with cable and adjustable lever arm operation, suitable for commercial grade damper.
    e. Basis of design: Young Regulator.

2.7 FIRE DAMPERS - CURTAIN STYLE

A. Listed and labeled according to UL 555 for use in dynamic systems.

B. Type for use where a 1.5-hour fire rating is required, and Type for use where a 3-hour fire rating is required.

C. Ratings:

1. Rated for operation at 4,000 feet per minute (20.3 meters per second) and 4" w.g. (995 Pa) static pressure.
2. Fire resistance in accordance with UL 555 for no less than 1.5 hours in barriers rated for 2 hours or less, and no less than 3 hours in barriers rated for more than 2 hours.

D. Blades: Folding, with 100-percent interlocking joints to form a continuous steel curtain when closed. Provide joints with 180 degrees of free movement.

E. Sleeve: Furnish each damper complete with a galvanized steel factory sleeve of length and gauge required for satisfactory installation. Sleeves, angles, and methods of fastening shall meet requirements of manufacturer's UL-approved installation instructions.

F. Actuator: Constant-force, stainless-steel spring.

G. Fusible links: Replaceable, 165 degrees F (74 degrees C) rated.

H. Frame types:

1. Dampers in rated partitions between non-ducted transfer grilles, or dampers terminating at a ducted wall grille or register: Type A frame, installed within or behind grille or register, access by removal of grille or register.
2. Dampers connected to supply air ductwork: 100 percent free opening, Type C frame with welded-seam housing.
3. Dampers connected to return air or exhaust air ducts: 90 percent free opening, Type B frame with welded-seam housing.

I. Basis of design:

1. 1.5-hour fire rating: Ruskin DIBD2 Series.
2. 3-hour fire rating: Ruskin DIBD23 Series.

2.8 FIRE DAMPERS – MULTIBLADE STYLE

A. Listed and labeled according to UL 555 for use in dynamic systems.

B. Type for use where a 1.5-hour fire rating is required, and Type for use where a 3-hour fire rating is required.

C. Ratings:

1. Rated for operation at 4,000 feet per minute (20.3 meters per second) and 8” w.g. (995 Pa) static pressure.
2. Fire resistance in accordance with UL 555 for no less than 1.5 hours in barriers rated for 2 hours or less, and no less than 3 hours in barriers rated for more than 2 hours.

D. Blades: Double-skin airfoil-shaped blades, with a pressure loss of not more than 0.1 inches w.g. (25 Pa) in full-open position at damper-face velocity of 2,000 feet per minute (10.2 meters per second) for a 36-inch by 36-inch (914 mm x 914 mm) damper.

E. Sleeve: Furnish each damper complete with a galvanized steel factory sleeve of length and gauge required for satisfactory installation. Sleeves, angles, and methods of fastening shall meet requirements of manufacturer’s UL-approved installation instructions.

F. Actuator: Constant-force, stainless-steel spring.

G. Fusible links: Replaceable, adjustable linkage, 165 degrees F (74 degrees C) rated.

H. Basis of design:

1. 1.5-hour fire rating: Ruskin DFD60 Series.
2. 3-hour fire rating: Ruskin DFD60-3 Series.

2.9 DUCT CLAMPS

A. Duct clamps for flexible duct and flexible fabric connections: Positive locking drawbands able to conform to any shape. Fabricate from a single piece of stainless steel, with hex screw and worm gear.

B. Nonmetallic duct clamps for flexible duct connections:

1. Heavy-duty adjustable nylon strap type for 12-inch (305-mm) diameter and smaller flexible ductwork, complying with UL 181.
2. Basis of design: HellermannTyton Corporation

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 FLEXIBLE CONNECTIONS

A. Flexible connections: Install using flexible joint fabric where duct connects to motor-driven equipment, and in other locations shown on drawings. Securely clamp flexible connection to duct and collar with duct clamps, providing 1 inch (25 mm) slack. Stitch seams with fiberglass thread.

1. Nonmetallic clamps: Install in accordance with manufacturer's recommendations, using manufacturer's special tools.
2. Flexible connections are not required where duct connects to air-handling equipment with internally isolated fans.

3.3 INSTALLING SCREENS

A. Install bird screen at open ended duct terminations and where indicated on mechanical drawings.

3.4 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.

3.5 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.

3.6 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.

3.7 INSTALLING FIRE DAMPERS

A. Fire dampers are an integral part of the rated barrier being penetrated. Install sleeves and dampers before beginning installation of the duct system being connected. Do not begin connecting ducts until rated assembly, including installed dampers, has been completed.

B. Install fire dampers where indicated and in accordance with the applicable requirements of the following:

1. Details on drawings.
2. NFPA requirements.
3. Local building code.
4. Manufacturer's UL-approved installation instructions.
5. SMACNA-05.

C. Install fire dampers in sleeves. Coordinate with other trades to properly frame openings so that damper and sleeve assembly can be secured in partition or floor.

1. Do not use dampers and sleeves as a lintel for supporting the wall above the damper. Provide separate steel angles on both sides of wall or floor slab to hold damper and sleeve firmly in place.
2. Sleeve thickness and retaining angle size are contingent on type of duct connection, duct size and damper manufacturer’s requirements. See SMACNA recommendations and NFPA requirements.

D. After damper installation is complete and required ductwork connected, test operation of damper by releasing holding mechanism to see that damper operates freely and properly and closes tight. Make adjustments if required and reset holding mechanism.

E. Provide concrete curbs for damper penetrations in mechanical room floors.

END OF SECTION 233300

SECTION 233346 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Insulated flexible ducts.

1.2 REFERENCES

A. UL 181: Factory-Made Air Ducts and Air Connectors.

B. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems

1.3 SUBMITTALS

A. Product data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURED SPECIAL FLEXIBLE DUCTS AND FITTINGS

A. Insulated flexible duct: UL 181, Class 1, factory pre-insulated, complying with NFPA 90A

1. Core: Non-metallic airtight polyester supported by galvanized steel wire helix.
2. Insulation: Fiberglass, R-6 (RSI-1.06) minimum.
3. Vapor barrier: Aluminized and reinforced.
4. Pressure Rating: 10 inches water gauge (2,500 Pa) positive and 1 inch water gauge (250 Pa) negative up to an 18 inch (457 mm) diameter.
5. Maximum Air Velocity: 4,000 feet per minute (20 meters per second)
6. Temperature Range: Minus 20 to plus 210 degrees F (Minus 29 to plus 99 degrees C).

B. Flexible duct connectors:

1. Clamps: Stainless-steel bands with cadmium-plated hex screw to tighten band with a worm-gear action, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

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.

B. Generally, it is intended that all horizontal ductwork be a minimum of 10 inches (255 mm) above suspended ceiling (where applicable) to allow for removal of ceiling panels and ceiling-mounted light fixtures and devices.

C. Provide insulated flexible duct where shown on drawings:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Lay out bends and turns with the longest practicable radius.
4. Bends of flexible ducting shall not have an inside radius less than one duct diameter.
5. Avoid contact with metal fixtures, water lines, pipes, or conduits.
6. Install flexible ducts in a direct line, without twists, or turns.
7. Lengths shall not exceed 5 feet (1.5 m).

D. Connections: Coat at least 3 inches inside the end of the flexible duct core with duct sealant, install over the rigid duct, and secure with a duct clamp. After replacing the insulation and vapor barrier, secure with another duct clamp.

E. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches (38 mm) wide or wider and spaced a maximum of 48 inches (1,200 mm) apart. Maximum centerline sag between supports shall not exceed 1/2 inch (13 mm) per 12 inches (300 mm).
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches (1,800 mm) on center.

END OF SECTION 233346

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 RELATED SECTIONS

A. Balancing: Section 230593.

B. Fire dampers: Section 233300.

1.3 REFERENCES

A. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.4 SUBMITTALS

A. Product data:

1. Each type of diffuser, register, and grille, including the following:

a. Frame style
b. Accessories
c. Mounting details
d. Available materials and finishes
e. Performance data including throw, static-pressure drop, and noise ratings

B. Shop drawings:

1. For each diffuser, register, and grille, provide a schedule including the following:

a. Location
b. Quantity
c. Type
d. Size
e. Function
f. Material
g. Finish

C. Samples: Manufacturer's complete line of color chips for anodized aluminum linear grilles and diffusers.

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:

a. Steel where mounted in ceilings.
b. Either aluminum or steel where mounted in walls near ceiling.
c. Heavy-duty steel where mounted in walls near floor.
d. Welded or mechanically fastened cores in diffusers located in gymnasium.

2. Aluminum devices shall be all aluminum construction, including dampers, where specifications call for aluminum or stainless steel ductwork.
3. 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.

E. Provide stainless-steel safety cables to diffusers to prevent the face of each diffuser from falling during removal.

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. Square and rectangular ceiling diffusers: Square, rectangular, or round neck and removable core. Each unit shall have a straightening grid. The grids shall be set at right angles to one another. Basis of design: Krueger Series SH.

1. Frame Style 23 (panel diffuser): Diffusers mounted in nominal 24 by 24-inch (600 by 600-mm) or 24 by 48-inch (600 by 1200-mm) flat steel panels as indicated on the drawings, to lay into suspended ceiling grid of acoustical ceilings.
2. Frame Style 22 (surface mount): Diffuser with flat frame to mount at underside of plaster or gypsum wallboard ceilings.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

A. For registers, provide opposed-blade dampers with linkage and adjustment through grille face with a screwdriver or Allen wrench. For plaster wall or ceiling construction, provide with plaster frames.

B. Ceiling-mounted and wall-mounted near ceiling: Grilles and Registers, fixed horizontal face bars set at 35 to 45 degrees deflection, minimum 1.25-inch (32-mm) margin.

1. Provide all aluminum construction.
2. Basis of design:

a. Grilles: Krueger S-80H (steel); S-580H (aluminum).
b. Registers: Kruger S-80H-OBD (steel); S-580H-5OBD (aluminum).

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.

D. Adjust supply register deflectors to provide uniform air distribution to the areas served.

END OF SECTION 233713

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 Contracting Officer’s Technical Representative (COTR).

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 food service and mechanical systems to support the project area.

4. The project includes commissioning under the direction of a Commissioning Agent (CxA).

F. See Division 01 for requirements related to commissioning, Smithsonian'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 SI.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse SI 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. 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 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 COTR, 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 COTR 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 Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
13. 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 Smithsonian 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 COTR. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the COTR and revise schedule based on any SI 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 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 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.

1.19 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, Owner 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. 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 Smithsonian 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 Smithsonian 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 of items for reuse.

1.2 RELATED SECTIONS

A. Demolition: Division 02.

1.3 SUBMITTALS

A. Shop drawings: Demolition and removal procedures and schedules.

B. Project record documents:

1. Record drawings.

1.4 QUALITY ASSURANCE

A. Demolition shall be carried out as expeditiously as possible, in accordance with accepted practice and applicable building code provisions.

1.5 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. 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, luminaires, 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.”
5. Do not remove track heads. Track heads will be removed by museum staff.
6. When removal of raceway results in an opening in an existing-to-remain box, cabinet, or enclosure, provide fitting as needed to close opening.

E. Remove the anchors, bolts, and fasteners associated with raceway and equipment to be removed.

3.3 ITEMS FOR REUSE

A. The following items shall be removed and reused as indicated or specified:

1. Exit sign(s).

B. Remove items to be reused in a manner to prevent damage. Pack or crate if required to protect the items from damage in storage

3.4 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.

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. Service cord.

C. Type MC cable as permitted in Part 3.

D. Type AC-HCF, and Type NM cables are not permitted.

1.2 RELATED SECTIONS

A. Raceways: Section 260533.

B. Lighting controls: Section 260923.

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.

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

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 HARD-USAGE, JACKETED, FLEXIBLE CORD

A. SJOOW cord, UL 62.

1. 300 V, 90 deg C, hard service cord with oil resistant jacket and oil resistant insulation for usage in wet locations.
2. Copper conductors

a. For 15- and 20-ampere circuits, #12
b. For 30-ampere circuits, #10.

B. Basis of design is Southwire #70220.

2.4 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”.

2.5 METAL-CLAD CABLE, TYPE MC

A. Cable: UL 83 and UL 1569 listed; 600-volt, single- or multi-circuit Type MC Cable, multi-conductor with ground conductor; aluminum or steel interlocked armor.

B. Conductors: Solid copper No. 10 and smaller, and stranded copper No. 8 and larger; conforming to ASTM B 3 or B 8.

C. Conductor Insulation: Type THHN/THWN insulated single conductors including ground conductor.

D. Fittings:

1. UL 514B listed, steel or malleable iron fittings. Zinc die-cast fittings shall not be acceptable.
2. Basis of design: KonKore/Atkore International.

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.

E. Cords shall be used only for the immediate connection of equipment to receptacles.

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.
4. Where it is impractical to install raceway, Contractor may request special permission from the COTR to use MC cable. Permission will be granted on a case-by-case basis. The design intent is for all circuits to be installed in raceway.
5. Do not use cords for building wiring. Cords are to be used only where needed to connect equipment to receptacles.

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.

B. Terminate each end of each cord in accordance with the instructions of the manufacturer of the equipment or device on which cord is terminated.

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.

3.5 INSTALLING MC CABLE

A. Except as noted below, install only after receiving written permission from the COTR for each instance of use. Acceptable uses for MC cable are:

1. For wiring within the café front and back counters
2. Feeder LPMA.

B. Install in compliance with NFPA 70.

1. Bend radius shall not be less than 7 times the external diameter of the cable.
2. Securely fasten in place at intervals of not more than two meters (six feet), with suitable clamps or fasteners of approved type.
3. Maintain at least 150 mm (6 inch) clearance between MC cables and piping systems.
4. Do not fasten MC cable to raceways, pipes, or ducts.
5. Support individual MC cables hung from roof structure or structural ceiling by independently supported hangers using hanger rods or No. 10 wire.
6. Support groups of MC cable run in parallel on trapeze hangers suspended from 12-mm (0.5-inch) hanger rods, held in place with MC cable clamps or fasteners.
7. Installing hangers for MC cable shall be similar to installing raceway hangers.
8. Support MC cable on each side of a bend and not more than 300 mm (one foot) from an enclosure where an MC cable is terminated.

C. Locations:

1. Type MC cable may be used for branch circuits in the following locations and conditions, unless otherwise indicated:

a. Within the casework of the café’s front and back counters.
b. Concealed within other casework, after obtaining written permission from the COTR.

2. Type MC cable may be used for Feeder LPMA.

3. Do not install in masonry partitions or masonry walls.

D. Connect cable with wiring accessories specified above.

E. MC cable run to switches shall have a neutral conductor. This conductor is not indicated on the drawings.

3.6 PROTECTION

A. After installation, protect cords from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by COTR.

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 plumbing equipment: Section 220513.

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.

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 food service equipment furnished under other sections and equipment furnished by Smithsonian. 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 raceway couplings finishing flush with finished floor.
3. For equipment indicated as connecting to a receptacle, provide service cord and plugs as needed to connect equipment to the receptacle should the manufacturer not furnish the equipment with a cord and plug.

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 plumbing equipment specified in Division 22. Refer to sections of Division 22 for equipment and controls.

1. Mount starters where required, and provide proper size overload protection.

F. Where a Division 22 section requires installation of equipment under supervision of equipment manufacturer's representative, coordinate electrical installation to cooperate with representative's requirements.

G. 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.

H. 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.

I. Provide power sources for Smithsonian 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. Water heaters: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

C. 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, spacers, 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):

1. Conforming to ANSI C80.3
2. Unless otherwise noted: hot-dip galvanized or sherardized thin-wall steel raceway conforming to UL 797.
3. Where exposed in food service areas (e.g., the pantry, the kitchen, and the café counter area), and where penetrating the floor or wall adjacent to food service areas: Type 304 stainless-steel thin-wall raceway conforming to UL 797A.

B. Connectors and couplings for EMT: Set screw type unless otherwise noted, made of zinc- or chromium-plated steel. Connectors shall have nylon insulating throats. Model numbers below are for ¾" fittings; provide equivalent fittings for other sizes of EMT used.

1. Set screw connector:

a. Basis of design: Steel City No. TC722A.

2. Set screw coupling:

a. Basis of design: Steel City No. TK122A.

3. For fire alarm EMT only:

a. Compression connector: Basis of design: Thomas & Betts No. 5223.
b. Compression coupling: Basis of design: Thomas & Betts No. 5220.

4. For stainless-steel EMT only:

a. Type 316 stainless steel compression connector: Basis of design: Atkore (Calbrite) No. S20700MC00.
b. Type 316 stainless steel compression coupling: Basis of design Atkore (Calbrite) No. S20700CC00.

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:

1. UL-listed as wireways and auxiliary gutters.
2. Hinged cover.

3. Cover complete width and length of wireway.
4. In food service areas (e.g., Pantry):

    a. Stainless-steel wireway, NEMA 4X
    b. Finish: stainless-steel
    c. Basis of design: nVent Hoffman

5. In other areas:

    a. Steel wireway, NEMA 1.
    b. Finish: Baked enamel.
    c. 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 AND SPACERS

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. Spacers (clampbacks):

1. Stamped steel, UL-listed.
2. Basis of design: Eaton Crouse-Hinds CB series.

G. Finish: For hangers, assemblies, plate washers, rods, locknuts, channels, bolts, spacers, 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. 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. Where raceway is surface-mounted on the walls of kitchens, pantries, and other areas where food is prepared, use spacers to keep raceways off the wall, to allow for cleaning behind the raceway.

F. Do not install conductors or pull rope during installation of raceway.

G. 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.

H. 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.

I. 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.

J. Make vertical runs plumb and horizontal runs level and parallel with building walls and partitions.

K. Ground raceways as required by NFPA 70.

L. Where raceways pass through building expansion joints, and wherever relative movement could occur between adjacent slabs, equip with weatherproof expansion fittings and bonding jumpers.

M. 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.

N. 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.

O. Install no raceway in these locations:

1. Setting beds for terrazzo or tile.
2. Concrete toppings, unless specifically approved by Structural Engineer.

P. 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).

Q. Where raceway is stubbed up through concrete slab, exterior walls, or bearing walls, provide galvanized steel raceway elbows.

R. Install insulated bushings on ends of raceway stubs.

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		
208/120-V wye, 3-phase, 4-wire	White	Black	Red	Blue

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 260573 - OVERCURRENT PROTECTIVE DEVICE STUDIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical system fault-current and protective device study:

1. Fault-current analysis.
2. Arc flash hazard analysis.

B. Description: Obtain from the Government previous overcurrent protective device studies. For portions of the electrical distribution system affected by the work of the project, including all relocated distribution components, all new distribution components and all portions of the distribution system upstream of the new components, perform overcurrent protective device studies to determine the required fault current rating, coordination settings, and arc flash hazards.

1.2 RELATED SECTIONS

A. Sections in Division 26.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE 3001.3 – Recommended Practice for the Design of Industrial and Commercial Power Systems.
2. IEEE 3001.5 – Recommended Practice for the Application of Power Distribution Apparatus in Industrial and Commercial Power Systems.
3. IEEE 3004.5 – IEEE Recommended Practice for Application of Low-Voltage Circuit Breakers in Industrial and Commercial Power Systems.
4. IEEE 3002.3 – IEEE Draft Recommended Practice for Conducting Short-Circuit Studies of Industrial and Commercial Power Systems.
5. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations.

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.

3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
4. ANSI C37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code, latest edition.
2. NFPA 70E – Standard for Electrical Safety in the Workplace.

D. Occupational Safety and Health Administration (OSHA):

1. OSHA 29 Code of Federal Regulations (CFR) Part 1910, Subpart S.

1.4 SUBMITTALS

A. Product data: For computer software to be used to perform studies.

B. Product certificates: For coordination-study and fault-current analysis computer software programs, certifying compliance with IEEE 399.

C. Qualifications:

1. Submit evidence indicating individual and organization compliance with requirements indicated in “Quality Assurance” below.

D. Preliminary electrical system study: Submit for review before distribution equipment shop drawings have been submitted, and before equipment order has been released to the manufacturer.

1. If approved for use in ordering equipment, preliminary draft shall include sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

E. Final electrical system study:

1. Submit Final report for review and record.
2. Incorporate changes resulting from deficiencies and corrections of preliminary draft report.

F. Reports:

1. Electrical system study report: Submit reports required above including the following items:

    a. General report information: Scope, definitions, descriptions, assumptions, and other information necessary to properly interpret results of the report.
    b. Tabulated summary comparing protective device ratings and calculated available fault-current levels.
    c. Tabulated summary of protective device settings including circuit breaker, fuse, and relays.
    d. Fault-current analysis calculations.
    e. Arc flash hazard calculations including details of the incident energy and flash protection boundary calculations.
    f. Recommendations for system improvements.
    g. System one-line diagram.
    h. Input and output data used for each component and for study calculations.

2. Submit Final reports as electronic files in portable document format (.pdf) to Government. Submit program base files in file format of computer software utilized to perform study.

1.5 QUALITY ASSURANCE

A. Electrical system study shall be performed by one or more independent qualified organizations, and under the supervision and approval of a Registered Professional Engineer skilled in performing and interpreting the power system studies.

B. Qualifications of organization performing electrical system study: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices:

1. Registered Professional Engineer shall be a full-time employee of the equipment manufacturer or of an approved engineering firm.
2. Registered Professional Engineer shall have a minimum of five (5) years of experience in performing power system studies and registered in the state where the project is located.

C. Qualifications of computer-based software: Widely available, complying with standards, guides, and codes as referenced above.

D. Comply with IEEE P3002.3 for general study procedures.

E. Comply with IEEE 3001.3, IEEE 3001.5, and IEEE 3004.5 for short-circuit currents and coordination time intervals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Computer software: Subject to compliance with requirements, utilize product by one of the following:

1. EDSA Micro Corporation
2. Operation Technology, Inc.
3. SKM Systems Analysis, Inc. (Basis of Design)

2.2 COMPUTER SOFTWARE REQUIREMENTS

A. Comply with IEEE P3002.3 and IEEE 1584.

B. Computer software program shall be capable of performing fault-current analysis of project electrical distribution system.

C. Computer software program shall be capable of plotting and diagramming time-current characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

D. Computer software program shall be capable of performing arc fault hazard analysis using equations as established by IEEE 1584 and requirements presented in NFPA 70E, Annex D.

E. Software shall include a comprehensive equipment library of manufacturer-based and IEEE / ANSI based equipment to accurately model the electrical distribution system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine project submittals for compliance with electrical distribution system requirements outlined on the drawings and in electrical specification sections.

3.2 SYSTEM DATA COLLECTION

A. The Contractor shall furnish all data required to perform the power system studies. The Engineer performing the fault analysis, and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to ensure completion of the studies as required for Final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. If applicable, include fault contribution of existing motors and equipment in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

C. The Engineer performing the studies shall gather and tabulate input data necessary to support each study including the following:

1. Product data for each component of the electrical distribution system.
2. Utility available fault contribution and impedance values.
3. Drawings, one-line, and riser diagrams showing system configuration, equipment designations, feeder lengths, and other applicable system characteristics.

3.3 SYSTEM FAULT CURRENT ANALYSIS

A. Calculate the maximum available short-circuit momentary current and interrupting duties in amperes rms symmetrical for electrical power distribution system components affected by the work of this project. The calculation shall be performed for current immediately after initiation and for a three-phase bolted fault at each of the following locations:

1. Branch circuit panelboards.

B. Study the project’s electrical distribution system from normal and alternate power sources throughout electrical distribution system. Where system configuration allows multiple switching and operation arrangements through tie-breakers or closed-transition switches, include study that results in maximum fault conditions.

C. For grounded systems, provide line-to-ground fault current values for areas as defined above for the three-phase, bolted fault, short-circuit study.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 3001.3, IEEE 3001.5, IEEE 3004.5, and IEEE 3002.3.

E. Study Report:

1. Input data: Gather and provide the following input data, in tabular or graphic form, used to perform fault calculations and other studies in this section.

    a. Utility three-phase and line-to-ground available contribution with associated X/R ratios.
    b. Short-circuit reactance of rotating machines with associated X/R ratios.
    c. Cable type, construction, size, quantity per phase, length, impedance and raceway type.
    d. Busway type, size, length, and impedance.
    e. Transformer primary & secondary voltages, winding configurations, kVA rating, impedance, and X/R ratio.
    f. Circuit breaker types and sizes.

2. Methods and assumptions: Indicate calculation methods and assumptions that may have been used to perform analysis.
3. Results: Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram. Provide the following in a table format:

    a. Source fault impedance and generator contributions
    b. X/R ratios
    c. Asymmetry factors
    d. Motor contributions
    e. Short circuit KVA
    f. Symmetrical and asymmetrical fault currents

4. Equipment evaluation and conclusions:

    a. Verify interrupting ratings and withstand ratings are equal to or higher than calculated fault current levels.
    b. Verify adequacy of phase conductors at maximum three-phase, bolted fault currents.

5. Recommendations: List recommendations for equipment with inadequate ratings. Notify COTR, in writing of existing equipment improperly rated for the calculated available fault current of the system.

3.4 SYSTEM ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system affected by this project (such as switchboards, switchgear, motor-control centers, panelboards, and busway) where work could be performed on energized parts.

C. The arc flash hazard analysis shall include electrical equipment locations where work such as examination, adjustment, service, or maintenance could be performed on energized parts.

D. Safe working distances shall be based upon the calculated arc flash boundary considering incident energy of 1.2 cal/cm2.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off).

    1. Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

    1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
    2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

L. Incident energy and flash protection boundary calculations:

1. Arcing fault magnitude
2. Device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction

3.5 ARC FLASH WARNING LABELS

A. The Contractor and organization performing the Arc Flash Hazard Analysis shall provide a 90 mm by 125 mm (3.5 inches by 5 inches) thermal transfer type label of high adhesion polyester for each new work location analyzed.

B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the Government and after any system changes, upgrades or modifications have been incorporated in the system.

C. The label shall include the following information, at a minimum:

1. Location designation
2. Nominal voltage
3. Flash protection boundary
4. Hazard risk category
5. Incident energy
6. Working distance
7. Engineering report number, revision number and issue date

D. Labels shall be machine printed, with no field markings.

E. Labels shall be in compliance with NFPA 70E and OSHA standards.

F. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

1. For each 600V, 480V, and applicable 208V panelboard, one arc flash label shall be provided.

3.6 FIELD QUALITY CONTROL

A. Field Adjustment: Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify the COTR in writing of any required equipment modifications.

END OF SECTION 260573

SECTION 260913 - ELECTRICAL POWER AND WATER MONITORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following for monitoring of portions of the electrical power system:

1. Power monitors.
2. Current Transformers
3. Data collection servers
4. Software

B. Section includes connection of water flow meters to equipment specified in this section for measurement of water consumption. Water meters are specified in Division 22.

1.2 REFERENCES

A. ANSI C12.1 Code for Electricity Metering

B. ANSI C12.20 Standard for Electricity Meters - accuracy and performance.

C. UL 916 Standard for Energy Management Equipment

D. UL 60101 Standard for Safety Electrical Equipment For Measurement, Control, and Laboratory Use

1.3 DEFINITIONS

A. LCD: Liquid crystal display.

B. Low voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or remote-control, signaling and power-limited circuits.

C. 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.

D. rms: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.

E. RS 485: Telecommunications Industry Association Standard TIA-485.

1.4 ACTION SUBMITTALS

A. Product data: For each type of product indicated.

1. Attach copies of approved product data submittals for products that describe power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Other informational submittals:

1. Manufacturer's system installation, operation, and maintenance manuals for the electrical sub-metering system data collection system, and data management software.
2. List each meter, serial number, address, load and CT ratio.

1.6 QUALITY ASSURANCE

A. Installer qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this project.

B. Manufacturer qualifications: A firm experienced in manufacturing power monitoring and control equipment similar to that indicated for this project and with a record of successful in-service performance.

C. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 COORDINATION

A. Coordinate features of distribution equipment and power monitoring and control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of specified functions.

B. Coordinate work of this section with those in sections specifying distribution components that are monitored or controlled by power monitoring equipment.

1.8 WARRANTY

A. Special warranty for meters, servers, and other system components: Written warranty against defects in materials or installation for five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-design products: Leviton “VerifEye” metering products.

1. Subject to compliance with requirements, provide the basis of design products. Unnamed products will only be considered and approved according to Bidding and Contracting requirements and Division 01 requirements for substitutions.

2.2 FUNCTIONAL DESCRIPTION

A. Instrumentation and recording devices: Monitor and record load profiles.

1. Calculate and record the following:

a. Peak electric demand periods.
b. Kilowatt-hour consumption.
c. Water consumption.

2. Measure and record metering data for the following:

a. Electricity.
b. Water.

B. System: Report equipment status.

2.3 SYSTEM REQUIREMENTS

A. Environmental conditions: Unless otherwise noted, system components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Indoor installation in spaces that have environmental controls to maintain ambient conditions of 0 to 122 degrees F (minus 18 to plus 50 degrees C) dry bulb and 20 to 90 percent relative humidity, noncondensing.

2.4 DATA ACQUISITION SERVER

A. Provide data acquisition servers that measure and verify data from electrical meters and environmental sensors. Basis of design is Leviton Energy Monitoring Hub, model A8810.

B. Server shall comply with the following codes and standards:

1. FCC CFR 47 Part 15, Class A
2. EN 610000
3. EN 61326
4. UL 61010
5. Power supply: UL 60950-1

C. Server shall be equipped with a minimum of 32 MB of onboard RAM, and a minimum of 16 MB of NOR flash memory, and a USB expansion port.

D. Environmental conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Indoor installation in spaces that have environmental controls to maintain ambient conditions of 41 degrees F to 104 degrees F (5 degrees C to 40 degrees C), 0-90 percent RH, non-condensing.

E. Server shall have the capability to collect information at intervals from one to sixty minutes.

F. Server shall timestamp all acquired data and store it in a non-volatile memory.

G. Server shall use Ethernet connections for internet access allowing either static IP (internet protocol) or DHCP (Dynamic Host Control Protocol) addressing.

H. Server shall communicate with metering data points via wired connections using a pulse protocol.

I. Server shall communicate with external devices via wired connections over the following protocols:

1. Ethernet LAN (Local Area Network) or WAN (Wide Area Network).
2. ModBus/RTU
3. ModBus TCP
4. TCP/IP.
5. HTTP/HTML.
6. FTP.
7. NTP.

8. XML.
9. SNMP.

J. Server shall upload data (water consumption and electricity usage) at scheduled intervals via HTTP or FTP and download data in XML or custom formats.

K. Server shall have the following input and output connections:

L. Input:

1. RS485 Modbus serial input capable of supporting a minimum of 32 external devices. Input to be expandable at SI's option.
2. Eight flexible I/O inputs configurable for the following modes:

a. 0-10V DC
b. 4-20mA
c. Resistive
d. Standard KYZ pulse modes for A or C dry contact relay outputs

M. Output: modem and/or Ethernet connections for internet access allowing either static IP (internet protocol) or DHCP (Dynamic Host Control Protocol) addressing.

N. Environmental Conditions: Server shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Indoor installation in spaces that have environmental controls to maintain ambient conditions of 41 to 122 degree F (5 to 50 degree C) dry bulb and 10 to 90 percent relative humidity, noncondensing.

2.5 MULTIPLE POINT THREE-PHASE METERING DEVICES ("POWER METER")

A. Provide multiple point metering devices capable of metering single-phase and three phase 120-volt and 208-volt loads. Basis of design is Leviton "VerifEye" Series 7100. The power meter shall also be able to take pulse output from water meters and record the data as water consumption. At each location where power and/or water consumption is monitored, provide quantity of power meters needed to monitor the circuits and pipes indicated.

B. Electricity meters shall test to a minimum of plus or minus 0.5 percent accuracy per ANSI C12.20 Class 0.5

C. Electricity metering devices shall have the following components:

1. Electronic meters with embedded communications capability, and solid or split-core current transformer technology.
2. The current transformers shall have a full scale output of 0.1 amperes and secondary voltage clamps for safety purposes.
3. Remote communication hardware- compatible with data acquisition server.
4. Systems to have backup storage power to key components so no data is lost during power outages. Device must be capable of holding 2 years of interval data for a twenty-year period. The system shall continue to function after resumption of power. Failure of the building electrical normal power system shall not result in loss of data and will not require manual restarting of the metering system

D. See Division 22 for additional pulse-output water meter requirements.

E. System measurements:

1. Electricity metering devices to be complete with a liquid crystal display (LCD) to access all energy measurements and phase diagnostics when needed.
2. Electricity metering devices shall measure and display the following:

a. kWh real consumption
b. kW peak resettable kW peak

3. Water metering devices shall, at a minimum, measure and display real consumption in gallons. See Division 22 for additional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Coordinate with equipment suppliers to integrate electrical power monitoring equipment with the building’s existing automation system.

1. Provide programming modifications as needed in the existing building automation system as needed for it to receive electricity usage data from the electrical power monitoring system and to prepare electricity consumption reports to allow for billing.

B. Mount devices and control panels provided by equipment manufacturers, and provide required control wiring.

3.3 COMPONENT INSTALLATION

A. Comply with NECA 1.

B. Install metering devices, I/O devices, power supplies, and other components to meter circuit(s) as indicated on the drawings and as necessary for a complete electrical power monitoring system for the circuit(s) indicated.

C. Install items in accordance with manufacturers' instructions.

3.4 CABLING, INSTALLATION

A. Comply with NECA 1.

B. Install cables and wiring according to requirements in Section 260519, Wires and Cables, except as noted below.

C. Wiring Method: Install wiring in raceway except within cabinets. Conceal raceway and wiring except in unfinished spaces.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553, Identification for Electrical Systems.

B. Label each metering device with a unique designation.

3.6 GROUNDING

A. Comply with IEEE 1100, "Recommended Practice for Powering and Grounding Electronic Equipment."

3.7 FIELD QUALITY CONTROL

A. Manufacturer's field service: Engage a factory-authorized service representative to inspect and test components, assemblies, and equipment installations, including connections.

B. Tests and inspections:

1. Electrical tests: Use caution when testing devices containing solid-state components.

2. Continuity tests of circuits.
3. Operational tests: Set and operate controls at server and at metering devices to demonstrate their functions and capabilities. Use a methodical sequence that cues and reproduces actual operating functions as recommended by manufacturer. Submit sequences for approval. Note response to each test command and operation.

    a. Metering test: Load circuits, measure loads on circuit conductor with a rms reading clamp-on ammeter, and simultaneously read indicated current on the same phase at power monitor. Record and compare values measured at the two locations. Resolve discrepancies greater than 5 percent and record resolution method and results.

    b. Provide independent verification that water meters are functioning properly and accurately recording water consumption.

C. Monitoring equipment will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.

F. Test labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative. Provide a Certificate of Acceptance from the manufacturer stating that the system has been correctly installed and all components meet factory specifications.

G. Reports: Written reports of tests and observations. Record defective materials and artisanship and unsatisfactory test results. Record repairs and adjustments.

H. Remove and replace malfunctioning devices and circuits and retest as specified above.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train SI's maintenance personnel to adjust, operate, and maintain systems.

1. Train SI's management and maintenance personnel in interpreting and using monitoring displays.

    a. Include troubleshooting, servicing, adjusting, and maintaining equipment.
    b. Provide a minimum of 8 hours' training in a minimum of two sessions.
    c. Demonstrate:

1) Local meter readings
2) Phase diagnostics
3) Use of system manual.

d. Training aid: Use approved final versions of software and maintenance manuals as training aids.

END OF SECTION 260913

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Toggle / snap switches for lighting.

B. Occupancy sensors, non-networked, stand-alone.

C. Self-powered wireless wall stations.

D. Conductors and cables

E. Bluetooth gateway

F. Fire alarm interface

G. Bluetooth controller and software

H. Bluetooth relay nodes

I. Device programming requirements.

1.2 RELATED SECTIONS

A. Commissioning requirements: Division 01.

B. Identification: Section 260553.

C. Interior lighting: Section 265100.

1.3 REFERENCES

A. IECC: International Energy Conservation Code

B. NECA 1: Standard Practices for Good Workmanship in Electrical Construction.

C. NFPA 70: National Electrical Code.

1.4 DEFINITIONS

A. AES: Advanced Encryption Standard (Federal Information Processing Standard FIPS-197).

B. Bluetooth: wireless communications protocol complying with the requirements of the Bluetooth Special Interest Group.

C. dBm: decibel, referenced to milliwatts.

D. MicroSDHC: form-factor memory cards, minimum 4 GB capacity, compliant with the appropriate SD Association's secure digital standards.

1.5 SUBMITTALS

A. Product data: Each type of device used in the project.

B. Bill of materials: Provide detailed list of components and quantities.

C. Shop drawings: Detail assemblies of standard and project specific components. Indicate dimensions and arrangement of components.

1. Floor plans: Identify locations of lighting control system components; interconnection of components. Utilize reflected ceiling plans to show location, orientation, and coverage area of relay nodes, if any.
2. Wiring diagrams: Power, signal, and control wiring, differentiating between manufacturer-installed and field-installed wiring, provided on a schematic diagram.
3. Include representative views of components, including button layouts, engraving, colors, and other physical characteristics pertinent to each device.

D. Qualifications of factory certified field service engineer.

E. Field quality control test reports.

F. Operation and maintenance data: For lighting controls system and associated components, provide product data, shop drawings, and test reports in operation and maintenance manual. In addition to items specified in Division 01, include list of replacement parts and assemblies.

1.6 QUALITY ASSURANCE

A. Devices shall be UL listed and labeled for their intended application.

B. Manufacturer qualifications: A firm experienced in manufacturing power monitoring and control equipment similar to that indicated for this project and with a record of successful in-service performance.

C. Provide services from factory certified field service engineer to perform functional testing.

D. Qualifications for factory certified field service engineer:

1. Minimum experience of 2 years training in the electrical/electronic field.
2. Certified by the equipment manufacturer on the system installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store components indoors in a clean dry space with uniform temperature to prevent condensation. Protect devices from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.8 COORDINATION

A. Coordinate features of luminaires and lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of specified functions.

B. Coordinate work of this section with those in sections specifying luminaire components that are controlled by lighting control devices.

1.9 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

2.1 TOGGLE / SNAP SWITCHES FOR LIGHTING

A. Manufacturers:

1. Arrow Hart/Eaton Wiring Devices
2. Hubbell/Bryant Electric
3. Legrand/Pass & Seymour (P&S)
4. Leviton Manufacturing Co.

B. Toggle / snap switches: Specification grade conforming to UL 20:

1. General-use: Single-pole, 20 amperes, 120/277 volts:

a. Basis of design: P&S PS20AC1, industrial extra heavy-duty.

C. Device color: White

D. Device covers: Type 302 stainless steel.

1. Basis of design: P&S: Type 302 stainless steel, SS series.

2.2 OCCUPANCY SENSORS

A. Acceptable manufacturers:

1. Acuity Brands Lighting, Inc.
2. Hubbell Control Solutions
3. Leviton Manufacturing Co.
4. Lutron Electronics Co., Inc.
5. Signify/Cooper Lighting LLC.
6. Wattstopper/Legrand

B. Sensor types:

1. Wall switch sensor: Wired, dual-technology, combination ultrasonic/passive infrared detector with override switch, capable of installation in a standard wall switch backbox.

a. Line-voltage: 120/277-volt dual-input, 60 hertz.
b. Device finish color: White, with matching decorator style device cover and mounting screws above and below device.

C. Characteristics:

1. Adjustable delayed off-time range: Between 30 seconds and 30 minutes, factory set to 20 minutes.
2. Fail on: Lights will go to full brightness if sensor fails.
3. Ultrasonic detector: Volumetric sound wave at 40 kHz frequency. Detector shall automatically adjust detection threshold to compensate for learned environmental behavior.
4. Infrared detector: Passive, with field-adjustable ambient light adjustment.

2.3 SELF-POWERED WIRELESS WALL STATIONS

A. Basis of design:

1. Illumra model BTT-S2A-WH.

B. Wall stations shall be complete with white wall plate and fully-enclosed electronics assembly.

C. Mechanical:

1. Switches shall be self-powered, kinetic energy harvesting, and wireless.
2. Switches shall be single rocker, four-button).
3. Switches shall fit into a standard North American size light switch outlet box.
4. Switches shall be tested to exceed 250,000 presses.

D. Electrical

1. Wall stations shall use 2.4 GHz Bluetooth Low Energy (BLE) radios.
2. Wall stations shall have a lateral range of at least ten meters (thirty feet
3. Comply with FCC Part 15.231 and IC RSS- 2104.

E. Functional

1. Switches shall be able to switch loads on and off when used with compatible relays and controllers
2. Switches shall be able to dim loads up and down when used with compatible dimming relays and controllers
3. Switches shall be able to offer momentary control functionality when used with compatible relays and controllers

2.4 CONDUCTORS AND CABLES

A. Wiring to supply side of remote-control power sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519, Wires and Cables.

B. Low-voltage control cable: Manufacturer’s standard multi-conductor cable with stranded-copper conductors not smaller than No. 22 AWG, plenum rated.

1. Class 2 control cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG.
2. Class 1 control cables: Multi-conductor cable with copper conductors not smaller than No. 14 AWG.

C. Digital UTP cabling: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5E or Category 6 for horizontal copper cable.

2.5 BLUETOOTH GATEWAY

A. Basis of design: Xicato GalaXi XIG-0102.

B. Regulatory compliance:

1. UL 62368-1

2. UL 60950-1
3. FCC Certified

C. Power supply: Power over Ethernet (PoE).

1. Basis of design is Microsemi model PD-3501G midspan single-port Gigabit PoE power injector.
2. Minimum 15.4 watt power output.
3. Output voltage 48 volts DC.

D. HTTP API interface.

E. Password-protected.

2.6 FIRE ALARM INTERFACE

A. Basis of design is the Philips Dynalite model PDEG.

B. UL 924 listed.

C. Device shall be capable of monitoring a fire alarm system command module dry contact status, and producing an output, transmitted over Ethernet, to the gateway so that the gateway will signal all controlled luminaires to turn on at full brightness during a fire alarm.

2.7 BLUETOOTH CONTROLLER AND SOFTWARE

A. Basis of design: Xicato XCT Configuration Tool system.

B. FCC DSS Part 15C compliant spread spectrum transmitter.

C. Software

1. Capable of integrating Bluetooth controls (e.g., wall stations) with Bluetooth-enabled LED drivers (e.g., Xicato Intelligent Modules, ‘XIM’).
2. Software shall have password protection.

D. Hardware

1. Aluminum housing.
2. Capable of operating in 40^{O}C (104^{O}F) temperatures.
3. Complete with 120-volt power supply.
4. 1.2 GHz 64-bit quad-core ARM Cortex-A53 central processing unit or equal.
5. 300 MHz VideoCore IV 3D graphics core or equal.
6. Input/Output interfaces

a. Minimum of four USB ports
b. Full HDMI port
c. Ethernet port (RJ-45)
d. Combined 3.5mm audio jack and composite video.
e. Bluetooth Low Energy (BLE) wireless interface via pre-installed adapter.
f. MicroSDHC card slot with 16GB MicroSD card preloaded with software.

2.8 BLUETOOTH RELAY NODE

A. Basis of design: Xicato Relay Node, part number XRN.

B. Provide 120-volt power supply, wire harnesses and other parts as needed for a complete installation.

C. Wireless specifications:

1. Bluetooth 5 protocol.
2. 2.4 GHz ISM band.
3. 1 Mbps bandwidth.
4. Minimum twenty channels
5. Transmit power configurable from -10 dBm to +8 dBm in 1 dBm increments.
6. Received Signal Strength Intensity Resolution: 1 dBm.

D. Firmware

1. AES-128, 128-bit encryption

2.9 DEVICE PROGRAMMING REQUIREMENTS

A. Provide password-protected software to allow SI to program system operation.

B. Initial programming of lighting controls shall be performed by a factory certified field service engineer.

C. Refer to lighting controls diagrams on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

1. Proceed with installation only after unsatisfactory conditions have been corrected

3.2 INSTALLATION, GENERAL

A. Install devices in complete compliance with manufacturer’s recommendations.

B. Provide a single cover plate where two or more devices are grouped together in one box.

C. Verify door swings with door frame installed prior to rough-in for switches. Mount lighting control devices at the opposite side of the door frame as the hinges.

D. Ground components according to Section 260526, Grounding and Bonding.

E. Install and program devices to meet the control intent.

F. Manufacturer's factory certified field service engineer shall provide start-up service, including physical inspection of lighting control system and connected wiring and final adjustments to meet specified performance requirements.

G. Provide non-metallic, lockable enclosures for gateways and controllers.

3.3 WIRELESS MESH INSTALLATION

A. Provide Bluetooth relay nodes as needed to allow control of all Bluetooth-enabled luminaires in the project area.

1. Provide power wiring to nodes.
2. Prior to installation of nodes, submit shop drawings showing node locations and wiring routes. Conceal wiring in public spaces.

3.4 IDENTIFICATION

A. Materials: Refer to Section 260553, "Identification for Electrical Systems." Identify devices and wiring.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's field service: Engage a factory certified field service engineer to test and inspect components, assemblies, and equipment installations, including connections.

B. Functional testing: Perform tests and prepare test reports for the following:

1. Occupancy sensors: Confirm that the placement, sensitivity, and time-out settings are optimized to ensure lights turn off only after each space is vacated and do not turn on unless the space is occupied.
2. Fully document control device calibration settings and submit information as a part of the operation and maintenance data.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train SI's maintenance personnel to adjust, operate, and maintain systems.

1. Demonstrate that during fire alarms, the system will turn all Bluetooth-enabled controlled luminaires on, at full brightness.
2. Train SI's management and maintenance personnel in interpreting and using monitoring displays.

    a. Include troubleshooting, servicing, adjusting, and maintaining equipment
    b. Provide a minimum of 8 hours' training in a minimum of two sessions.
    c. Demonstrate:

        (1) Programming of scenes
        (2) Use of system manual

    d. Training aid: Use approved final versions of software and maintenance manuals as training aids.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Circuit breaker panelboards, distribution and lighting and appliance branch-circuit types.

B. Fusible branch circuit panelboards.

C. Panelboards installed in existing cabinets that formerly housed panelboards removed under this project.

1.2 RELATED SECTIONS

A. Identification for electrical systems: Section 260553.

B. Overcurrent protective device studies: Section 260573.

C. Fuses: Section 262813.

D. Surge protective devices: Section 264313.

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.

H. UL 1449: Surge Protective Devices.

1.4 DEFINITIONS

A. Circuit-breaker panelboards in this section:

1. Distribution panelboard: Capable of accepting up to 1200-ampere branch circuit breakers.
2. Lighting and appliance panelboards: Maximum branch circuit breaker amperage:

a. 120/208-volt panelboards: 100 amperes.

1.5 SUBMITTALS

A. Product data: For each type of panelboard, overcurrent protective device, surge 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. Coordination drawings: Floor plans, drawn to 1/4"=1'-0" scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Dimensioned showing: mounting location; outline of equipment; and required clearances; relationship between components and adjacent architectural, structural, and mechanical elements.

a. Underground or underfloor raceway stub-up locations.
b. Identify equipment sections including orientation.
c. Identify space for future panel installation as indicated on drawings.

2. Submit proposed layout for each electrical room, closet, or location where equipment will be installed for COTR review.

E. Operation and maintenance data: For panelboards and 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. Do not submit equipment submittals prior to completing Short-Circuit and Coordination Study as indicated in Section 260573.

B. Source limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

C. 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.

D. Product selection for restricted space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. 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. Product selection for restricted space:

1. Drawings indicate maximum dimensions for panelboards, including clearances between panelboards, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
2. Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum clearances specified in NFPA 70.]

B. 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.
3. Furnish spare fuses for fused switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Circuit breaker panelboards: Subject to compliance with requirements, provide circuit breaker panelboards manufactured by Schneider Electric; Square D products or comparable product by one of the following:

1. ABB; General Electric products
2. Eaton Corporation
3. Schneider Electric; Square D products
4. Siemens Industry, Inc.

B. Fusible branch circuit panelboards: Subject to compliance with requirements, provide fusible branch circuit panelboards manufactured by Eaton Corporation; Bussmann products or comparable product by one of the following:

1. ABB; General Electric products
2. Eaton Corporation; Bussmann
3. Littelfuse, Inc.
4. Mersen
5. Schneider Electric; Square D products
6. Siemens Industry, Inc.

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, 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.
b. Kitchen and Wash-Down Areas: NEMA 250, Type 4X stainless steel.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4X stainless steel.
d. Where a panel is installed in an existing enclosure, the new door shall maintain the NEMA 250 rating of the original enclosure.

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 bolt-on circuit breakers.

B. Cabinets and fronts: Minimum 20 inches wide, wiring gutter space in accordance with UL 67, with minimum 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 amperes.

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 or determined by the results of the Short-Circuit Analysis performed under Section 260573, whichever is greater.

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 amperes 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. Arc-fault circuit interrupter (AFCI) type circuit breakers: Comply with UL 1699; 120/240-volt, single-pole configuration.
10. 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 be 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-ampere branch circuit breakers.

1. Branch circuit breakers serving exit lights, fire alarm, clocks, telephone equipment, and security equipment shall be provided with handle-blocking devices which shall prevent accidental operation but not prevent tripping.

2.4 FUSIBLE BRANCH CIRCUIT PANELBOARDS

A. Factory-assembled complete with branch fuse disconnect:

1. Emergency (life-safety) panelboard(s) shall be fusible branch circuit panelboards.
2. Main lug only, main fused switch, or main non-fused switch as indicated on the drawings, with main fused switch selectively coordinated with fusible branch switches.
3. Six spare single-pole 20-ampere fuses, unless otherwise noted.
4. UL Listed minimum interrupting rating of 200,000 rms symmetrical amperes at 600 volts AC.

B. Cabinets and fronts: Minimum 20 inches wide, wiring gutter space in accordance with UL 67.

1. Cabinet front: Door-in-door construction, one or more latches as required for size, with outer door covering the gutter.
2. Door: Lock, two keys per lock, steel hinges, and circuit directory card on inside of door.

C. Branch fuse disconnects: UL 248, UL 98, and NEMA FU 1; voltage, continuous-current rating, and interrupting rating as indicated on the drawings or determined by the results of the Short-Current Analysis performed under Section 260573, whichever is greater.

1. Incorporating overcurrent protection fuse and disconnecting means into a single integrated finger-safe component (1-pole, 2-pole or 3-pole) mechanically interlocked to prevent removal of the fuse while fuse terminals are energized.
2. Interchangeable from 15 amperes to 100 amperes without requiring additional space.
3. Time-delay UL Listed Class CF power fuses (equivalent to Class J).
4. Visible circuit ON/OFF indication positions and open fuse indication.
5. Permanently installed lockout means in the OFF position.

D. Bussing assembly and temperature rise: Panelboard bus structure and mains shall have current ratings as shown on the drawings:

1. Sufficient cross section to meet UL 67 temperature rise requirements.
2. Current-carrying parts of the bus structure shall be tin-plated aluminum.
3. Provide a separate copper equipment ground bar and neutral bus bar.

2.5 SOURCE QUALITY CONTROL

A. With branch circuit breakers installed, short-circuit test panelboards as complete units, in accordance with requirements of UL 67.

2.6 TEMPORARY PANELBOARDS (“LOAD CENTERS”)

A. ADF

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. 72 inches (1829 mm) to top of panelboard.
b. Panelboards taller than 72 inches (1829 mm): Bottom edge no more than 4-inches (102 mm) above floor.
c. Top breaker or fused switch maximum height: No more than 6-feet, 7-inches (2.0 m) 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 in both new panelboards and in existing panelboards affected by the work of this project.

3.2 CONNECTIONS

A. Connect panelboards and components to wiring and to ground as indicated.

B. Shared neutral conductors shall not be permitted, except where indicated.

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. Identify available fault current and calculation date for new panelboards, including new panelboards installed in existing cabinets. Refer to Division 26 Section "Overcurrent Protective Device Studies" for additional requirements.

E. Provide printed directory for each panelboard. Handwritten directories are not acceptable. Copying of panel schedules and descriptions on drawings is not acceptable. 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.

F. 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.

C. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification for molded-case circuit breakers, with the exception of thermographic survey. 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 panelboards.

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, receptacles, ground-fault circuit interrupter (GFCI) devices, and arc-fault circuit interrupter (AFCI) devices.

B. Plugs.

C. Terminal blocks.

1.2 RELATED SECTIONS

A. Nameplates: Section 260553.

1.3 REFERENCES

A. ANSI/NEMA WD 6: Wiring Devices - Dimensional Specifications.

B. NEMA WD 1: General Color Requirements for Wiring Devices.

C. UL 20: General-Use Snap Switches.

D. UL 498: Attachment Plugs and Receptacles.

1.4 SUBMITTALS

A. Product data: Each type of device used in the project.

PART 2 - PRODUCTS

2.1 SWITCHES , RECEPTACLES, AND AFCI DEVICES

A. Acceptable manufacturers:

1. Pass & Seymour, Inc.
2. Leviton Manufacturing Co.
3. Hubbell/Bryant Electric
4. Cooper Industries/Cooper Wiring Devices.

B. Switches: Industrial extra heavy-duty specification grade switches conforming to UL 20:

1. Toggle type switches: Single pole.

    a. Basis of design: Pass & Seymour PS20AC1.

C. Receptacles: Conforming to UL 498. Either heavy-duty specification grade, or industrial grade:

1. Convenience receptacles: Duplex, brass mounting strap, NEMA 5-20R.

    a. Basis of design: Pass & Seymour PS5362.

2. Straight-blade power receptacles: Simplex, reinforced thermoplastic polyester face and base, tin-plated brass contacts, zinc-plated steel mounting strap, brass-plated steel terminal screws, brass ground shunt, zinc-plated steel mounting screws.

    a. Basis of design: Bryant/Hubbell

        (1) NEMA 5-30R: 9530FR
        (2) NEMA 6-30R: 9630FR

3. Locking power receptacles: Simplex, nylon face and body, back- and side-wired, all-brass mounting and grounding.
    a. Basis of design: Hubbell

        (1) NEMA 6-30R HBL 2620.

D. GFCI receptacles: Specification grade receptacle conforming to UL 498:

1. Convenience receptacles: Duplex GFCI, NEMA 5-20R.

    a. Basis of design: Pass & Seymour 2097.

E. GFCI devices: meeting Federal Specification Listing WC596, UL 943, self-testing, status indicating light, no reset if GFCI function is impaired, back & side wired, feed-through rated for twenty amperes at 120 volts.

1. Basis of design: Leviton GFRBF-W.

F. AFCI devices: meeting Federal Specification Listing WC596, green power ON LED indicator, automatic self-test each time reset button is pressed in place, no reset if AFCI function is impaired, back & side wired, feed-through rated for twenty amperes at 120 volts.

1. Basis of design: Hubbell AFR20BFW

G. Device color:

1. Switches and general-purpose receptacles: White
2. Special receptacles: Black.

H. Device plates: Type 302 stainless steel.

1. Basis of design: Pass & Seymour:

a. Type 302 stainless steel, SS Series.

2.2 PLUGS

A. Description: Male connectors for attachment to cord that do not incorporate switches or overcurrent protection.

B. Acceptable manufacturers:

1. Pass & Seymour, Inc.
2. Leviton Manufacturing Co.
3. Hubbell/Bryant Electric
4. Cooper Industries/Cooper Wiring Devices.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. General Characteristics:

a. Reference Standards: UL CCN AXUT and UL 498.

D. Indoor-Use, Male Sealed Cord Connector

1. Basis of design: Pass & Seymour, with rubber body and nickel-plated blades and contacts.

a. NEMA 5-15P: 14W47
b. NEMA 5-20P: 14W33
c. NEMA 6-20P: 14W48
d. NEMA L6-30P

2. Basis of design: Leviton, with nylon body and solid brass blades and contacts.

a. NEMA 6-30P: 9630-P

2.3 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices in complete compliance with the manufacturer's recommendations.

B. Receptacles 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.
E. For each existing circuit getting new AFCI protection, locate AFCI devices in same electrical closet as the panelboard that supplies the circuit. Provide a metal outlet box and surface-mount. Coordinate exact location with existing work in the closet.
F. Where plug-and-cord connected equipment is called for in the contract documents, but a plug is not provided by the equipment manufacturer, provide a plug. Coordinate plug configuration with circuit voltage and ampacity and receptacle configuration.

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.

3.3 PROTECTION

A. After installation, protect plugs from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by COTR.

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. Motors requirements for plumbing equipment: Section 220513.

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, 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. Motors:

1. Motors requirements for plumbing equipment: Section 220513.

B. 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.

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 262914 - ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Alternating-current motor starters (enclosed controllers) rated 600 V and less that are supplied as enclosed units.

1. Magnetic motor starters and combination starters.
2. Manual motor starters.

1.2 RELATED SECTIONS

A. Motors and variable-frequency drives:

1. Motors requirements for plumbing equipment: Section 220513.

B. Fuses: Section 262813.

1.3 SUBMITTALS

A. Product data:

1. Each type of motor starter included in the project, including dimensions, ratings, and data on features and components.

B. Shop drawings: Composite wiring diagram showing the interlocking and control wiring.

C. Operation and maintenance data: For operating and maintenance manuals, as specified in Section 260101.

1.4 QUALITY ASSURANCE

A. Source limitations: Obtain motor starters of a single type through one source from a single manufacturer.

B. Electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate layout and installation of motor starters with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for work space and for access.

B. Coordinate features, accessories, and functions of each motor starter with ratings and characteristics of supply circuit, motor, control sequence, and duty cycle of motor and load.

1. Refer to wiring diagrams required in the sections specifying the equipment.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS, GENERAL

A. Basis-of-design product: Subject to compliance with requirements, provide the specified Schneider Electric; Square D products, or comparable products by one of the following:

1. Eaton Corporation
2. ABB; General Electric products
3. Schneider Electric; Square D products
4. Siemens Industry, Inc.

2.2 MAGNETIC MOTOR STARTERS

A. Enclosure: Surface-mounted, NEMA 250 Type 1, unless otherwise indicated.

B. Motor starters and combination starters shall be across-the-line magnetic type, rated in accordance with NEMA Standards, sizes, and horsepower ratings. Basis of Design: Square D Company, Class 8536, Type S.

1. Contacts: Double-break silver-alloy type, replaceable from the front without removing power wiring or removing the starter from its mounting.
2. Overload protection: Solid-state overload relay, one-piece construction, interchangeable, with reset button set in cover.

a. Sensors in each phase: Matched to nameplate full-load current of the motor to which they connect and with appropriate adjustment for duty cycle.

3. Starter shall operate only when protective relays are in place.
4. Combination starters shall be lockable in the Off position.

5. Disconnecting switch for combination starters: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Interlock with unit cover.

C. Control circuit: 120-Volt.

1. Control power transformer: Primary voltage as required for the motor, 120-V secondary voltage; capacity to operate connected indicating and control devices and 100 percent spare capacity.
2. Primary and secondary fuse protection for each control power transformer: Class CC fuses, current-limiting rejection type, rated 0.1 to 30 A, 600 V, and 200 kA interrupting rating.

D. Auxiliary control contacts:

1. One spare normally open and one spare normally closed.
2. Additional contacts required by the automatic temperature control system.

E. Selector switches, indicating lights, and identification on each motor starter cover, complete with wiring and interconnections to starter and auxiliary control contacts:

1. Selector switch: Hand-Off-Automatic (HOA), heavy-duty.
2. Indicating lights: Push-to-test, 30.5 mm or 22 mm, transformer type, LED or neon. Indications:

a. Red for Stopped and green for Running.

3. Identification: Printed or engraved nameplates for HOA switch and for each indicating light.

2.3 MANUAL MOTOR STARTERS

A. Enclosures: NEMA 250 Type 1 for interior use.

1. Mounting: Flush-mounted in finished areas and where possible; surface-mounted elsewhere, with cover plates to suit the mounting.
2. Indicating lights mounted in enclosure.
3. Engraved plastic identification plates.

B. Manual motor-starting switch: Single- or two-pole as required, with built-in thermal overload protection.

1. Basis of design: Square D Class 2510.

C. Switch: Toggle, quick-make and quick-break, with self-indicating, trip-free handle, and means for locking in Off position.

D. Overload protection unit: Melting-alloy type, interchangeable; starter shall be inoperative if unit is removed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. For equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For equipment not at walls, mount on lightweight structural-steel channels bolted to floor or to structure above ceiling.

B. Provide wiring as indicated on the drawings.

C. Applications: Magnetic motor starters for all equipment unless otherwise specified or indicated on drawings.

D. Install starters, auxiliary contacts, and automatic control devices furnished with equipment, except those that are already mounted on the equipment, fully wired and connected. See coordination requirements specified in Part 1 above.

E. Check the size of the overload protection, and change or adjust it as required, after the HVAC systems have been adjusted and balanced as specified in Section 230593, Testing, Adjusting, and Balancing.

F. Install fuses in each fusible switch. Comply with requirements of Section 262813.

END OF SECTION 262914

SECTION 264313 – SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices (SPD's) for the protection of AC electrical circuits from the effects of lightning-induced currents, substation switching transients, and internally generated transients resulting from inductive or capacitive load switching.

1.2 RELATED SECTIONS

A. Panelboards: Section 262416.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. MCOV: Maximum continuous operating voltage.

C. MOV: Metal-oxide varistor.

D. SPD: Surge protective device.

E. VPR: Voltage protection rating.

1.4 SUBMITTALS

A. Product data: Manufacturer’s catalog information, including unit dimensions and rated capacities for each type of unit included in the project.

B. Certifications:

1. Cover page of manufacturer’s UL test report for each type of unit, showing that the unit is UL 1449 Fourth Edition listed.
2. UL 1449 Fourth Edition listing documentation verifying the following:

    a. Voltage protection rating (VPR).
    b. Maximum continuous operating voltage (MCOV).

3. Electromagnetic interference certification in accordance with UL 1283.

1.5 QUALITY ASSURANCE

A. Each SPD shall be UL 1449 Fourth Edition listed and labeled.

B. A single manufacturer shall provide SPD's for every location.

1.6 WARRANTY

A. In addition to the general project warranty and correction period, provide manufacturer's special warranties providing unlimited replacements of suppressor modules if they are destroyed by transients. Length of warranties:

1. Secondary distribution SPD: Ten years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide externally mounted SPD units manufactured by ASCO Power Technologies, or comparable product by one of the following:

1. ABB; General Electric products.
2. ASCO Power Technologies.
3. Eaton Corporation.
4. Erico International Corp.; Pentair.
5. Schneider Electric; Square D products.
6. Siemens Industry, Inc.
7. Surge Suppression Inc.

2.2 SURGE PROTECTIVE DEVICES FOR SECONDARY BRANCH CIRCUIT PANELBOARDS

A. SPD unit externally mounted and field wired to the panelboard as specified in Section 262416, Panelboards. SPD integral to the panelboard shall not be acceptable.

B. Suppression components shall be MOV based, serviceable, and replaceable.

C. SPD shall provide surge current paths for the following modes of protection: L-N, L-G, L-L, and N-G.

D. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of -50dB at 100 kHz.

E. Provide terminals for the necessary power and ground connections. Each terminal shall accommodate wire sizes of No. 10 to No. 1 AWG.

F. SPD's shall meet or exceed the following criteria:

1. Surge current capacity, single pulse rated, (L-N + N-G):

a. For branch-circuit panelboards: 100 kA per phase.

2. The UL 1449 Fourth Edition; voltage protection ratings (VPR) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120V	700V	800V	1200V	700V

3. UL 1449 listed maximum continuous operating voltage (MCOV):

System Voltage	Allowable System Voltage Fluctuation	MCOV
208Y/120V	25 percent	150V

G. SPD shall be equipped with the following:

1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
2. Audible alarm with on/off silence function and diagnostic test function.
3. One set of normally open/normally closed dry contacts.

H. Enclosure: NEMA 250 Type 1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install per manufacturer's installation instructions and recommendations.

B. Install SPD's plumb, level and rigid without distortion.

3.2 INSTALLING SURGE PROTECTIVE DEVICES FOR PANELBOARDS

A. Install SPD external to branch panelboards.

B. Install per manufacturer's installation instructions with lead lengths as short (less than 24 inches) and straight as possible.

1. Rearrange circuit breaker or fused switch locations in panelboards to ensure short and straightest possible leads to each SPD.

3.3 ADJUSTMENTS AND CLEANING

A. Remove debris from SPD and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch up paint to match original finish.

3.4 FIELD QUALITY CONTROL

A. Test and inspections:

1. Perform each visual and mechanical inspection and electrical test in accordance with NETA Acceptance Testing Specifications in section for Surge Arresters, Low-Voltage, except for inspection and test procedures involving anchorage and bolted connections. Certify compliance with test parameters.
2. After installing SPD devices but before electrical circuitry has been energized, test for compliance with requirements.
3. Complete startup procedures according to manufacturer's written instructions.

B. SPD device shall be considered defective if it does not pass tests and inspections.

END OF SECTION 264313

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Luminaires, including lamps, drivers, and accessories.

B. Light track.

C. Emergency lighting control transfer relay device.

1.2 RELATED SECTIONS

A. Dimming control: Section 260923.

1.3 SUBMITTALS

A. Product data:

1. For each type of luminaire indicated, arranged in order of luminaire designation. Include data on features, accessories, and the following:

    a. Dimensions of luminaires, photometrics and efficiency, wattage, reflectors, glassware, voltage, suspension, and appurtenances.
    b. Certified results of laboratory tests for luminaires and lamps for photometric performance.
    c. LED drivers
    d. Lumen output, rated color temperature, and manufacturer’s LED binning procedures.
    e. Types of lamps.

2. For emergency lighting control transfer relay device.

B. Coordination drawings: Reflected ceiling plans and sections drawn to scale and coordinating luminaire installation with ceiling grid, ceiling-mounted items, and other components in the vicinity. Include work of all trades that is to be installed near lighting equipment.

C. 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.

D. Samples:

1. 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.

    a. One complete luminaire of each approved type, except as otherwise instructed by the COTR.
    b. Install approved samples as work of the project, in locations as directed, as standards for all luminaires of the same type.
    c. Ascertain that the luminaire will fit in the available space and is coordinated with adjacent and connected products.

2. Provide sample of custom-made replacement light track intended to replace removed track.

E. Maintenance data: For luminaires to include in maintenance manuals specified in Division 01.

F. Field quality control report.

G. Warranties: Special warranties specified in this section.

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 WARRANTY

A. Special warranty for batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Special warranty period for batteries: Manufacturer's standard, but not less than 5 years from date of substantial completion. Full warranty shall apply for first year, and prorated warranty for last four years.

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

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: 3 mm (0.125 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, or by a wireless Bluetooth signal.

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 watts 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. Light sources for ac operation: Light-emitting diodes, 70,000 hours minimum rated life.

2.5 EMERGENCY BATTERY LIGHTING UNITS

A. General requirements: Self-contained units. Comply with UL 924. Units include the following features:

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lights on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lights automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lights, and battery is automatically recharged and floated on charger.
4. Wire guard: Where indicated, heavy-chrome-plated wire guard arranged to protect light heads or fixtures.
5. Integral time-delay relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.

2.6 EMERGENCY LIGHTING CONTROL TRANSFER RELAY DEVICE

A. External type (multiple luminaire): Self-contained, modular unit mounted within accessible ceiling. UL 1008 listed as “emergency lighting equipment” and UL listed for field installation.

1. Capable of bypassing the local switching means when normal utility power has been lost.
2. Device shall consist of a test switch, normal power indicator light and an alternate power indicator light.
3. Fire alarm interface contacts to allow fire alarm to force luminaires on regardless of switch position.
4. Rated for 120 through 277-volts AC, up to 20 amperes of lighting load.
5. Emergency lighting control relay control device: Equal to Bodine, Model BLCD-20B.

2.7 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 Government.
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.

2.8 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.

2.9 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.

1. Each luminaire shall be completely equipped with lamps of the size, type, wattage and shape indicated and specified. Lamps shall be of the proper voltage for the building.

C. Furnish luminaires in the quantities, sizes, and types indicated on drawings.

D. Where a letter designating luminaire type is adjacent to a row of luminaires, it shall be understood that all luminaires in the row shall be of this type, consisting of either four-foot or eight-foot units, the rows consisting of the total lengths indicated. Where the catalog numbers of the luminaires refer to 1.2 meters (4-foot) units, 2.4 meters (8-foot) units may be used where applicable.

E. Provide recessed luminaires with flexible conduit connector and wire (luminaire whip), or a removable wiring access plate, so that they may be wired without removing driver cover. Plate shall be screwed to luminaire housing and conduit shall be securely attached and grounded to luminaire to meet NEC requirements.

F. Track head luminaires shall be furnished by Contractor and installed by SI.

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 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.
4. Connections to structural metal channel: fittings approved for that purpose by both the manufacturer of the channel and the manufacturer of the luminaire.

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. 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, and re-lamped with the specified lamps.

3.5 FIELD QUALITY CONTROL

A. Perform demonstrations.

B. Demonstrations:

1. Schedule demonstrations with the COTR.
2. Demonstrate each luminaire works.
3. Demonstrate, for each length of light track, that each circuit works. This demonstration will require placing a track head on each length of track, on each circuit in that track. It is not necessary to demonstrate all track in the gallery simultaneously; that would require more heads than are being provided under this project.

C. Luminaires and track will be considered defective if they cannot be demonstrated to work.

D. Submit report documenting results of each demonstration session.

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 Contracting Officer’s Technical Representative (COTR).

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, SI'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 SI.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse SI 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 COTR, 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 SI 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 COTR. Provide detailed schedule for completion of

work within 24-hours of receiving written notice from the COTR and revise schedule based on any SI 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 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 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.

1.19 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, Architect and SI 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 Smithsonian 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 Smithsonian personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon by the COTR.

END OF SECTION 270500

SECTION 271500 - VOICE AND DATA COMMUNICATIONS CABLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wire, cable, connecting devices, installation, and testing for wiring systems to be used as signal pathways for voice and high-speed data transmission.

1.2 DEFINITIONS

A. BICSI: Building Industry Consulting Service International

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. LAN: Local area network.

E. OCIO: Smithsonian’s Office of the Chief Information Officer.

F. PVC: Polyvinyl chloride.

G. RCDD: Registered Communication Distribution Designer

H. STP: Shielded twisted pair.

I. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

A. Product data: Include data on features, ratings, and performance for each component specified.

B. Shop drawings: Include dimensioned plan and elevation views of each individual component. Show equipment assemblies, method of field assembly, workspace requirements, and access for cable connections.

1. System labeling schedules, including electronic copy of labeling schedules, as specified in Part 3, in software and format selected by Smithsonian’s Office of the Chief Information Officer.
2. Wiring diagrams. Show typical wiring schematics including the following:

a. Backbone Riser Diagram
b. Workstation outlets, jacks, and jack assemblies.
c. Patch cords.
d. Patch panels.
e. Fiber-optic boxes.

C. Cable Administration Drawings: As specified in Part 3.

D. Optical fiber cable testing plan.

E. Source quality-control reports.

F. Product certificates: For each type of cable, connector, and terminal equipment, signed by product manufacturer.

G. Qualification data: For installer.

H. Field quality-control test reports.

I. Operation and maintenance data: For voice and data communication cabling to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer qualifications: Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of BICSI certified Technician or Level 2 Installer. Whenever fiber optic cable work is performed at the project site, this supervisor shall be present.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing. System installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.

B. Source limitations:

1. Obtain all twisted-pair copper cables through one source from a single manufacturer.
2. Obtain all twisted-pair copper cable hardware through one source from a single manufacturer.
3. Obtain optical fiber cable hardware from single source and from single manufacturer. Provide cable hardware from same manufacturer as optic fiber cable.

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.

D. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of voice and data communication cabling with Smithsonian's Office of the Chief Information Officer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Test fiber optic cables upon receipt at project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in indoor spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Connecting blocks: One of each type for every 25 installed, but no less than one.
2. Outlet assemblies: One of each type for every 25 installed, but no less than one.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Copper cable:

a. Belden Inc.; Electronics Division.
b. Lucent Technologies; Global Service Provider.
c. Mohawk/CDT; a division of Cable Design Technologies.
d. Superior Essex; Superior Telecommunications Inc.

2. Copper cable terminal and connector components and distribution racks:

a. AMP Incorporated; a Tyco International Ltd. Company.
b. Hubbell Premise Wiring.
c. Leviton Telecom.
d. Lucent Technologies; Global Service Provider.

3. Fiber optic cable, terminal and connector components and distribution racks:

a. Belden Inc.; Electronics Division.
b. Corning Cable Systems.

2.2 SYSTEM REQUIREMENTS

A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

B. Expansion capability: Unless otherwise indicated, provide spare conductor pairs in cables, positions in cross-connect and patch panels, and terminal strips to accommodate 20 percent future increase in active workstations.

C. General Performance: Fiber optic cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

D. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 50 or less.

2.3 MOUNTING ELEMENTS

A. Raceways and boxes: Comply with Sections 260533 and 260534.

B. Backboards: 19-mm (0.75-inch), Category B-B, marine grade, fire-retardant-treated plywood.

2.4 TWISTED-PAIR CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

A. Cables: Listed as complying with Category 6 of TIA/EIA-568-D, except where explicitly called out on the drawings as Category 5 or Category 5E.

1. Where called out on the drawings as Category 5, listed as complying with Category 5 of TIA/EIA-568-D.
2. Where called out on the drawings as Category 5E, listed as complying with Category 5E of TIA/EIA-568-D.

B. Conductors: Solid copper.

C. UTP cable: Comply with TIA/EIA-568-D. Four, thermoplastic-insulated, individually twisted pairs of conductors; No. 24 AWG, color-coded; enclosed in PVC jacket.

D. UTP plenum cable: Listed for use in air-handling spaces. Features are as specified for cables, conductors, except materials are modified as required for listing.

E. UTP cable connecting hardware: Comply with TIA/EIA-568-D. IDC type, using modules designed for punch-down caps or tools.

1. IDC terminal block modules: Integral with connector bodies, including plugs and jacks where indicated.
2. IDC connecting hardware: Consistent throughout project.

F. Patch panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of jacks per field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to satisfy specified expansion criteria.
2. Mounting: Backboard.

G. Jacks and jack assemblies for UTP cable: Modular, color-coded, RJ-45 receptacle units with integral IDC-type terminals. Use keyed jacks for data service. Jacks shall be white.

H. UTP patch cords: Four-pair cables in 1200-mm (48-inch) lengths, terminated with RJ-45 plug at each end. Use keyed plugs for data service.

I. Workstation outlets:

1. Faceplate: High-impact plastic; white.
2. Mounting: Flush, unless otherwise indicated.
3. Legend: As indicated on drawings, by silk-screening or engraving.

2.5 850 NANOMETER LASER-OPTIMIZED, 50/125 MICROMETER, PLENUM RATED, INDOOR MULTIMODE OPTICAL FIBER CABLE (OM4), 6-STRAND, TIGHT BUFFER

A. Acceptable Manufacturers

1. Belden
2. Corning Cable Systems

B. Basis of design: Belden FD4D006P9, Corning 006T88-31190-29 or approved equivalent.

C. Minimum Required Features and Specifications

1. Standards:

a. Comply with ICEA S-83-596 for mechanical properties.
b. Comply with TIA-568-C.3 for performance specifications.
c. Comply with TIA-492AAAD for detailed specifications.

2. Maximum Attenuation: 3.00 dB/km at 850 nm; 1.0 dB/km at 1300 nm.
3. Minimum Overfilled Modal Bandwidth-length Product: 3500 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
4. Minimum Effective Modal Bandwidth-length Product: 4700 MHz-km at 850 nm.
5. Jacket:

a. Jacket Color: Black or Aqua
b. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

6. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

    a. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.

2.6 FIBER-OPTIC CONNECTORS AND TERMINAL EQUIPMENT

A. Standards:

1. Comply with Fiber Optic Connector Intermateability Standard (FOCIS) specifications of the TIA-604 series.
2. Comply with TIA-568-C.3.

B. Closet Connector Housing

1. Acceptable Manufacturers

    a. Corning
    b. Belden

2. Corning CCH-04U and CCH-01U; Belden AX105565 and AX105563, or approved equivalents
3. Minimum Required Features and Specifications

    a. Holds 12 CCH and 2 CCH connector panels
    b. Four (4) rack units high or
    c. One (1) rack unit high
    d. Flush mount in 19” rack
    e. Front and rear access

4. Additional Required Options / Parts

    a. Corning Closet Connector Housing Panel CCH-CP12-A9 or approved equivalent

        (1) Holds 12 fibers, Single Mode (OS2)
        (2) LC duplex connectors

    b. Corning Closet Connector Housing Panel CCH-CP24-E4 or approved equivalent

        (1) Holds 24 fibers, Multimode (OM/4)
        (2) LC duplex connectors

C. Fiber Patch Panel (FPP) Housing (Surface Mount)

1. Acceptable Manufacturers

    a. Corning

2. Corning WCH-04P is the basis of design.
3. Minimum Required Features and Specifications

    a. Holds 4 CCH connector panels
    b. Surface/wall mountable

4. Additional Required Options / Parts – Quantity based on configuration

    a. Corning Closet Connector Housing Panel CCH-CP12-E4 or approved equivalent

        (1) Holds up to 12 fibers, 50 micron, multimode (OM/4)
        (2) LC duplex connectors

    b. Corning Closet Connector Housing Panel CCH-CP12-A9 or approved equivalent

        (1) Holds up to 12 fibers, single mode (OS2)
        (2) LC duplex connectors

    c. CCH Strain relief brackets CCH1-STRN-INT or approved equivalent

D. Fiber Single Panel (FSP) Housing

1. Acceptable Manufacturers

    a. Corning

2. Corning SPH-01P is the basis of design.
3. Minimum Required Features and Specifications

    a. Holds 1 CCH connector panel
    b. Surface/wall mountable
    c. Optimized for box-in-a-box applications

4. Additional Required Options / Parts

    a. Corning Closet Connector Housing Panel CCH-CP12-E4 or approved equivalent

        (1) Holds 12 fibers, 50 micron, multimode (OM/4)

(2) LC duplex connectors

b. DIN rail bracket SPH-DIN-KIT or approved equivalent
c. Jumper protection bracket SPH-01P-JMPR-BKT or approved equivalent

E. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

F. Patch Cords: Factory-made, dual-fiber cables in 36 inch (900 mm) lengths.

G. Connector Type: Type LC duplex complying with TIA-604-10-B.

H. Plugs and Plug Assemblies:

1. Male; color-coded modular telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.25 dB.
3. Marked to indicate transmission performance.

I. Jacks and Jack Assemblies:

1. Female; quick-connect, simplex and duplex; fixed telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.25 dB.
3. Marked to indicate transmission performance.
4. Designed to snap-in to a patch panel or faceplate.

2.7 IDENTIFICATION PRODUCTS

A. Comply with Division 27 Section "Common Work Results for Communications" and the following:

1. Cable labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.
2. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.8 SOURCE QUALITY CONTROL

A. Factory test multimode optical fiber cables according to TIA-526-14-B and TIA-568-C.3.

B. Factory test pre-terminated optical fiber cable assemblies according to TIA-526-14-B and TIA-568-C.3.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION OF MEDIA

A. Horizontal cable for data service: Use UTP Category 6 cable for runs between wiring closets and workstation outlets.

B. Horizontal cable for voice service: Use UTP Category 6 cable for runs between wiring closets and workstation outlets.

C. Horizontal cable for video service: Use UTP Category 6 cable for runs between wiring closets and workstation outlets.

D. Horizontal cable from Division 28 fiber module in Cash Room to existing fiber terminal cabinet: fiber optic cable.

3.3 INSTALLATION

A. Comply with requirements in TIA/EIA-568-D and TIA/EIA-569-E.

B. Wiring method: Install wiring and optical fiber in raceway except within equipment rooms, wiring closets, consoles, cabinets, desks, and counters and except in accessible ceiling spaces. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings.

C. Install cables using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.

D. Install cables without damaging conductors, shield, or jacket.

E. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

F. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

1. Pull cables simultaneously if more than one is being installed in same raceway.
2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.

G. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.

H. Secure and support cables at intervals not exceeding 760 mm (30 inches) and not more than 150 mm (6 inches) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

I. Wiring in closets and enclosures: Provide conductors of adequate length. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

J. Separation of wires: Comply with TIA/EIA-569-E rules for separating unshielded copper voice and data communication cabling from potential EMI sources, including electrical power lines and equipment.

K. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.

L. Use splice and tap connectors compatible with media types.

M. Optical Fiber Backbone Cables

1. Comply with NECA 1, NECA 301, and NECA/BICSI 568.
2. General Requirements for Optical Fiber Cabling Installation:

a. Comply with TIA-568-C.1 and TIA-568-C.3.
b. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
c. Terminate all cables; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

d. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
e. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
f. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
g. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
h. Cold-Weather Installation: Bring cable to room temperature before unreeling. Heat lamps shall not be used for heating.
i. In the communications rooms, provide a 10 foot (3 m) long service loop on each end of cable.
j. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
k. Terminate cable on connecting hardware that is rack or cabinet mounted.
l. Placement of Cable into Conduit Risers: Provide conduit risers as indicated on the plans. Use grips and/or other hanger devices to support the vertical drop of cable and prevent any possible kinking of the cable after installation.
m. Minimum Bend Radius: For static storage, do not bend the cable at any location to less than ten times the outside diameter of the cable or as recommended by the manufacturer. During installation, the cable shall not be bent at any location to less than twenty times the outside diameter of the cable or as recommended by the manufacturer.

3. Open-Cable Installation:

a. Install cabling with horizontal and vertical cable guides in communications spaces with terminating hardware and interconnection equipment.
b. Do not run cable through structural members or in contact with pipes, ducts, or other potentially damaging items.

4. Group connecting hardware for cables into separate logical fields.

3.4 GROUNDING

A. Comply with Section 260526, Grounding and Bonding.

B. Ground equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.5 INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

A. Install plywood backboards on walls of equipment rooms and wiring closets where indicated.

B. Mount patch panels, terminal strips, and other connecting hardware on backboards, unless otherwise indicated.

C. Group connecting hardware for cables into separate logical fields.

D. Use patch panels to terminate cables entering the space, unless otherwise indicated.

3.6 IDENTIFICATION

A. In addition to requirements in this Article, comply with applicable requirements in Section 270500, Common Work Results for Communications, and TIA/EIA-606.

B. System: Use a unique, three-syllable, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.

1. First syllable identifies and locates equipment room or wiring closet where cables originate.
2. Second syllable identifies and locates cross-connect- or patch-panel field in which cables terminate.
3. Third syllable designates type of media (copper or fiber) and position occupied by cable pairs or fibers in field.

C. Workstation: Label cables within outlet boxes.

D. Distribution racks and frames: Label each unit and field within that unit.

E. Within connector fields in equipment rooms and wiring closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

F. Cables, general: Label each cable within 100 mm (4 inches) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

G. Exposed cables and cables in wireways: Label each cable intervals not exceeding 4.5 meters (15 feet).

H. Cable schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project, in software and format selected by Smithsonian's Office of the Chief Information Officer.

I. Cable administration drawings: Show building floor plans with cable administration point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606. Furnish electronic record of all drawings, in software and format selected by the Smithsonian's Office of the Chief Information Officer.

3.7 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
2. Copper cable procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 6 tester (or Category 5 or 5E tester for those types of cables). Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-TSB67, "Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems." Link performance for UTP cables must meet minimum criteria of TIA/EIA-568-D.
3. Fiber-optic cable procedures:

    a. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color- coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
    b. Visually inspect cable placement, cable termination, equipment and patch cords, and labeling of all components.
    c. Optical Fiber Cable Tests:

        (1) Test instruments shall meet or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
        (2) Link End-to-End Attenuation Tests:

(a) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
(b) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568-C.1.

(3) OTDR Test: Perform optical time domain reflectometer test in the 800 to 1300 nanometers wavelength band on the fiber optic cable after it is installed. Calibrate he optical time domain reflectometer to show anomalies of zero point two (0.2) dB as a minimum. If the optical time domain reflectometer test results are unsatisfactory, replace unsatisfactory segments with a new segment of cable at no cost to SI. Test the new segment of cable to demonstrate acceptability. Furnish photographs of the traces to the SI for each circuit.

B. Document data for each measurement. Print data for submittals in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and submit electronically.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Validation: Test random fiber strands at OCIO's discretion to confirm validity of test results. Contractor to perform cable testing in presence of OCIO using Contractor staff and utilizing same test equipment that was used for final acceptance testing by Contractor. Smithsonian reserves the right to validate up to Final of installed optical fiber.

3.8 DEMONSTRATION

A. As required in Section 270500, provide operating instructions.

END OF SECTION 271500

SECTION 280101 – ELECTRONIC SAFEY & SECURITY GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for electronic safety and security 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 COTR.

E. Electronic safety and security work of this project includes, as a brief general description, the following:

1. Providing video surveillance equipment.
2. Providing access control equipment.

3. Integrating equipment into the building’s existing video surveillance and access control systems.
4. The project includes commissioning under the direction of a Commissioning Agent (CxA).

F. See Division 01 for requirements related to commissioning, SI'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 28 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 SI.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse SI 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 electronic safety and security 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. 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 Contracting Officer's Technical 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 COTR's 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 electronic safety & security, 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 electronic safety and security 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. Electronic safety and security 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 SI 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 electronic safety and security 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 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 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 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.

1.19 COMMISSIONING

A. This project includes commissioning under the direction of a Commissioning Agent (CxA). Contractors' 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, Architect and SI 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 280101

SECTION 280500 – COMMON WORK RESULTS FOR ELECTRONIC SAFEY & SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The National Museum of Asian Art (Sackler Gallery) has an electronic security system (ESS). Under this project, new video surveillance and access control devices shall be provided in the National Museum of Asian Art (NMAA). Provide modifications to the ESS in accordance with the drawings, specifications, and referenced publications, in order to incorporate the new equipment into the existing ESS.

B. This section includes general requirements that apply to Smithsonian ESSs. Not every requirement will apply to this project. However, during the course of the project the Smithsonian may wish to add to the ESS; therefore, this section includes requirements for systems not part of the original contract.

C. Perform work, products, systems integration, engineering, and design work required for the project in order to ensure complete and fully operational systems and proper installation of equipment. Provide calculations and analysis to support design and engineering decisions as specified in submittals. Provide and pay all labor, materials, and equipment, sales and gross receipts and other taxes. Secure and pay for plan check fees, permits, other fees, and licenses necessary for the execution of work as applicable for the project. Give required notices; comply with codes, ordinances, regulations, and other legal requirements of public authorities, which bear on the performance of work.

D. The modified ESS shall be installed, programmed, configured, documented, and tested. The security system includes but is not limited to: access control, video surveillance and assessment, video recording and storage, equipment cabinetry, and uninterruptible power supplies (UPS) interface. Only modifications made under this project must be documented and tested under this project.

E. The work includes the procurement and installation of electrical wire and cables, the installation and testing of system components. Inspection, testing, demonstration, and acceptance of equipment, software, materials, installation, documentation, and artisanry, shall be as specified herein. Provide associated installation support, including the provision of primary electrical input power circuits.

F. Provide repair service replacement parts and on-site service during the warranty period. Guarantee parts and labor for a term of one (1) year, unless dictated otherwise in this specification from the acceptance date of the system. The Contractor is responsible for equipment, software, firmware, licensing, shipping, transportation charges, and expenses associated with the service of the system for one (1) year.

G. Operator training is not required.

1.2 SUMMARY

A. This specification provides general requirements for the overall electronic security system (ESS) applicable to all projects.

1.3 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. This Specification is the base document for electronic security systems. Use the following specification sections in conjunction to provide a complete and fully integrated security management system.

1. 260526 – Grounding and Bonding
2. 260533 – Conduits
3. 262716 – Cabinets and Enclosures
4. 271500 – Voice and Data Communications Cabling
5. 280507.10 – Power Sources for Electronic Security
6. 280509.10 – Surge Protection for Electronic Security
7. 280531.10 – Communications Equipment for Electronic Security
8. 280800.10 – Commissioning of Electronic Security
9. 281000 – Access Control
10. 281515 – Electrified Locking Devices & Accessories
11. 282000 – Video

C. Requirements of Specification 280800.10 take precedence over Division 01 System Acceptance requirements.

D. Related Sections include the following:

1. Division 01, including requirements for commissioning and construction waste management.
2. Division 08

    a. Coordinate Division 8 and 28 requirements.

3. Division 26

    a. Provide dedicated Optional Standby Electrical Power (120 VAC) circuits as needed to provide full system functionality.

4. Division 27

    a. Shared pathways

5. Section 280500 – Common Work Results for Electronic Safety and Security. This section contains requirements for work of more than one section of Division 28. Where the requirements of Section 280500 do not conflict with the requirements of 280500.10, comply with Section 280500.

1.4 REFERENCES

A. American National Standards Institute (ANSI)

1. ANSI INCITS 92 (1980, R 2003), Data Encryption Standard
2. ANSI/TIA-568.0-D, Rev D (9/2015+Edit:12/2015), Generic Telecommunications Cabling for Customer Premises
3. ANSI/TIA-568.1-D, Rev D (9/2015), Commercial Building Telecommunications Infrastructure Standard
4. ANSI/TIA-568-C.2, Rev C (8/2009+A1:6/2016), Balanced Twisted-Pair Telecommunications Cabling And Components Standards
5. ANSI/TIA-568-C.3, Rev C (6/2008+A1:10/2011), Optical Fiber Cabling Components Standard
6. ANSI/TIA-568-C.4, Rev C (7/2011), Broadband Coaxial Cabling and Components Standard
7. ANSI/TIA-569, REV D (4/2015), Telecommunications Pathways and Spaces
8. ANSI/TIA-606, Rev B (6/2012+A1:12/2015), Administration Standard for the Telecommunications Infrastructure
9. ANSI/TIA-607, Rev C (11/2015), Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
10. ANSI/TIA/EIA 492AAAB Rev B (11/2009), Detail Specification for 50µm Core Diameter / 125µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers.
11. ANSI/TIA/EIA-526-14 Revision C (4/2015), Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; Modification of IEC 61280-4-1 edition 2, Fiber-Optic Communications Subsystem Test Procedures- Part 4-1: Installed Cable Plant-Multimode Attenuation Measurement
12. ANSI/SIA CP-01-2014, Control Panel Standard - Features for False Alarm Reduction

B. ASTM International (ASTM)

1. ASTM A153/A153M-16, Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2. ASTM B3-13, Standard Specification for Soft or Annealed Copper Wire

3. ASTM B32-08 (2014), Standard Specification for Solder Metal
4. ASTM C1107/C1107M-14a, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
5. ASTM D709-16, Standard Specification for Laminated Thermosetting Materials
6. ASTM E84-16, Standard Test Method for Surface Burning Characteristics of Building Materials

C. Federal Information Processing Standards (FIPS):

1. FIPS PUB 201 2nd Edition (8/1/2013), Personal Identity Verification (PIV) of Federal Employees and Contractors

D. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE Std 100 (2000), The Authoritative Dictionary of IEEE Standards Terms
2. IEEE 81, 2012 Edition (12/2012), Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
3. IEEE 142, 2007 Edition (11/2007), Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book (Color Book Series)
4. IEEE C2 National Electrical Safety Code (NESC), 2017 Edition
5. IEEE C62.41.1, 2002 Edition (11/2002), RN: (12/2008), Guide on Surges Environment in Low Voltage (1000 V and Less) AC Power Circuits
6. IEEE C62.41.2, 2002 Edition (11/2002), CRGD: (12/2012), Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

E. International Organization for Standardization (ISO)

1. ISO 7810, 2003 Edition, A2 (01/2012), Identification Cards – Physical Characteristics

F. National Electrical Contractors Association (NECA)

1. NECA 1 2015 Edition (1-2015), Standard for Good Workmanship in Electrical Construction

G. National Electrical Manufacturers Association (NEMA)

1. NEMA 250, 2014 Edition (1/2014), Enclosures for Electrical Equipment (1000 Volts Maximum)
2. NEMA ICS 1 (2000; R 2015), Industrial Control and Systems: General Requirements
3. NEMA ICS 2 (2000; Errata 3/2008), Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated 600 Volts

4. NEMA ICS 6 93rd Edition (1993; R 2011), Industrial Control and Systems: Enclosures

H. National Fire Protection Association (NFPA)

1. NFPA 70 2017 Edition (2017), National Electrical Code
2. NFPA 72 2016 Edition (1/2016), National Fire Alarm and Signaling Code.
3. NFPA 101 2015 Editon (2015), Life Safety Code
4. NFPA 262 2015 Edition (1/2015), Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
5. NFPA 730 2014 Edition (1/2014), Guide for Premises Security
6. NFPA 731 2015 Edition (1/2015), Standard for the Installation of Electronic Premises Security Systems

I. National Institute of Standards and Technology (NIST)

1. PIV Card Specifications:

   a. SP 800-73-2 (9/2008), Interfaces for Personal Identity Verification
   b. NISTIR 7284 (2006), Personal Identity Verification Card Management Report
   c. SP 800-76-2 (7/2013), Biometric Data Specification for Personal Identity Verification
   d. SP 800-78-4 (5/2015), Cryptographic Algorithms and Key Sizes for Personal Identity Verification
   e. SP 800-73-4 (4/2016), PIV Card Application and Middleware Interface Test Guidelines

2. PIV Card and Middleware Conformance Testing:

   a. SP 800-85B (2006), PIV Data Model Conformance Test Guidelines

3. PIV Accreditation:

   a. SP 800-96 (2006), PIV Card / Reader Interoperability Guidelines

4. Issuing Organizations:

   a. SP 800-87 Rev 1 (4/2008), Codes for the Identification of Federal and Federally-Assisted Organizations
   b. NISTIR 7337 (2006); Personal Identity Verification Demonstration Summary

J. Security Industry Association (SIA)

1. SIA BIO-01-1993.02 (R2000.06), Biometric Vocabulary Standard
2. SIA DC-01-1988 (R2001.04), DCS Computer Interface (CIS-1) Technical Report
3. SIA DC-03-1990.01 (R2003.10), DCS SIA Format Standard
4. SIA DC-07-2001.04, DCS Computer Interface (CIS-2) Standard

K. Telecommunications Industries Association (TIA)

1. TIA-232 Rev F (10/1997; R 12/2012), Interface Between Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary data Exchange
2. EIA/ECA-319 Rev E (12/2005), Cabinets, Racks, Panels, and Associated Equipment
3. TIA-455-3, Rev B (7/2009), Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components
4. TIA-455, Rev C (8/2014), General Requirements for Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components
5. TIA-598 Revision D (7/2014), Optical Fiber Cable Color Coding
6. TIA-604-3 Revision B (8/2004; R 1/2014), FOCIS-3 Fiber Optic Connector Intermateability Standard, Type SC and SC-APC
7. TIA-604-1 1996 Edition (3/1996; R 1/2012), Fiber Optic Connector Intermateability Standard

L. Underwriters Laboratories (UL)

1. UL 6 2014 Edition (11/2014), Electrical Rigid Metal Conduit - Steel
2. UL 50 13th Edition (10/2015), Enclosures for Electrical Equipment, Non-Environmental Considerations
3. UL 50E 2nd Edition (10/2015), Enclosures for Electrical Equipment, Environmental Considerations
4. UL 83 15th Edition (3/2014), Thermoplastic-Insulated Wires and Cables
5. UL 294 6th Edition (2/2015), Access Control System Units
6. UL 444 4th Edition (4/2015), Communications Cables
7. UL 464 10th Edition (1/2016), Audible Signaling Devices for Fire Alarm and Signaling Systems, including Accessories
8. UL 467 10th Edition (3/2013), Standard for Safety Grounding and Bonding Equipment
9. UL 497B 4th Edition (12/2012), Protectors for Data Communication and Fire Alarm Circuits
10. UL 609 11th Edition (3/2015), Local Burglar Alarm Units and Systems
11. UL 634 2009 Edition (12/2009; R 3/2015), Connectors and Switches for Use with Burglar-Alarm Systems
12. UL 636 10th Edition (10/2008; R 1/2013), Holdup Alarm Units and Systems
13. UL 639 8th Edition (5/2012), Intrusion Detection Units

14. UL 681 15th Edition (1/2014), Installation and Classification of Burglar and Holdup Alarm Systems
15. UL 796 11th Edition (5/2016), Printed-Wiring Boards
16. UL 797 9th Edition (12/2012), Electrical Metallic Tubing -- Steel
17. UL 827 8th Edition (2/2015), Central Station Alarm Services
18. UL 910 5th Edition (11/1998), Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air
19. UL 969 4th Edition (11/2001), Marking and Labeling Systems
20. UL 972 6th Edition (7/2011), Burglary Resisting Glazing Material
21. UL 1037 6th Edition (9/2016), Antitheft Alarms and Devices
22. UL 1076 5th Edition (3/2015), Proprietary Burglar Alarm Units and Systems
23. UL 1424 4th Edition (1/2015), Power-Limited Fire-Alarm Circuits
24. UL 1492 (3/2002; R 7/2013), Audio-Video Products and Accessories
25. UL 1581 4th Edition (8/2016), Reference Standard for Electrical Wires, Cables, and Flexible Cords
26. UL 1610 4th Edition (7/2016), Central-Station Burglar-Alarm Units
27. UL 1635 3rd Edition (1/2012; R 3/2015), Digital Alarm Communicator System Units
28. UL 1638 5th Edition (1/2016), Visible Signaling Devices for Fire Alarm and Signaling Systems, including Accessories
29. UL 1638A 1st Edition (6/2016), Visual Signaling Appliances for General Signaling Use
30. UL 1655 2nd Edition (11/2014; R 11/2014), Community-Antenna Television Cables
31. UL 1660 5th Edition (7/2014), Liquid-Tight Flexible Nonmetallic Conduit
32. UL 1666 5th Edition (6/2012), Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
33. UL 1981 3rd Edition (4/2015). Central Station Automation Systems
34. UL 2050 5th Edition (11/2010), National Industrial Security Systems
35. UL 2196 1st Edition (3/2012), Tests for Fire Resistive Cables

1.5 DEFINITIONS

A. ARA: Area of Rescue Assistance

B. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

C. BICSI: Building Industry Consulting Service International

D. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.

E. CPU: Central processing unit.

F. Credential: Data assigned to an entity and used to identify that entity.

G. DGP: Data Gathering Panel

H. EMI: Electromagnetic interference.

I. EMT: Electric Metallic Tubing

J. ESS: Electronic Security System

K. GFI: Ground fault interrupter.

L. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

M. I/O: Input/Output.

N. INC: Intelligent Network Controller

O. Intrusion Zone (IZ): A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.

P. LAN: Local area network.

Q. LCD: Liquid-crystal display.

R. LED: Light-emitting diode.

S. LOD: Level of Detail

T. LOE: Level of Effort

U. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

V. M-JPEG: Motion – Joint Photographic Experts Group.

W. MPEG: Moving picture experts group.

X. NEC: National Electrical Code

Y. NECA: National Electrical Contractors Association

Z. NEMA: National Electrical Manufacturers Association

AA. NFPA: National Fire Protection Association

BB. NRTL: Nationally Recognized Testing Laboratory.

CC. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

DD. OCIO: Office of the Chief Information Officer

EE. OPS: Office of Protection Services

FF. OTDR: Optical Time Domain Reflectometer

GG. PACS: Physical Access Control System

HH. PIR: Passive infrared

II. PIR Rex: Passive Infrared Request to Exit

JJ. PoE: Power over Ethernet

KK. PPSD: Personnel and Physical Security Division (a department within OPS)

LL. RCDD: Registered Communications Distribution Designer.

MM. RF: Radio frequency.

NN. RFI: Radio-frequency interference.

OO. RIGID: Rigid conduit, galvanized steel.

PP. RS-232: A TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.

QQ. RS-485: A TIA/EIA standard for multipoint communications.

RR. SMS: Security Management System – A SMS is a software that incorporates multiple security subsystems (e.g., access control, intrusion detection, closed circuit television, intercom) into a single platform and graphical user interface.

SS. Standard Intruder: A person who weighs 100 lb. (45 kg) or more and whose height is 1525 mm (60 in) or more; dressed in standard clothing.

TT. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.

UU. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

VV. TDMM: Telecommunications Distribution Methods Manual

WW. TIA: Telecommunications Industry Association

XX. UPS: Uninterruptible Power Supply

YY. UTP: Unshielded Twisted Pair

ZZ. VASS: Video Assessment and Surveillance System

AAA. VPN: Virtual Private Network

BBB. WAN: Wide Area Network.

CCC. WAV: The digital audio format used in Microsoft Windows.

DDD. Windows: Operating system by Microsoft Corporation.

EEE. Workstation: A PC with software that is configured for specific limited security system functions.

FFF. WYSIWYG: (What You See Is What You Get.) Text and graphics appear on the screen the same as they will print.

1.6 GENERAL ARRANGEMENT OF CONTRACT DOCUMENTS

A. The Contract Documents supplement to this specification indicates approximate locations of equipment. The installation and/or locations of the equipment and devices shall be governed by the intent of the design; specification and Contract Documents, with due regard to actual site conditions, recommendations, ambient factors affecting the equipment and operations in the vicinity. The Contract Documents are diagrammatic and do not reveal all offsets, bends, elbows, components, materials, and other specific elements that may be required for proper installation. If any departure from the contract documents is deemed necessary, or in the event of conflicts, submit details of such departures or conflicts in writing to the COTR for direction before initiating work.

1.7 SUBMITTALS

A. General

1. Comply with the Contract Documents and in accordance with this section. Submittals lacking the breath or depth of these requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and require coordination with applicable divisions to provide a complete and comprehensive submission package. Additional general provisions are as follows:

    a. Schedule submittals to maintain the project schedule. For coordination drawings refer to Division 1 Specification, which outline basic submittal requirements and coordination.
    b. Identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.
    c. Submit each package at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.
    d. Manufacturer's information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for COTR and Contractor review stamps.
    e. Drawings shall be in the project specific version of AutoCAD® or REVIT, drawn accurately, and in accordance with Smithsonian Institution CAD and REVIT Standards. Freehand sketches or copied versions of the construction documents will not be accepted. If departures from the drawings are subsequently deemed necessary by the Contractor, submit details of such departures and the reasons thereof in writing to the COTR and the PPSD Security Engineer for approval before initiating work.
    f. Submittal Format

        1) Provide one (1) hard-copy of drawings. Make all other submittals as PDF with bookmarks for sections.
        2) Refer to SI Special Conditions Document for drawing format and content requirements.

B. Pre-Installation Submittals

1. Qualifications

a. The Security Contractor is not allowed on-site until the COTR approves the Qualifications submittal.
b. Provide Company certifications

1) Software House

a) Advanced Integrator

c. Include qualifications and manufacturer's certifications for individuals working on the project including but not limited to:

1) Software House

a) CCURE 9000

2) American Dynamics

a) Victor
b) Video Edge

3) Vingtor-Stentofon
4) Cisco

a) Cisco Certified Network Professional (CCNP)

5) BICSI

a) RCDD

d. Provide project references as outlined in Paragraph 1.11 A "Contractor Qualifications".

2. Product Data

a. Provide a chart of product data listing the specification section and paragraph number of each product. Annotate if "Provided as Specified" or "Substitution Requested".
b. Product data sheets organized and bookmarked by Specification Division. Annotate deviations from the design documents and the justification for the change.
c. Where the words, "or approved equivalent" or like words are used, either furnish the equipment as specified or submit a request for substitution in writing with the make, model, and justification to the COTR and the PPSD Security Engineer for approval.

d. If Contractor recommends equipment substitution, Contractor is responsible for complete documentation of the reason for the change including price differential and is financially liable for the design time expended by the Smithsonian's Architect and sub-consultants to research the substitution.

3. Shop Drawings

a. Build upon the design documents to reflect current conditions and approved product data. Annotate deviations from the design documents and the justification for the change.
b. Include wiring diagrams to include but not limited to power supplies, card readers, fire alarm connections, elevator interface, and tamper circuits.
c. Security door schedule coordinated with Division 8 requirements. Include the following information:

1) Configuration Number
2) Door Number (Derived from Architectural Drawings)
3) Floor Plan Sheet Number
4) Standard Detail Number
5) Door Description (Derived from Loading Sheets)
6) Security Point Number (Derived from Loading Sheets)
7) Door Position or Monitoring Device Type, Make & Model Number
8) Lock Type, Model Number & Power Input/Draw (standby/active)
9) Card Reader Type, Make & Model Number
10) Shunting Device Type, Make & Model Number
11) Sounder Type, Make & Model Number
12) Camera Make & Model Number
13) Misc. devices as required
14) Remarks column indicating special notes or door configurations

C. Pre-Programming Submittals

1. Nameplates
2. IP Addressing Scheme

a. Provide OPS with the quantity of devices requiring IP addresses. OPS will then provide the IP addressing scheme.

3. Loading Sheets

a. Provide loading sheets for each DGP, including input and output boards for all field panels associated with the project.
b. OPS-PPSD will provide blank electronic sheets for contractor use.

c. Provide a spreadsheet for each DGP. Name the spreadsheet with the DGP number (e.g. “Site Name DGP-01.xls”)

D. Pre-Acceptance Testing Submittals

1. OPS-PPSD will provide blank testing forms for contractor to reproduce and fill out during testing.
2. Contractor Field Test

a. Contractor performs the Contractor Field Test (CFT) of all devices utilizing OPS provided forms and submits test results to OPS-PPSD.

3. Performance Verification Test

a. Based on the OPS-PPSD approval of the Contractor’s Field Test, the COTR will schedule the PVT with the Contractor and OPS-PPSD.
b. OPS-PPSD will witness the Contractor conduct the PVT of all devices utilizing the same form as for the CFT.

E. Closeout Submittals

1. Project Redlines

a. Neatly maintain an up-to-date set of construction redlines detailing current location and configuration of the project components.
b. Mark the redline documents with the words ‘Master Redlines’ on the cover sheet and be maintained by the Contractor in the project office.
c. Field drawings shall be used for data gathering & field changes. These changes shall be made to the master redline documents daily. Field drawings shall not be considered “master redlines”.
d. Provide access to redline documents anytime during the project for review and inspection by the COTR or authorized OPS representative.
e. Any project component or assembly that is not installed in strict accordance with the drawings shall be so noted on the drawings.
f. Submit the Master Redline document to the COTR and PPSD Security Engineer for review and approval of all changes or modifications to the documents prior to producing Record Construction Documents. The Government shall be given a minimum of a thirty (30) day review period to determine the adequacy of the Master Redlines. If the master redlines are found suitable by the COTR and the PPSD Security Engineer, the COTR will initial and date each sheet and turn the redlines over to the Contractor for Record As-Built development.

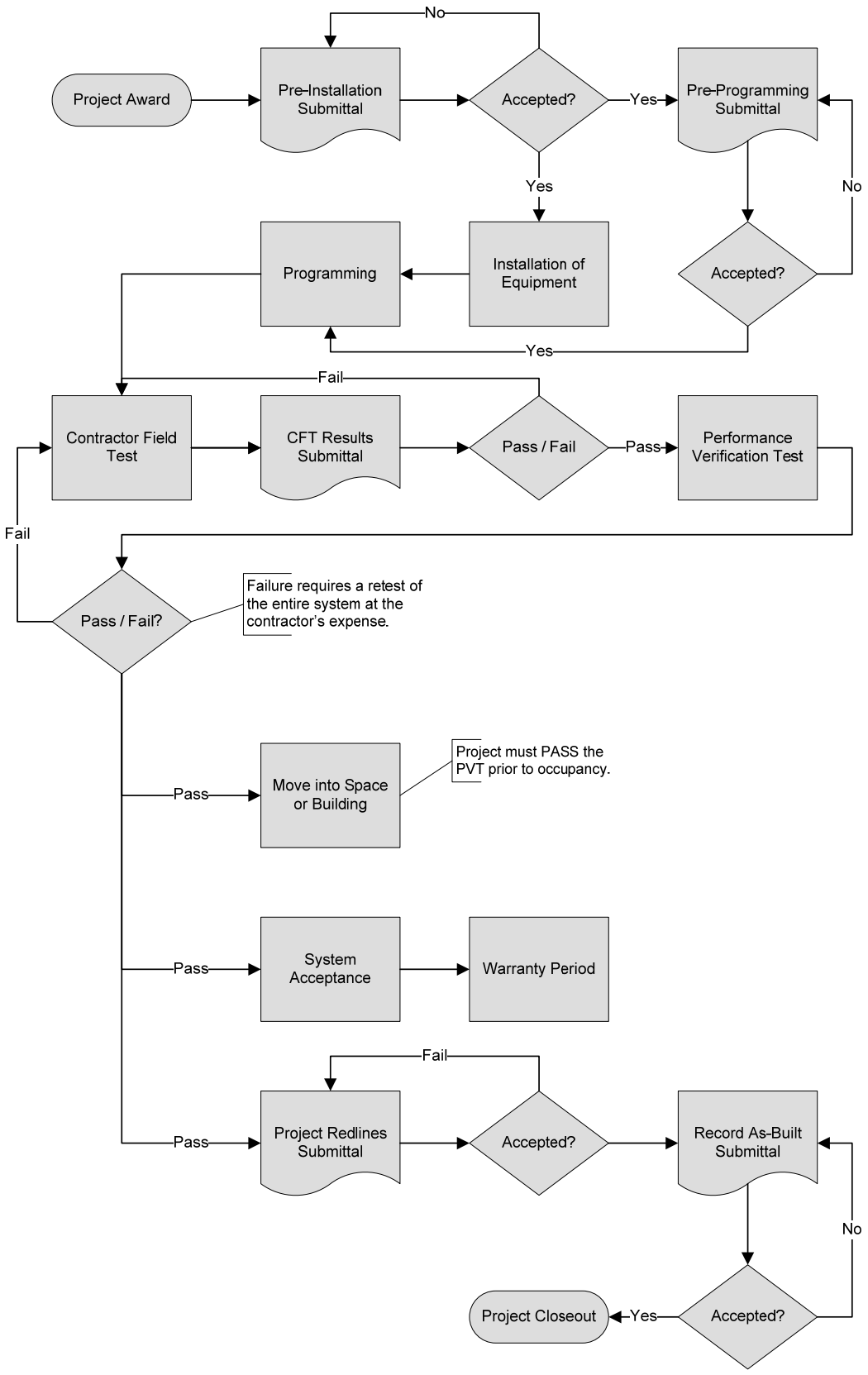
2. Record Construction Documents (Record As-Built)

a. The submitted as built documents shall be in editable electronic formats and the ownership of the drawings shall be fully relinquished to the SI.

1.8 PROJECT PROCESS DIAGRAM

A. The ESS Project Process Diagram (below) is provided to identify key consecutive or concurrent tasks and milestones required to ensure the project is completed prior to SI occupancy. Substantial completion means all systems have been fully tested and accepted in writing by OPS. Minor or non-life safety related punch list items may continue through SI occupancy, but shall be resolved within two (2) weeks of official date of occupancy.

B. The Contractor is encouraged to utilize the diagram for the development of project schedules, and coordinating submissions.


Project Award
Pre-Installation Submittal
Accepted?
No
Yes
Pre-Programming Submittal
Yes
No
Programming
Installation of Equipment
Accepted?
Yes
Fail
Contractor Field Test
CFT Results Submittal
Pass / Fail
Pass
Performance Verification Test
Fail
Pass / Fail?
Failure requires a retest of the entire system at the contractor's expense.
Pass
Move into Space or Building
Project must PASS the PVT prior to occupancy.
Pass
System Acceptance
Warranty Period
Fail
Pass
Project Redlines Submittal
Accepted?
Record As-Built Submittal
No
Project Closeout
Yes
Accepted?

1.9 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic security equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and raceway installed at required heights.

B. Ensure raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

C. Coordinate the installation of required supporting discipline devices placement and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

D. Coordinate the locations of access panels and doors for electronic security items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

1.10 QUALITY ASSURANCE

A. Contractor Qualifications

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years' experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the electronic security systems included in the project scope.
2. Provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project.
3. The Government reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system.

4. Provide copies of system manufacturer certification for all technicians. Only utilize factory-trained technicians to install, program, and service the electronic security systems. The Lead Technician shall have a minimum of five (5) continuous years of technical experience in electronic security systems.
5. The Contractor shall have a local service facility located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The Government and the PPSD Security Engineer reserves the option of visiting the company's facility to verify the service inventory and presence of a local service organization.
6. Lead network engineer onsite configuring the security data network equipment must have a minimum of a Cisco CCNP route/switch certification.
7. Refer to Division 27 Specifications for additional requirements for cabling.

B. Electrical Components, Devices, and Accessories

1. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Material & Installation

1. Unless otherwise specifically provided under this contract, equipment, material and articles to be incorporated in the work shall be new and of the most suitable grade for the purposes intended.
2. References to any equipment, material, article, or patented process, by trade name, make or catalog number shall be regarded as establishing a standard of performance and quality, and shall not be construed as limiting competition.
3. When so directed, the Contractor shall submit samples for approval at the Contractor's expense. Equipment, materials, and articles installed or used without the required approval shall be at the Contractors risk of rejection.
4. Warranties of all work and installed products shall be according to the Contract General Provisions.

1.11 MAINTENANCE & SERVICE

A. General Requirements

1. Provide services required and equipment necessary to maintain the electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system.
2. Provide necessary material required for performing scheduled adjustments or other non-scheduled work. Minimize impacts on facility operations when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.

B. Description of Work

1. The adjustment and repair of the security system includes the following items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors, access control equipment, facility interface, signal transmission equipment, intercoms, and video equipment.

C. Personnel:

1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. Advise the COTR and the PPSD Security Engineer in writing of the name of the designated service representative, and of any change in personnel. Provide the COTR and the PPSD Security Engineer with copies of system manufacturer certification for the designated service representative.

D. Emergency Service

1. The Smithsonian Institution shall initiate service calls whenever the system is not functioning properly. Provide an emergency service center telephone number. Staff the emergency service center 24 hours a day 365 days a year.
2. The Smithsonian Institution has sole authority for determining catastrophic and non-catastrophic system failures.
3. Catastrophic system failures are defined as any system failure that the Smithsonian Institution determines will place the facility(s) at increased risk. For catastrophic system failures, provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from notification.
4. For non-catastrophic failures, provide eight (8) hour service response with a defect correction time not to exceed 24 hours from notification.

E. Work Request

1. Separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date, and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion. Deliver a record of the work performed within five (5) working days after the work was completed.

F. System Modifications

1. Make any recommendations for system modification in writing to the COTR and the PPSD Security Engineer. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the COTR and the PPSD Security Engineer.

1.12 PROJECT ENVIRONMENTAL CONDITIONS

A. Interior, Controlled Environment

1. System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.

B. Interior, Uncontrolled Environment

1. System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (-18 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 4x enclosures.

C. Exterior Environment

1. System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of -30 to 122 deg F (-34 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 137 km/h (85 mph) and snow cover up to 24 in (610 mm) thick. NEMA 250, Type 4X enclosures.

D. Corrosive Environment

1. For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

E. Security Environment

1. Use vandal resistant enclosures in high-risk areas where equipment may be subject to damage.

1.13 EQUIPMENT AND MATERIALS

A. General Equipment Requirements

1. Equipment and materials shall be standard, current products of the manufacturer, and be suitable for the systems being installed and the intent of the design.
2. Any material, device, or equipment damages including dents and marred finishes before or during installation and before acceptance of the completed system, shall be replaced unless repairs can be made that are acceptable to the COTR and the PPSD Security Engineer. Any such replacement or repairs, including repairs to the finish, shall be made at no cost to the Smithsonian Institution.
3. Parts of the project site are finished spaces, including paint, trim, wall covering, floor treatments, lighting, and building mechanical systems. Therefore, perform the work specified herein, such that, at the completion of the work, all finished spaces are restored to the original condition existing prior to the commencement of work. During the course of performing the work specified herein, if the Contractor encounters any damaged finish in any area where the Contractor's work is to be performed, notify the COTR in writing prior to performing work in that area. Proceed with the work in these areas only after receiving written confirmation that the existing conditions have been documented and authorization has been given to proceed.

B. Nameplates

1. Provide nameplates for all non-field devices accessed by - Smithsonian Institution Security Maintenance Personnel. This includes but is not limited to the following:

    a. Data Gathering Panels
    b. Security Enclosures
    c. Network Switches
    d. Fiber Switches
    e. Servers
    f. Workstations
    g. Power Supplies (including electrical circuit)
    h. Electrical Circuits

2. The laminated plastic shall be 0.06 in (1.6 mm) thick, black with white lettering center core. Nameplates shall be a minimum of 0.75 in (19 mm) high, with a minimum of 0.13 in (3.3 mm) high-engraved block lettering. Attach nameplates with screws or located as required by security documentation plans and specifications. All console monitors shall be labeled with the monitor number and intended function.
3. Submit planned naming conventions for approval.

1.14 COMPONENT ENCLOSURES

A. Tamper Provisions and Tamper Switches

1. Enclosures with terminal strips or circuit boards require tamper switches.
2. Arrange tamper switches to initiate an alarm signal that will report to the monitoring station when the door or cover is moved.
3. Tamper switches shall be inaccessible until the switch is activated. Be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating. Be spring-loaded and held in the closed position by the door or cover and be wired so they break the circuit when the door cover is disturbed. Tamper circuits shall be adjustable type screw sets and shall be adjusted by the contractor to eliminate nuisance alarms associated with incorrectly mounted tamper device shall annunciate prior to the enclosure door opening (within 1/4 " tolerance).
4. The single gang junction boxes for the portrait alarming and pull boxes with less than 102 square mm will not require tamper switches.
5. All enclosures over 12 sq in (305 sq mm) shall be hinged with an enclosure lock.
6. Control Enclosures: Maintenance/Safety switches on control enclosures, which must be opened to make routing maintenance adjustments to the system and to service the power supplies, shall be push/pull-set automatic reset type.
7. Provide one (1) enclosure tamper switch for each 24 in (609 mm) of enclosure lock side opening evenly spaced.
8. Security screws shall be Torx-Post Security Screws.

1.15 WARRANTY

A. The Contractor shall, as a condition precedent to the final payment, execute a written guarantee (warranty) to the COTR certifying all contract requirements have been completed according to the final specifications. Contract drawings and the warranty of materials and equipment furnished under this contract are to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this work accepted) for one (1) year from the date the Contactor received written notification of final acceptance from the COTR and the PPSD Security Engineer. Repair or replace all defects or damages due to faulty materials or installation without delay, to the COTR's satisfaction, and at the Contractor's expense.

B. When equipment and labor covered by the Contractor's warranty, or by a manufacturer's warranty, have been replaced or restored because of its failure during the warranty period, the warranty period for the replaced or repaired equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work. In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.

1.16 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 (NOT USED)

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SECURITY INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

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

3.2 GENERAL

A. Install 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, artisanry, inspection, and testing shall be in accordance with manufacturers’ recommendations and as modified herein.

B. Consult the manufacturer's installation manuals for wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the Riser/Connection diagrams, if present, for schematic system installation/termination/wiring data.

C. Firmly attach equipment to walls and ceiling/floor assemblies (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 agree with the design package. Report all changes to the site or conditions that will affect performance of the system to the COTR as part of the Pre-Installation Submittal. Take no corrective action without written permission from the COTR.

3.3 SYSTEM PROGRAMMING

A. General

1. The following Loading Sheet submittals are required:

a. Shop Drawings – Pre-Installation Submittal
b. Final Construction Document Submittal – Closeout Submittal

2. Loading Sheets

a. See the attached loading sheets. Refer to Section 1 regarding loading sheet submissions.
b. System Configuration and Data Entry:

1) The contractor is responsible for providing all system configuration and data entry for the SMS and subsystems (e.g., intercom, Inovonics wireless, digital video recorders, network video recorders). All data entry shall be performed to Smithsonian Institution's standards & guidelines. The Contractor is responsible for participating in all meetings with the OPS and the client to compile the information needed for data entry. These meetings shall be established at the beginning of the project and incorporated in to the project schedule as a milestone task. The Contractor shall be responsible for all data collection, data entry, and system configuration. The Contractor shall collect, enter, & program and/or configure the following components:

a) Access control system components
b) Video surveillance, control and recording systems
c) All other security subsystems shown in the contract documents

3. Graphics

a. Based on record drawings developed for the construction project, create map sets and system icons showing locations of alarms and field devices.
b. Produce graphical maps of alarm points installed under this contract including perimeter and exterior alarm points.
c. Create and install graphics needed to make the system operational.

d. Utilize data from the contract documents, Contractor's field surveys, and all other pertinent information in the Contractor's possession to complete the graphics.
e. Identify and request from the COTR and the PPSD Security Engineer, any additional data needed to provide a complete graphics package.
f. Graphics shall have sufficient level of detail for the system operator to assess the alarm.
g. Supply hard copy, color examples at least 8 x 10 in (203.2 x 254 mm) of each type of graphic to be used for the completed Security system. Deliver the graphics examples to the COTR and the PPSD Security Engineer for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires them.

B. Alarm / Event Identification Format for Monitoring Station

1. Initial Descriptor

a. The Initial Descriptor is a brief description of the event taking place and shall be no more than 50 characters in length. Contact OPS-PPSD for any Building ID, Area ID or Device / Condition Type not listed below.
b. Building ID

1) This is a two (2) or four (4) character identification of the building where the event is taking place. This shall follow the standard format as shown in the listing below. Confirm buildings and identifications with the Smithsonian.

Building	ID	Building	ID
African Art	AA	Hirshhorn	HH
Air and Space	AS	Horticulture Greenhouse	HG
American History	AH	Library (STRI)	LB
American Indian (NY)	IN	Maintenance Shop (STRI)	TP
American Indian Mall	IM	MSC (Suitland)	MS
Anacostia	AN	NAOS (STRI)	NAOS
Ancon (STRI)	AC	National Zoological Park	NZ
Apollo Drive	AD	Natural History	NH
Arts and Industries	AB	NMAAHC	AAHC
Barro Colorado (STRI)	BC	Patent Office Building	PB
Bocas del Toro (STRI)	BT	Pennsy Drive	SISC
Capital Gallery	CG	Postal Museum	PM
Columbia Warehouse	CW	Quad	SQ
Conference Center (STRI)	CC	Renwick	RW

Building	ID	Building	ID
Cooper Hewitt (NY)	CH	Research Branch (NY)	RB
CRC (Suitland)	CR	Sackler	SK
Culebra (STRI)	CU	SAO Arizona	AZ
Dulles	DL	SAO Hilo HI	HI
Engineering Building (STRI)	EB	SAO Mauna Kea HI	MK
Folk Life Festival	FF	SCBI Front Royal VA	FZ
Freer	FR	SERC	SR
Galeta (STRI)	GA	SI Castle	SB
Gamboa (STRI)	GM	Tivoli Facility (STRI)	TV
Garber (Suitland)	GB	Tupper Facility (STRI)	TP
Herndon	HN	Victor Building	VB

c. Monitor Point Location

1) This is the monitor point physical location. There is no separation between the Building ID and the Monitor Point Location.
2) Description of iStar:

a) The Monitoring Point Location includes a two (2) character descriptor for the iStar Cluster, followed by a colon and then a two (2) character descriptor for the iStar panel followed by a colon then a one (1) character space.
b) Next is the one (1) character descriptor for ACM # (1 or 2) 'ACM:#' followed by a one (1) character space.
c) Next is the device connection location for where the device terminates using 'I8' for an I-8 module, 'R8' for an R-8 module, 'RDR' for a reader module, followed by a colon. Then a one (1) character number representing which module it is (i.e. the fourth I-8 module), followed by a colon. Last is a one (1) character number representing the input number on the module; the inputs on the ACM board require a two (2) character number.

3) Example of iStar

a) xx01:01 ACM:1:i06 = iStar Cluster 01, iStar #01, ACM #1, main panel, sixth input
b) xx01:02 ACM:2 I8:3:i6 = iStar Cluster 01, iStar #02, ACM#2, I-8 module #3, sixth input
c) xx02:16 ACM:1 R8:2:o4 = iStar Cluster 02, iStar #16, ACM #1, R-8 module #2, fourth output

d) xx01:15 ACM:1 RDR:4:i2 = iStar Cluster 01, iStar #15, ACM#1, reader module #4, second input

d. Area ID (Type)

1) This is a brief description of the location of the alarm / event. There shall be a one (1) character space between the Monitor Point Location and the Area ID. At a minimum level of description, this shall follow the standard format as shown in the listing below. Confirm areas and identifications with the owner.

Description	Area ID
Vault	VAULT
Collection Storage	COLL STORAGE
Archive Areas	ARCHIVE
Collection Archive Areas	COLL ARCHIVE
Collection Processing / Preparation Areas	COLL PREP ROOM
Alcohol Storage Areas	ALCOHOL STOR-
Cold Collection Storage Areas	COLD STORAGE
Curatorial Areas	CURATORIAL
Exhibit Gallery (XX To be replaced with Gallery No.)	GALLERY XX
Exhibit Alarms Located in Lobbies or Reception Areas	LOBBY EXHIBIT
Exhibit or Artifact Alarms in “Other” Ar-	MISC EXHIBIT
Registrar Areas	REGISTRAR
Perimeter Door, Glass Break, Motion	PERIMETER
Staff Cafeteria	STAFF CAFE
Public Access Cafeteria	PUBLIC CAFE
Public Staff Separation Door	STAFF DOOR
Museum Shop	MUSEUM SHOP
Museum Shop Storage Areas	MUSEUM SHOP
Cash Processing Areas	CASH ROOM
Automated Teller Machines	ATM
Executive Office Space	EXECUTIVE OF-
Support Staff Office Space	STAFF OFFICE
Loading Dock Areas	LOADING DOCK
Security Unit Control Room	UNIT CONTROL
Security Wire Closet	WIRE CLOSET
Computer Center Rooms	COMPUTER

Description	Area ID
Mechanical Room	MECHANICAL
Electrical Room	ELECTRICAL
Communication Closet	COMM CLOSET
Fabrication Shop	FABRICATION
Support Staff Storage Area	STAFF STORAGE
Warehouse Storage Area	WAREHOUSE
Shipping and Receiving Area	SHIPPING RE-
Security Officer Kiosks / Posts	SECURITY POST
Information Booths	INFO BOOTH
Locker Rooms	LOCKER ROOM
Laboratories	LABORATORIES
Libraries	LIBRARY
Liquor Storage Areas	LIQUOR STOR-
Child Care Centers	CHILD CARE
Photo Processing Laboratories	PHOTO LAB
Animal Area for Public Viewing	ANIMAL EX-
Animal Area not for Public Viewing	ANIMAL OFF-EX-
Outside Animal Area	ANIMAL YARD
Marine Animal Area	ANIMAL TANK
Animal/Keeper Area	KEEPER WORK-
Keeper (only) Area	KEEPER SPACE

e. Device / Condition Type

1) This is a two (2) digit descriptor for the type of device / condition that initiated the alarm / event. There is a one (1) character space between the Area ID and the Device / Condition Type. This follows the standard format as shown in the listing below. Confirm device / condition identifications with the owner.

Type of Device / Condition	ID
Door Contact	DC
Motion Detector	MD
Vibration Detector	VD
Glass Break Detector	GB
Hold Up / Duress Button	HU
Bill Trap (Last Bill Detector)	BT

Type of Device / Condition	ID
Window Contact	WC
Hazard Alarm	HZ
Case / Display Alarm	CA
Low / Missing Battery	LB
Communication Failure	CF
Security Fault	SF

Type of Device / Condition	ID
Door Held Open	HO
Door Forced Open	FO
Power Failure	PF
Tamper Alarm	TP
Delayed Egress Pre Alarm	DE
Temperature Alarm	TA
Shock Sensor	SS
Photo Beam	PB
Request to Exit	REX
Seismic Alarm	SA
Video Loss	VL
Supervision Error	SE

Type of Device / Condition	ID
UPS / Power Supply Trouble	PT
Restore / Reset	RS
Proximity Alarm	PA
Pressure Mat	PM
HVAC Duct Alarm	DA
Lock Secure	LS
Battery Fail	BF
Tamper Alarm	TP
Lock	LK
Door Status Monitor	DSM
Sounder	SD

f. Examples for the Initial Descriptor:

1) National Museum of Natural History monitor point location DGP chain 1 DGP number 2 first I-8 input 4, collection storage motion detector in alarm.

a) NH01:02 I8:1:i4 COLL STORAGE MD

2) Arts and Industries Building monitor point location DGP chain 3 DGP number 4 main panel input 6, public staff separation door contact.

a) AB03:04 M:i6 STAFF DOOR DC

2. Secondary Descriptor

a. The Secondary Descriptor is 128 characters
b. This is an in-depth description for the location of the alarm / event taking place. If multiple devices are connected to the same monitor point the number of devices should be indicated.
c. Examples for the secondary descriptor

1) National Museum of Natural History monitor point location DGP chain 1, DGP number 6, I32 board input 31, collection storage motion detector in alarm.

a) NH01:06 I32:i31 COLL STORAGE MD: NMNH 5th Fl East Wing Rm. 5210 Motion Detectors (3).

2) Arts and Industries Building monitor point location DGP chain 1, DGP number 2 third I-8 board input 5, public staff separation door forced open.

a) AB01:02 I8:3:i5 STAFF DOOR FO: AIB 1st Fl East Hall Card Access Door Forced Open.

d. Linked Instruction Event

1) This is a full instructional description for the processing of the alarm / event and follows the standard format of:

a) Repeat 50 character descriptor
b) In-depth description of location
c) Response instructions
d) Logging instructions
e) Reset instructions
f) Nearest camera location (If multiple views are available list all)
g) DGP input is connected to

e. Examples for the linked instructional event

1) National Museum of Natural History monitor point location DGP chain 1 DGP number 3, I32 board input 31, collection storage motion detector in alarm.

Step	Display
1	NH01:03 I32:i31 COLL STORAGE MD
2	5th fl east wing Rm. 5210 motion detectors (3)
3	Dispatch officer to investigate and report findings
4	Log officer’s name and actions into computer log
5	Device resets automatically when motion has stopped
6	Nearest camera is No. (camera Nos. provides other
7	Device connected to DGP

C. Alarm / Event Mapping Requirements

1. General

a. Maps associated with alarm / event call-ups shall be a black foreground on a white background.

2. Map Information Screen

a. The map information screen shall provide access to three different map levels for each event
b. Building Floor Map

1) This map has the quadrant where the event is taking place line colored blue or the colored event icon in place. Identify this map with the building name and floor at the bottom of the map.

c. Quadrant Map

1) This is the map called up by the system automatically upon event activation. Identify this map with the building name, floor number, and quadrant at the bottom of the map. This map has the icon representing the event shown upon call up. Clicking on the icon or a map "zoom in" icon at this map level calls up the Area map.

d. Area Map

1) This map represents the local area of the building where the event is taking place. This map contains all icons associated with this area. These icons are "living", changing colors as the associated devices change state. Identify this map with the building name, floor number, quadrant, and area name at the bottom of the map.

3. Mapping icons

a. Mapping icons are "living" changing color as the associated devices change state.

1) Red = alarm / activated state
2) Green = secure / normal state
3) Yellow = masked, shunted, accessed, etc. state

b. Group and position mapping icons represented on the Area map as follows:

1) Motion detectors providing back up to perimeter door(s) / window(s).

a) Place a single icon in a close geographical position to the protected door(s) or window(s), to represent all devices in the zone or group

2) Motion detectors providing back up to public staff separation doors and other internal doors.

    a) Place a single icon in a close geographical position to the protected door.

3) Motion detectors providing volumetric protection of a room.

    a) Place a single icon in the center of the room, to represent all devices in the zone or group

4) Glass break detectors protecting perimeter windows

    a) Place a single icon in a close geographical position to the center of the window or group of windows, to represent all devices in the zone or group

5) Door contacts protecting individual perimeter doors or logical groups of perimeter doors.

    a) Place a single icon in a close geographical position to the center of the door or group of doors, to represent all devices in the zone or group

6) Delayed egress pre alarm contacts protecting individual doors or logical groups of doors.

    a) Place a single icon in a close geographical position to the center of the door or group of doors, to represent all devices in the zone or group.

7) Window contacts protecting individual perimeter windows or logical groups of perimeter windows.

    a) Place a single icon in a close geographical position to the center of the window or group of windows, to represent all devices in the zone or group.

8) Card reader events to include door forced open and door held open alarms.

    a) A single icon shall be the same as the door contact protecting the door.
    b) Icon descriptor shall identify the appropriate event taking place.

9) Tamper alarms protecting panels in security closets.

a) Place a single icon in the center of the room, to represent all devices in the zone or group.

10) Tamper alarms protecting individual devices or logical groups of devices.

a) Place a single icon in close geographical position to the device or group of devices, to represent all devices in the zone or group.

11) Exhibit level case/display alarms.

a) A single icon shall represent all devices protecting the case/display.
b) Place icon directly over the case/display so the case outline is still visible below (around) the icon
c) Icon descriptor shall identify the appropriate device in alarm.

12) Vibration detectors protecting any physical barrier or point of entry.

a) Place a single icon in close geographical position to the physical barrier / point of entry or group of devices, to represent all devices in the zone or group.

D. System Programming

1. General Programming Requirements

a. Use the following section to identify the anticipated level of effort (LoE) required setup, program, and configuring the ESS.
b. Provide all setup, configuration, and programming to include data entry for the SMS and subsystems (e.g., video system, intercoms, digital video recorders, intrusion devices, maps and icons, time synchronization, including integration of subsystems to the SMS.

2. Configuration Management of Servers

a. Provide SI-OPS the security system servers for baseline configuration 90 days before system programing begins.
b. Once the security system server is baselined according to SI-OCIO requirements the server will be returned to the security contractor for system programing.

c. There are other programming requirements the contractor needs assistance on as follows:

1) OPS has to enter the Levels and Permissions of programing
2) Synchronize system with C-Cure Central
3) Employee card reader data will be automatically entered in the system server
4) OPS will enter Card reader Clearances

3. Level of Effort for Programming

a. Perform and complete system programming (including all data entry) at an offsite location using the Contractor's own copy of the C*Cure 800/8000 software which must be the same version SI is using.
b. Deliver the completed forms (loading sheets) to the COTR and PPSD Security Engineer for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires it.
c. Once system programming has been completed, deliver the programming to the COTR and the PPSD Security engineer on data entry forms (loading sheets) and an approved electronic medium.
d. System programming may not be uploaded until the COTR and the PPSD security Engineer provide written approval.
e. The Contractor is responsible for backing up the system prior to uploading new programming data.
f. Additional programming requirements are provided as follows.

1) Programming for Existing SMS Servers

a) Perform all related system programming except for personnel data as noted.
b) The contractor is not responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, access schedules, personnel groupings).
c) Conduct a weekly coordination meeting and work alongside OPS to ensure data uploading is performed without incident of loss of function or data loss.
d) Perform system programming for SMS servers using the Contractor's own server and software. These servers shall not be connected to existing devices or systems at any time.

g. Identify any additional data needed to provide a complete and operational system as described in the contract documents and request the information from the COTR and the PPSD Security Engineer.

h. Programming effort requires a high level of coordination between Contractor and OPS to ensure programming is performed in accordance with SI requirements and programming uploads do not disrupt existing systems functionality.

1) Conduct a weekly coordination meeting and work alongside OPS to ensure data uploading is performed without incident of loss of function or data loss.

i. Ensure data uploading is performed without incident or loss of function or data loss.

j. The following Level of Effort Chart is provided to communicate the expected level of effort required by contractors on SI ESS projects. Determine actual levels of effort prior to bidding on the project.

SMS Setup & Configuration		
Description of Tasks	Develop System Loading Sheets	e.g., program monitoring stations, programming networks, interconnections between CCTV, intercoms, time synchronization
	Coordination	e.g., retrieve IP addresses, naming conventions, standard event descriptions, programming templates, coordinate special system needs
	Initial Set-up Configuration	e.g., Load system Operating System and Application software, general system configurations
	Graphic Maps	e.g., develop naming conventions, develop file folders, confirming accuracy of AutoCAD Floor Plans, convert file into jpeg file then to bitmap.bmp file
	System Programming	e.g., program monitoring stations, programming networks, interconnections between CCTV, intercoms, time synchronization
	Final Checks	e.g., check all system diagnostics (e.g., clients, panels)
	Level of Effort (Typical Tasks)	Load and set-up 4-6 CDs and configure servers (to configure Loading and Configuring software Administrative account, audit log Keystrokes, mouse clicks, multi-screen configuration
Electronic Entry Control Systems		
Description of Tasks	Develop System Loading Sheets	e.g., setup of device, door groups & schedules, REX, Locks, link graphics
	Coordination	e.g., confirming device configurations, naming conventions, event description and narratives
	Initial Set-up Configuration	e.g., enter data from loading sheets; configure components, link events, cameras, and graphics

	Graphic Maps	e.g., develop naming conventions, develop file folders, confirming accuracy of AutoCAD Floor Plans, convert file into jpeg file then to bitmap.bmp file
	System Programming	e.g., setup of device, door groups & schedules, REX, Locks, link graphics
	Final Checks	e.g., performing entry testing to confirm correct set-up and configuration
	Level of Effort (Typical Tasks)	e.g., creating a door, door configuration, adding request to exit, door monitors and relays, door timers, door related events (e.g., access, access denied, forced open, held open), linkages, controlled areas, advanced door monitoring, time zones, sequence of operations
CCTV Systems		
Description of Tasks	Develop System Loading Sheets	e.g., programming call-ups recording
	Coordination	e.g., confirming device configurations, naming conventions
	Initial Set-up Configuration	e.g., enter data from loading sheets; camera naming convention, sequences, configure components)
	Graphic Maps	e.g., develop naming conventions, develop file folders, confirming accuracy of AutoCAD Floor Plans, convert file into jpeg file then to bitmap.bmp file
	System Programming	e.g., programming call-ups recording
	Final Checks	e.g., confirm area of coverage, call-up per event generated and recording rates
	Level of Effort (Typical Tasks)	e.g., setting up cameras points, recording ratios (e.g., normal, alarm event) timed recording, linkages, maps placements, call-ups
Console Monitoring Components		
Description of Tasks	Develop System Loading Sheets	N/A
	Coordination	per monitor
	Initial Set-up Configuration	per monitor
	Graphic Maps	e.g., develop naming conventions, develop file folders, confirming accuracy of AutoCAD Floor Plans, convert file into jpeg file then to bitmap.bmp file
	System Programming	N/A
	Final Checks	per monitor
	Level of Effort (Typical Tasks)	N/A
Note: Programming tasks are supported through the Contractor's development of the Submittals.		

END OF SECTION 280500.10

SECTION 280507.10 – POWER SOURCES FOR ELECTRONIC SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 280500 Common Work Results for Electronic Safety and Security.

1.2 SYSTEM DESCRIPTION

A. The power sources support the electronic security systems (ESS) and the telecommunications system which carries security system data. Provide power sources as needed if the existing ESS power sources are inadequate to support the work of this project.

1.3 SUMMARY

A. This Section includes the following:

1. PACS Power Supplies+
2. Uninterruptible Power Supplies for both security and telecommunications.
3. 55-VDC Power Supplies for Power-over-Ethernet Injectors (for camera power)

1.4 DEFINITIONS

A. ESS: Electronic Security Systems

B. PACS: Physical Access Control System

1.5 SUBMITTALS

A. Product data: For each type and rating of equipment, include electrical ratings, operating characteristics, manufacturers' technical data on features and functions, enclosures, and furnished accessories.

B. Bill of materials: Provide detailed list of components.

C. Shop drawings: For each type of unit, indicate the following:

1. Dimensioned plans, elevations, and sections.
2. List of installed device and related equipment ratings and features including:

a. Unit type and standard details
b. Enclosure type
c. Nameplate and identification labels
d. Factory settings of installed devices

3. Wiring diagrams: Power, signal, and control wiring.

D. Operation and maintenance data: For each type of power source and associated components, include in operation and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Detailed operating and programming instructions.
2. Troubleshooting procedures.
3. Warranty, executed and signed at the time of putting the unit in service.

PART 2 - PRODUCTS

2.1 ISTAR ENCLOSURE / POWER SUPPLY (FOR PHYSICAL ACCESS CONTROL SYSTEM PANEL)

A. Acceptable Manufacturers

1. Life Safety Power

B. Life Safety Power Flexpower FPO75/150-C4D8E1, Pro-wire 4 Door Access Dual Voltage Enclosure / Power Supply

C. Minimum Required Features and Specifications

1. Input Power

a. Input 120 VAC 60 Hz 150 Watts
b. Overload and short circuit protection
c. Over temperature protection
d. Polarized AC power supply disconnect

2. Output Power

a. FPO150: 24V/6A 144 Watts
b. Outputs: Continuous (DC1) Resettable (DC2)
c. 4 managed control outputs, fused at 3A each
d. 8 auxiliary outputs, fused at 3A each

e. 120 mV output voltage ripple
f. System Efficiency: 87%
g. System BTU Rating: 99 BTU/Hr

3. Battery Charging

a. Independent built-in 2A charger for sealed lead acid or gel type batteries
b. Microprocessor dual rate charging of 12 or 24 V battery sets
c. Charges up to 80Ah battery sets within UL limit
d. Automatic switchover to standby battery when AC fails
e. Zero voltage drop when switched over to battery backup

4. Associated Battery Cabinet

a. Provide battery cabinet and 24-volt battery set compatible with power supply.
b. Battery set shall have sufficient ampere-hours for eight (8) hours of operation at connected load, plus 20% extra capacity for future expansion.

5. Supervision

a. AC Fail (form "C" contacts)
b. System Fault (form "C" contacts) may be triggered by low/no battery, short to earth ground, power supply failure or blown fuse.
c. System shall report to the PACS failure of any battery as a fault condition.

6. Visual Indicators

a. AC input, DC1 and DC2 output
b. System fault
c. AC fault
d. Short to earth ground
e. Reverse battery polarity
f. Fire Alarm Input activated
g. D8: DC outputs

7. Regulatory Compliance (LSP equipment)

a. UL294, UL603, UL1076
b. ULC S318, ULC S319, CSA C22.2 #107.1, CSA C22.2 #60950
c. FCC Part 15, Subpart B / CSFM Approved

8. Connect tamper and power outputs to the unsupervised inputs on the associated data gathering panel (DGP).

9. Annunciate the following conditions on the security management system: cabinet tamper, AC power fail, and low battery.
10. Provide appropriate number of modules for the specific project.

2.2 UNINTERRUPTIBLE POWER SUPPLY

A. Acceptable Manufacturers

1. APC
2. Approved equal

B. APC Smart-UPS SRT2200XLA is the basis of design.

C. Minimum Required Features and Specifications

1. Automatic voltage regulation and surge protection
2. Tower configuration
3. 1800 W / 2200 VA
4. Battery charge power 102W
5. Typical recharge time 3 hours
6. Surge energy rating: 340 joules
7. Heat dissipation: 535 Btu/hour.
8. Six NEMA 5-20R receptacles and one NEMA L5-20R receptacle.

D. Additional Required Options / Parts

1. APC UPS Network Management Card 3 (AP9641) with Environmental Monitoring or approved equivalent

    a. Enables secure monitoring and control of an individual UPS via Web browser, CLI, or SNMP

2. APC Hardwire Conversion Kit SRT012 or approved equivalent, where unit output is to be hard-wired.
3. Provide an interface (dry contact closure) to allow the PACS to monitor the UPS system’s trouble signals and main power failure. Basis of design is the APC #AP9810.

2.3 FIFTY-FIVE VOLT DIRECT CURRENT POWER SUPPLIES

A. Acceptable Manufacturers

1. Comnet Communication Networks
2. Approved equal

B. Comnet PS-DRA480-48A is the basis of design.

C. Minimum Required Features and Specifications

1. Input power range 90 to 264 volts AC
2. Input current at 115 volts AC: 4.9 amperes.
3. Input line frequency tolerance: 47 to 63 Hz.
4. Power dissipation: 60 watts
5. Power output adjustable between 47 and 56 volts DC.
6. Minimum load 0%.
7. Line Regulation +- 0.5%.
8. Output hold up time 25 milliseconds at 115 volts AC input.
9. Output current 10 amperes at 48 volts DC.
10. 10-ampere input fuse
11. IEC 61000-4-5 internal surge protection
12. Rated overload protection minimum 110%.
13. Overvoltage protection: auto recovery, 125 – 140%.
14. Indicating LEDs

    a. DC ON: green, at start-up.
    b. DC LOW red, after start-up.

15. Metal case
16. DIN-rail mounting
17. Environmental:

    a. Minimum 400,000 hours mean time between failures at 40^{O}C.
    b. Operating temperature -40^{O}C to 85^{O}C.
    c. Relative humidity tolerance: 20% to 95% non-condensing

D. Regulatory Approvals and Compliance

1. UL508 Listed
2. UL 60950-I Recognized
3. Meets IEC 60068-2-6 for vibration
4. Meets IED 60068-2-27 for shock

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power supplies and associated battery cabinets as directed by manufacturer.

B. iSTAR Enclosure / Power Supply (for Physical Access Control System Panel)

1. The main power loss or switch from primary power to generator power shall generate an AC Fail alarm on the Physical Access Control System.
2. Detect and report on the Physical Access Control System failure of any battery as a fault condition.

C. Uninterruptible Power Supply

1. Provide UPS units as needed so that connected load plus 20% can be powered for at least one hour.
2. Wall-mount dedicated UPS units for security. Provide shelves as needed to support each UPS.
3. Provide dedicated NEMA 5-20R receptacle on an optional standby power circuit to provide input power to the UPS.
4. Plug in or hardwire security equipment to the output of the UPS as appropriate.
5. Provide an interface (dry contact closure) between the PACS and each UPS system so the UPS trouble signals and main power fail appear on the PACS operator terminal as alarms.

D. 55 VDC Power Supply

1. Mount inside DIN-rail cabinet.
2. Set output voltage to that required by PoE injectors.

END OF SECTION 280507.10

SECTION 280509.10 – SURGE PROTECTION FOR ELECTRONIC SECURITY

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 SYSTEM DESCRIPTION

A. This specification is for surge protection for electronic security systems (ESS).

B. Transient Voltage Surge Suppression:

1. Protect 120-volt Division 28 equipment against Transient Voltage surges.
2. The surge protective device (SPD) device shall be UL listed in accordance with Standard TIA 497B.
3. Fuses shall not be used for surge protection.
4. Test the inputs and outputs in both normal mode and common mode to verify there is no interference.
5. General Performance Requirements

    a. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
    b. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.3 SURGE PROTECTIVE DEVICES (SPDS) SUBMITTALS

A. Product data: For each type and rating of equipment, include electrical ratings, operating characteristics, manufacturers' technical data on features and functions, enclosures, and furnished accessories.

B. Bill of materials: Provide detailed list of components.

C. Shop drawings: For each type of unit, indicate the following:

1. Dimensioned plans, elevations, and sections.
2. List of installed device and related equipment ratings and features including:

    a. Unit type and standard details
    b. Enclosure type
    c. Nameplate and identification labels

3. Wiring diagrams.

D. Operation and maintenance data: For each type of power source and associated components, include in operation and maintenance manuals. In addition to items specified in Division 01 Section “Operation and Maintenance Data,” include the following:

4. Troubleshooting procedures.

PART 2 - PRODUCTS

2.1 SURGE PROTECTIVE DEVICE, 120V

A. Acceptable Manufacturers

1. Ditek
2. Approved Equivalent

B. Ditek DTK-120HW approved equivalent

C. Minimum Required Features and Specifications

1. Suitable for surface mounting or DIN rail (DTK_DRK required) within the enclosure/rack.
2. Protects power (120V)
3. Approved for 20A Circuit Breakers
4. Operating Temperature: -31 to 176 deg F (-35 to 80 deg C)

PART 3 - EXECUTION

3.1 GROUNDING

A. For each 20-ampere 120-volt circuit serving Division 28 equipment, provide 120V surge protection within 914 mm (three feet) downstream of the supplying branch circuit breaker.

END OF SECTION 280509.10

SECTION 280531.10 – COMMUNICATIONS EQUIPMENT FOR ELECTRONIC SECURITY

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 SYSTEM DESCRIPTION

A. This specification is for the communications equipment directly supporting the electronic security systems (ESS).

B. As described elsewhere in the contract documents, cameras will record video from points around the National Museum of Asian Art's new café and associated spaces. A card reader will control access to the Cash Room of the café. Under this section, provide equipment and programming as needed to transmit signals from the cameras and card reader to the existing OPS system, using the existing Smithsonian Wide Area Network. Also provide equipment as needed to power the cameras using Power-over-Ethernet (PoE).

1.3 SUMMARY

A. This Section includes the following:

1. Network Access Switches
2. Fiber Modules / Media Converters
3. PoE Extenders

1.4 SUBMITTALS

A. Product data: For each type and rating of equipment, include electrical ratings, operating characteristics, manufacturers' technical data on features and functions, enclosures, and furnished accessories.

B. Bill of materials: Provide detailed list of components.

C. Shop drawings: For each type of unit, indicate the following:

1. Dimensioned plans, elevations, and sections.
2. List of installed device and related equipment ratings and features including:

a. Unit type and standard details

b. Enclosure type
c. Nameplate and identification labels
d. Factory settings of installed devices

3. Wiring diagrams: Power, signal, and control wiring.

D. Operation and maintenance data: For each type of power source and associated components, include in operation and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Detailed operating and programming instructions.
2. Troubleshooting procedures.
3. Warranty, executed and signed at the time of putting the unit in service.

PART 2 - PRODUCTS

2.1 NETWORK ACCESS SWITCH – 24 PORT

A. Acceptable Manufacturers

1. Cisco

B. Cisco 9300 series C9300-24P with C9300-NM-8X or approved equivalent

C. Minimum Required Features and Specifications

1. Twenty-four (24) 10/100/1000 copper PoE ports
2. Two (2) 10 Gigabit Ethernet SFP+ ports
3. Four (4) SFP+ modules rated for 400M over MM OM4 cable
4. Redundant power supplies
5. Switching capacity of 256 Gbps
6. 480 Gbps stacking bandwidth
7. Eight (8) GB of DRAM
8. Eight (16) GB Flash
9. MTBF of 299,000 hours
10. Stacking cable
11. Power stacking cable
12. 24/7/365 hardware and software support from OEM with 4-hour onsite parts.

D. Required Options / Parts

1. C9300-NM-8X

2. Four (4) Cisco SFP-10G-SR per access switch (two for the access switch and one for each core switch)
3. MultiMode OM4 patch cords

2.2 ENVIRONMENTALLY HARDENED 8-PORT FIBER MODULE

A. Acceptable Manufacturers

1. Comnet
2. Blackbox

B. Comnet CNGE8FX4TX4MS or approved equivalent

C. Minimum Features and Specifications

1. Environmentally hardened
2. Eight (8) 10/1000 BASE-TX ports
3. Three (3) 10/100/1000FX combo ports
4. The eight (8) electrical ports support the 10/100/1000 Mbps IEEE 802.3
5. Cooling: Natural convection
6. Operating Temperature: -40 to 75 deg C (-40 to 167 deg F)
7. MTBF: >100,000 hours
8. Relative Humidity: 5% to 95% (non-condensing).
9. Lifetime warranty

D. Additional Required Options / Parts

1. Comnet PS-DRA120-48A or approved equivalent

a. Universal AC input: 90 to 264 VAC, 47-63Hz
b. Mounts on standard 7.5 mm (0.3 in) or 15 mm (0.6 in) DIN–rail
c. Adjustable output voltage range support
d. High operating efficiency; up to 87%

2. Comnet SFP Modules
3. Network Speed: Gigabit Ethernet

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer.

B. Comply with OCIO requirements for connections to the Smithsonian Wide Area Network.

C. Provide equipment as needed to fulfill the requirements in 1.2.B of this section.

3.2 IP ADDRESSING

A. Refer to 280500 Submittals for requirements.

END OF SECTION 280531.10

SECTION 281000 – ACCESS CONTROL

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 SYSTEM DESCRIPTION

A. The physical access control system (PACS) is an enterprise class system with intrusion detection inherent to the PACS controllers. The PACS is the central system for the entire electronic security system. Integrate all other systems (intrusion detection, intercommunications, and video) with the PACS so the PACS provides a single unified control and management platform.

B. This is an extension of the Smithsonian's existing Software House C•CURE 9000 system. The work of this project is to provide access control hardware and software to allow the Smithsonian's existing system to control access at the Cash Room for the National Museum of Asian Art café using card readers and electrified door hardware.

1.3 SUMMARY

A. This Section includes the following:

1. PACS Software
2. PACS Panels
3. Reader Module
4. Card readers

1.4 SUBMITTALS

A. Product data: For each type and rating of equipment, include electrical ratings, operating characteristics, manufacturers' technical data on features and functions, enclosures, and furnished accessories.

B. Bill of materials: Provide detailed list of components.

C. Shop drawings: For each type of unit, indicate the following:

1. Dimensioned plans, elevations, and sections.
2. List of installed device and related equipment ratings and features including:

a. Unit type and standard details
b. Enclosure type
c. Nameplate and identification labels
d. Factory settings of installed devices

3. Wiring diagrams: Power, signal, and control wiring.

D. Operation and maintenance data: For each type of power source and associated components, include in operation and maintenance manuals. In addition to items specified in Division 01 Section “Operation and Maintenance Data,” include the following:

1. Detailed operating and programming instructions.
2. Troubleshooting procedures.
3. Warranty, executed and signed at the time of putting the unit in service.

PART 2 - PRODUCTS

2.1 PACS SOFTWARE

A. Software Licensing

1. Upgrade existing site license to Software House PACS license 10.

B. Software Integrations

1. Video Assessment and Surveillance System (VASS) functionality

a. Control of cameras through the PACS and graphic maps
b. Associate cameras with access control and alarm events

2.2 PACS PANEL (ISTAR ULTRA)

A. Acceptable Manufacturers

1. Software House

B. Software House iSTAR Ultra

C. Minimum Features and specifications

1. Furnish with ACM (access control module) units as needed to interface between card readers and powered door hardware.

2. Furnish with GCM (general controller module, an interface between ACMs and Ethernet) units as needed for a functional system.
3. FIPS 140-2 Complaint
4. Install GCM and ACM units in Life Safety Power enclosure
5. Provide Life Safety Power supply as specified in 280507.10 – Power Sources for Electronic Security

2.3 INPUT/OUTPUT MODULES

A. Acceptable Manufacturers

1. Software House

B. Provide Software House I8 input module(s) and R8 output module(s) as needed for system expansion or integration

C. Minimum Features and specifications

1. Provides expansion of input and output capacity
2. Compatible with full range of Software House Istar and apC access control panels
3. I8 provides (8) eight Class A supervised inputs
4. R8 provides (8) eight Form C relay outputs
5. Dedicated tamper input included on each module
6. Optional UL-listed enclosure available

2.4 READER MODULE

A. Acceptable Manufacturers

1. Software House

B. Software House G2 RM-4E or approved equivalent

C. Minimum Features and specifications

1. Door Interface Junction Box: G2 RM-DCM-2 UL Listed tamper protected enclosure
2. G2 RM-4E module

2.5 CARD READER, STANDARD

A. Acceptable Manufacturers

1. Identiv
2. Software House

3. Approved Equivalent

B. The following readers are tested and acceptable

1. Identiv 8112ABPOOOO-TS449 Standard (Pigtail)
2. Identiv 8112ABTOOOO-TS449 Standard (Terminal Plug)
3. SWH-4130 Standard Reader (Terminal Plug)

C. Minimum Features and specifications

1. Works with C•CURE 800/8000 and C•CURE 9000
2. Read within 3 inches
3. Standard firmware that allows field programming no matter the model
4. Single-gang mounting
5. Black
6. Environmental

a. IP65 Pigtail models
b. IP55 Terminal models
c. Temperature range:-31 to 149 deg F (-35 to 66 deg C)

7. Terminal strip is preferred
8. Low Frequency Card Compatibility (125 kHz)

a. Indala

9. High Frequency Card Compatibility (13.56 MHz)

a. uTrust TS
b. Mi-Fare Classic
c. DESFire EVx
d. ISO 15693
e. ISO 14443A/B

2.6 DOOR POSITION SWITCH, RECESSED

A. Acceptable Manufacturers

1. Edwards
2. Magnasphere
3. Approved Equivalent

B. Edwards 1078C series or approved equivalent

C. Minimum Features and Specifications

1. UL listed
2. Recessed
3. Hermetically sealed reed switch encapsulated in polyurethane
4. IP 67 ingress protection
5. Electrical

    a. 7.5 volt-ampere minimum power rating
    b. 0.5 ampere minimum current rating
    c. 0.2 ohms maximum resistance

6. 100,000 life cycle under full load minimum.
7. 0.75 in (19 mm) or 1 in (25.4 mm) diameter
8. Capable of operating with a 0.4 in (10 mm) gap
9. Screw Terminals or twelve-inch (305 mm) wire leads, #22 AWG, solid

2.7 LOCAL SOUNDER

A. Acceptable Manufacturers

1. Securitron
2. Approved Equivalent

B. Provide Securitron Model PZ1 piezoelectric sounder or equal.

1. Anti-tamper screws.
2. Stainless-steel single-gang faceplate.
3. 5 volt DC to 28 volt DC.
4. 103 dB maximum at one foot and 24 VDC.

PART 3 - EXECUTION

3.1 GENERAL

A. Install system components and appurtenances in accordance with the manufacturers' instructions, ANSI C2, and furnish interconnections, services, and adjustments necessary for a complete and operable system as specified. Install control signals, communications, and data transmission lines grounding as necessary to preclude ground loops, noise, and surges from affecting system operation. Equipment, materials, installation, inspection, and testing shall be in accordance with manufacturers' recommendations and as modified herein.

B. Consult the manufacturers' installation manuals for wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the Riser/Connection diagram, if available, for schematic system installation/termination/wiring data.

C. Attach equipment to walls and ceiling/floor assemblies and 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. Mount the Reader Module in the Door Interface Junction Box. Provide mounting panels and hardware as needed to install per manufacturer's instructions.

E. Provide programming for the following operation:

1. Use of the card reader on the unsecure side of the door activates the electric strike and disables the door position switch.
2. Activation of the request-to-exit sensor on the secure side of the door disables the door position switch.
3. Otherwise, when the door position switch detects an open door, the PACS will send an alarm to the NMAA security system.

F. Provide programming and provide wiring as needed between the PACS and each automatic transfer switch so that the main power loss or switch from primary power to generator power shall generate an AC Fail alarm on the Physical Access Control System.

G. Provide programming and provide wiring as needed between the PACS and each dedicated security uninterruptible power supply so that the UPS trouble signals and main power fail appear on the PACS operator terminal as alarms.

3.2 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with EIA/TIA-606, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."

3.3 CURRENT SITE CONDITIONS

A. Visit the site and verify site conditions agree with the design package. Report changes to the site or conditions which will affect performance of the system to the COTR and PPSD-Security System Engineer in a report. Do not take any corrective action without written permission from the COTR.

3.4 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after correcting unsatisfactory conditions.

END OF SECTION 281000

SECTION 281515 – ELECTRIFIED LOCKING DEVICES 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.

B. Section 280500 Common Work Results for Electronic Safety and Security.

1.2 SYSTEM DESCRIPTION

A. This specification is electrified locking devices and accessories in support of the PACS directly supporting the electronic security systems (ESS). All locking and access control must comply with NFPA 101. Coordinate with Division 8 requirements.

1.3 SUMMARY

A. This Section includes the following:

1. Passive Infrared Request to Exit (PIR REX)
2. Push-to-Exit Switch
3. Sounders

1.4 SUBMITTALS

A. Product data: For each type and rating of equipment, include electrical ratings, operating characteristics, manufacturers' technical data on features and functions, enclosures, and furnished accessories.

B. Bill of materials: Provide detailed list of components.

C. Shop drawings: For each type of unit, indicate the following:

1. Dimensioned plans, elevations, and sections.
2. List of installed device and related equipment ratings and features including:

    a. Unit type and standard details
    b. Enclosure type
    c. Nameplate and identification labels
    d. Factory settings of installed devices

3. Wiring diagrams: Power, signal, and control wiring.

D. Operation and maintenance data: For each type of power source and associated components, include in operation and maintenance manuals. In addition to items specified in Division 01 Section “Operation and Maintenance Data,” include the following:

1. Detailed operating and programming instructions.
2. Troubleshooting procedures.
3. Warranty, executed and signed at the time of putting the unit in service.

PART 2 - PRODUCTS

2.1 PIR REQUEST TO EXIT

A. Acceptable Manufacturers

1. Bosch Security Systems

B. Bosch DS-160 or DS-161 or approved equivalent.

C. Minimum Features and Specifications

D. Request To Exit Detectors:

1. Passive infrared sensor designed for wall or ceiling mounting 2.1 to 4.6 m(7.5 to 15 ft)
2. Provide two (2) form “C” (SPDT) relays rated one (1) Amp. @ 30 VDC for DC resistive loads
3. The detectors relays shall be user adjustable with a latch time from 0.5-64 seconds. The detector shall also include a selectable relay reset mode to follow the timer or absence of motion.
4. Adjustable detection pattern plus or minus fourteen (± 14) degrees
5. Operate on 12 VDC with approximately 39 mA continuous current draw
6. Measure approximately 1.8 x 6.75 x 1.75 in (45 x 171 x 44 mm)

2.2 LOCAL SOUNDER

A. Acceptable Manufacturers

1. Mallory
2. Approved equal

B. Mallory SC 616N and SC 616CP are the basis of design.

C. Minimum Features and Specifications

1. Local alarms shall be provided for all perimeter doors and card access-controlled doors. All card access-controlled doors receive local sounders. The local perimeter door alarms shall be a steady tone (SC 616N) while the card access controlled doors shall have a chime tone (SC 616CP).
2. The local sounder shall be a solid-state sounding device with no moving parts. The sounder shall operate on 6-16 VDC at less than 16mA draw and produce a 2900 Hz signal at approximately 80-95 dB dependent upon input power. Sounders shall be powered by the auxiliary power supply. The power circuits supplying power to local sounders shall have an individual fuse for each positive leg between the main power supply output and individual distribution circuit. The fuse shall be rated at 50% of the rating of the fuse protecting the power supply output. The sounder shall be plate mounted to a recessed mounted junction box above and immediately adjacent the protected opening. Where the door is controlled by a card reader, the local sounder may be located on the reader module junction box providing the box is located immediately adjacent the protected opening and not obscured by ceiling tiles. The sounder shall be located on the secure side of the protected opening. The sounding device shall be activated and reset via the security management system. Each sounder shall be controlled by an individual relay at the DGP or at field relay modules. Reset or silencing of the sounder shall be via the control room operator terminals.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate with Division 8 requirements, finishes, and keyways.

B. OPS Lock Shop will rekey project provided cores. Coordinate with the OPS Lock Shop to purchase correct cylinder/cores.

C. Only Software House certified integrators may terminate cabling on PACS equipment.

END OF SECTION 281515

SECTION 282000 – VIDEO

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. Related Sections

1. Conduits: Section 260533.
2. Power supplies for PoE Injectors: Section 280507.10.

1.2 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 Smithsonian's existing American Dynamics Victor system.

C. Modify existing NVR as needed to integrate new camera feeds into the existing Smithsonian video surveillance network. Provide necessary associated licenses.

1.3 SUMMARY

A. This Section includes the following:

1. Cameras
2. Poles

1.4 DEFINITIONS

A. Pole: A support used to carry a security camera, provided with

1. Internal attachments for wiring
2. External attachments for brackets (if any) and camera.

1.5 SUBMITTALS

A. Product data:

1. Poles:

    a. Length and diameter
    b. Appurtenances

2. Cameras.

B. Shop drawings shall show complete dimensions of complete assembled unit with accessories. Include wiring diagrams, showing clearly manufacturer-installed and field-installed wiring.

1.6 QUALITY ASSURANCE

A. UL label and local testing (if required): As specified in Section 280500, Common Work Results for Electrical.

B. As specified in Section 280500 Common Work Results for Electronic Safety and Security.

PART 2 - PRODUCTS

2.1 MULTI-LENS DOME CAMERA, 20MP

A. Acceptable Manufacturers

1. Johnson Controls / Tyco
2. Arecont Vision
3. Hanwha
4. Approved Equivalent

B. Basis of Design is the Johnson Controls Illustra Pro-Gen4-20MP PTRZ.

C. Minimum Required 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 5MP CMOS
4. Resolution

    a. 2560 x 1920 (5MP) 4:3
    b. 2560x1444 (4MP) 16:9

5. Dynamic Range: 120 dB
6. Frame Rates:

    a. 30 FPS at 5MP.
    b. 60 FPS at 2MP.

7. Remote Focus
8. True day/night functionality with CF removal
9. PoE 802.3bt, Type 4 Class 8, 24VAC, Max Draw 71.3 watts
10. Outdoor rated IP66 and IK-10 Impact-Resistant Housing
11. H.264 / H.265 Motion JPEG and multi-streaming
12. Minimum Illumination:

    a. Color: 0.11 Lux
    b. B/W (Night Mode): 0.06 Lux, IR sensitive

13. Operating Temperature: -40 to 131 deg F (-40 to 55 deg C)
14. Humidity: 0% to 90% (non-condensing)
15. Total dimensions: 11.8 inch diameter by 6.7 inch height (299 mm diameter by 169 mm height)

2.2 POWER-OVER-ETHERNET POWER SUPPLY

A. Acceptable Manufacturers

1. Provide Power-over-Ethernet injector from same manufacturer as camera.

B. Basis of Design is the Johnson Controls / Tyco Illustra IA-POE-90-U00.

C. Minimum Required Features and Specifications

1. IEEE 8023.3bt Gigabit 90W PoE Injector
2. 90-watt capacity per port
3. 24 volt AC
4. Can handle data and power simultaneously.
5. Communications

    a. 10/100/1000Bast-T (X)
    b. Protocol: IEEE 802.3, 802.3u, 802.3x, 802.3af/at/bt, 802.3ab
    c. Transmission Distance: Up to 100 meters using Ethernet
    d. Transmission Speed: Up to 1000 Mbps.

6. Connectors:

    a. Data in: RJ45
    b. PoE out: RJ45

7. PoE and SYS LED indicators
8. Reverse Polarity protection
9. IP40 metal shell with solid mounting kit
10. UL62368 compliant
11. Environmental:

    a. Temperature:-40 to 75°C (-40 to 167°F)
    b. Relative Humidity: 10 to 95% (non-condensing)

PART 3 - EXECUTION

3.1 GENERAL

A. Install 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, 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, if available, for 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 agree with the design package. Report all changes to the site or conditions that will affect performance of the system to the COTR. Do not take any corrective action without written permission from the COTR.

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. Power Supplies

1. Provide a dedicated Power-over-Ethernet power supply for each camera, providing 24 volts AC power
2. Locate the power supply in the Cash Room.
3. Provide converters, adapters, transformers, and other equipment as needed to connect each power supply to a 120-volt receptacle on an optional standby circuit.

3.2 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.

END OF SECTION 282000

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 8: Door Release and unlocking
5. Division 9: Painting
6. Division 14: Elevators
7. Division 21: Sprinkler System, Fire Pumps
8. Division 23:

   Air Handling Systems

   Smoke Management Systems
   Stair Pressurization Systems
   Gaseous suppression systems

9. Division 26: Basic Electrical Requirements

1.02 SUMMARY

A. Scope: This work includes designing and providing a new, complete, addressable fire alarm system as described herein and on the contract drawings for <Building Name>. 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: Existing fire alarm equipment shall be maintained fully operational until the new equipment has been tested and accepted by the Smithsonian Institution. As 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 conduit 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.

1.03 ALLOWANCES

[List Allowances, if included as part of the contract. Confirm with OSHEM and COTR]

1.04 UNIT PRICES

[List Unit Prices, if included as part of the contract. Confirm with OSHEM and COTR]

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. 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

1.06 SYSTEM DESCRIPTION

A. The System shall be 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.

1.07 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 72 and all contract documents and specification requirements.

B. The system shall be classified as a proprietary protective signaling system.

C. Control features:

1. The system fire alarm control panel shall be 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. [The system fire alarm control panel shall be tied to a remote panel and a graphic annunciator in the locations identified on the drawings.]
3. 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.
4. A subprogram shall be provided to allow environmental compensating for smoke detector sensitivity. Each smoke detector shall be programmed with this capability.
5. 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.
6. 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.
7. 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.

8. History Logging - recirculating last 500 events, minimum. History shall be downloadable by classification for selective event reports.

D. Supervision

1. Style B initiating device circuits.
2. Style 4 signaling line circuits for each floor.
3. Style 7 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. Spare capacity:

1. All installed signaling line circuits and notification appliance circuits shall have 20 percent spare capacity.
2. All amplifiers shall have 20 percent spare capacity.
3. Battery size shall be a minimum of 125% of the calculated requirement.

F. 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. Sound General Evacuation Alarm: This function shall cause all strobe lights to activate and speakers in the building to sound a slow whoop for 3 cycles followed by the voice message,

   "May I have your attention please! May I have your attention please! A fire has been reported in the building. Please walk to the nearest exit and leave the building. Do not use the elevators."

2. This is repeated until the control panel is reset. After the digital message has ended, or if the digitally prerecorded message shall fail for any reason, the alarm signal shall revert back to a slow whoop which will continue until manually silenced. It shall also be possible to preempt the whoop signal or prerecorded

voice evacuation message and sound a live message from the microphone at the Fire alarm Master CPU location on a floor by floor basis. All floors not selected for a manual message shall continue to receive the pre-recorded message or whoop signal.

3. 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.
4. Release Held-Open Fire Doors: This function shall cause all fire doors in the building which are held open by electrical hold-open/release mechanisms to be released, and allowed to close.
5. Unlock Time Delay Hardware on Exit Doors: This function shall cause a signal to be sent to all exit doors provided with electrically operated locks to become unlocked and free for egress.
6. Shutdown Supply Fan Served: This function shall cause the air handling system supply fan to shut down.
7. Initiate Smoke Management Sequence of Operation: The building HVAC system [Smoke Removal 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.
8. Close Smoke Damper: This function shall cause smoke dampers installed in HVAC systems to shut-down.
9. 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.
10. Initiate Elevator Recall: This function shall cause a signal to be sent to the elevator controller recalling the elevator to the preselected floor, or if the activated initiation device is on the preselected floor, the elevator will be recalled to the preselected secondary floor. Recall shall be initiated for all elevators served by a common shaft, elevator machine room, or elevator lobby.
11. Shutdown Power to Elevator Equipment: This function shall cause a signal to be sent to a shunt trip switch in the power circuit serving the elevator to cause elevator shutdown. This shall be typical for all elevators served by a common shaft, elevator machine room or elevator lobby.

12. Activate Fire Suppression System Served: This function shall cause a signal to be sent to an interface device to operate a solenoid and activate a fire suppression system.
13. Shutdown Exhibit Hall Audio/Visual Equipment: This function shall cause a signal to be sent to a circuit shunt trip causing audio/visual equipment to shut down.
14. 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.
15. 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.]
16. [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.]
17. 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.
18. 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.
19. 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.

G. 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. Fire suppression system control valves shall be supervised to ensure circuit integrity and open position. Closing a control valve shall cause a trouble condition.
6. 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.

H. Fire Alarm Signal Initiation Shall Be By One Or More Of The Following Devices:

1. Manual pull station
2. Heat detector
3. Addressable area smoke detector
4. Projected beam detector
5. Aspiration Smoke Detector Alarm
6. Automatic sprinkler system water flow switch.
7. Combustible Gas Detection System
8. Conventional initiation device zone (for legacy systems).
9. Flame detector
10. [Operation of the building fire pump or pump running signal].

I. Supervisory signal initiation shall be by one or more of the following devices or actions:

1. Operation of a fire-protection system valve tamper switch.
2. [Operation of the building fire pump] and/or any associated fire pump system troubles/ supervisory signals.
3. Duct smoke detector
4. Laser Scanner Aspiration Smoke Detector Alert
5. Operation of any non-fire system alarms as designated on the Matrix.
6. [Generator running]
7. Generator fault
8. Fire pump fault

J. 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.

1.08 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 of the following:

1. Fire Alarm Control Panel (FACP) (Including Printers, interface modules, Covers, Console Rack, Video Display Unit, amplifier panels etc.)
2. Strobe Power Extender Panels
3. Storage Batteries
4. Battery Charger
5. Cabinet
6. Manual Pull Station
7. Addressable Interface Devices
8. Terminal Cabinets/Assemblies
9. Addressable Relays And Interface Modules
10. Graphic Annunciator Panel
11. Annunciation devices (speakers, strobes, bells, etc.)

12. Fire Detector (smoke, heat, flame, etc.)
13. Amplifiers
14. Tone Generators
15. Digitalized Voice Generators
16. Firefighter Telephones
17. Waterflow Switch
18. Tamper Switch
19. Electromagnetic Door Holder
20. Remote Fire Alarm Control Unit
21. Wire
22. Boxes
23. Terminal strips
24. Relays
25. Transient Voltage Surge Suppressors
26. Conduit
27. Support

D. Shop Drawings: Provide 5 sets of working drawings and 1 set of reproducible mylar sepia on sheets not smaller than 24 inches by 36 inches (609 mm by 914 mm). 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.
2. Provide point-to-point wiring diagrams on floor plans at a scale of not less than 1/8” = 1’-0” (1:100), showing all field devices (indicating and initiating devices, relays, switches, etc), field interconnections, the routing of conduit and circuits 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 lighting fixtures, 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 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.
6. Provide detailed drawings of the graphic annunciator.
7. 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 24 inches by 36 inches (609 mm by 914 mm). The drawings shall include:

1. As-built location of all devices and equipment. Device addresses shall be listed next to each device
2. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
3. Riser diagram
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 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 a complete 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 descriptive labels 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; manufacturers wiring specifications for the system; training manual.
2. Maintenance checklists for equipment.
3. As-built circuit diagrams, complete with color-code scheme, and device descriptions.
4. Complete parts list by make model number and manufacturer.
5. List of smoke detector addresses and corresponding sensitivity readings.
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 watts 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.
8. [Provide detailed specific airflow balancing calculations for each of the air sampling smoke detectors. Calculations shall be submitted with detailed drawings that indicate all sampling points, calculation nodes, and relevant information to allow complete review of the calculations against the detailed design drawings.]

M. FACP Wire Chart: Prepare a system wire chart. Chart every wire 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 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 envelop inside the fire alarm control panel.

N. Terminal Cabinet Wire Chart: Prepare a wire chart of the wires in each terminal cabinet. Chart every wire 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.

1.09 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):

UL Fire Protection Equipment Directory
UL Electrical Construction Materials Directory
UL 38 – Manually Actuated Signaling Boxes for Use With Fire Protection Signaling Systems
UL 228 – Door Holding Devices
UL 268 - Smoke Detectors for Fire Protective Signaling Systems
UL 268A - Smoke Detectors for Duct Application
UL 464 - Audible Signal Appliances
UL 497A – Secondary Protectors for Communications Circuits
UL 521 - Heat Detectors for Fire Protective Signaling Systems
UL 864 - Control Units for Fire Protective Signaling Systems
UL 1283 – Electromagnetic Interference Filters
UL 1449 - Transient Voltage Surge Suppressors
UL 1480 - Speakers for Fire Protective Signaling Systems
UL 1971 - Signaling Devices for the Hearing Impaired
FM Approval Guide

2. Codes and Standards

International Building Code, Latest Edition
Life Safety Code, Latest Edition
NFPA 70, National Electrical Code
NFPA 72, National Fire Alarm Code, 2002 Edition
Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
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.

1.10 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 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.

1.11 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.

1.12 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 equipments and piping layouts with other trades to avoid obstructions and excessive changes in direction for piping.

1.13 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.

1.14 SERVICE AGREEMENT

[List requirements, if part of the contract. Confirm with OSHEM and COTR].

1.15 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: 5
2. Heat detectors: 2
3. Manual pull stations: 2
4. Audio/visual devices: 5
5. Fuses for each fused circuit: 5
6. Electromagnetic door holder: 1
7. Spare rolls of paper for the system printer: 9 (plus sufficient paper for all fire alarm acceptance tests)
8. Lamps for each lamp type furnished: 5
9. Keys shall be provided for all fire alarm cabinets: 5
10. Wrenches or special tools required to gain access to all lockable equipment: 5

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, cabinets, and peripheral devices:

   EST
   FireLite
   Notofier
   Siemens
   Simplex Grinnell
   Gamewell
   FCI
   Approved equal.

2. Wire and Cable: Comtran Corporation.

   Helix/HiTemp Cables, Inc.; a Draka USA Company.
   Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
   West Penn Wire/CDT; a division of Cable Design Technologies.
   Approved equal.

3. Conduit:

   Allied
   Approved equal

4. Boxes, supports, terminal blocks, and appurtenances:

As per Section Division 26

2.02 FIRE ALARM CONTROL PANEL (FACP):

A. The control panel shall be a U.L. listed Fire Alarm Control Panel with multiplex signaling service and voice evacuation. All components shall be provided by one manufacturer. As the central control unit for the entire system, the control panel shall provide power, supervision, control, and logic, utilizing solid state, modular components, internally mounted and arranged for easy access. Each control unit shall be suitable for operation on a 120 volt, 60 hertz, normal building power supply.

B. Cabinet: Install control panel components in cabinets large enough to accommodate all components and also to allow ample gutter space for interconnection of all panels as well as all field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall say Fire Alarm Control Panel and shall not be less than 1-inch high. If multiple panels are provided, additional identification shall be provided on each nameplate to distinguish the panels. Provide prominent rigid plastic or metal identification plates for all lamps, circuits, meters, fuses and switches. The cabinet shall be provided in a sturdy steel housing, complete with backbox, hinged steel door with cylinder lock, and surface mounting provisions.

C. Control/Display Modules: Provide power and control modules in the FACP to perform all functions described in this specification.

1. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
2. Non-volatile memory for system data base, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition.
3. Visual indication of alarm, supervisory or trouble initiation on the fire alarm control panel shall be by liquid crystal display or similar means with a minimum of 80 characters of which at least 32 are field changeable.
4. LED display for "ALARM", "AUDIBLE SILENCED", "SUPERVISORY", "TROUBLE", and "POWER ON".
5. Switches or buttons for "ALARM ACKNOWLEDGE", "AUDIBLE SILENCE", "SUPERVISORY ACKNOWLEDGE", "TROUBLE ACKNOWLEDGE", and "RESET"
6. [Programmable buttons or switches to perform custom functions such as drill, disable, bypass automatic control commands or other special functions as required by design.]
7. Programmable panel mounted relays to be software programmed to perform control functions required for system operation.

8. Notification appliance circuits as required to supervise and operate all connected notification appliances. Operation of NACs shall be fully integrated with the FACP. Switches shall be used to activate or deactivate speaker and strobe circuits. Through the use of multi-colored LEDs, a clear indication shall be provided showing which circuits are active and to which strobe and audio channel. The audio circuit shall activate a slow whoop tone for three cycles followed by a voice message which is repeated until the control panel is reset. A live voice message shall override the automatic output through use of a microphone input at the control panel. The system shall be capable of operating all strobes and speakers at the same time. The digitalized voice message shall consist of a non-volatile (EPROM) microprocessor based input to the amplifiers. The microprocessor shall actively interrogate all circuitry, field wiring and digital coding necessary for the immediate and accurate rebroadcasting of the stored voice data into the appropriate amplifier input. Loss of operating power, supervisory power or any other malfunction which could render the digitalized voice module inoperative shall automatically cause the slow whoop tone to take over all functions assigned to the failed unit.
9. Locate diodes and relays, if any, on screw terminals in the FACP.
10. Additional Requirements: The FACP shall have the following additional features:

    System shall be UL 864 listed.
    Field programmable.
    Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions as required.
    Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
    Control panel shall have minimum 25% capacity for addition of future signaling line circuits and notification appliance circuits. Each installed circuit shall have 20% spare capacity.
    Analog Loop Driver to allow for continuous interrogation of each addressable device in the building.
    Communication with auxiliary devices, including waterflow switches, valve supervisory switches, door controls, etc. through the use of appropriate interface modules as indicated on the riser diagram and interface schematics.
    The FACP shall be listed for releasing service and shall be listed for connection to a Central Station Signaling System service.
    The FACP shall have drift compensation technology and shall be UL listed as a calibrated smoke test instrument.
    Device history shall be stored at the FACP. At a minimum, the following information for each sensor shall be maintained: device history, sensitivity levels, alarm verification status, drift compensation data.
    The FACP shall provide a minimum 500 event history log.

The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.

Flow test shall be programmed as a software zone to permit de-activation of the audible alarms, and to activate and de-activate the flow test through the use of function keys at the panel.

All keys switches and panel buttons shall be programmed in accordance with the using agency's specific requirements.

2.03 FIRE DETECTORS

A. Ionization and 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, 4 inch (101 mm) 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.

C. Duct Detectors: Duct smoke detectors shall meet the requirements for photoelectric light scattering type detectors. With the addition that duct detectors are U.L. listed for installation in air duct sampling housings for the detection of smoke in HVAC system ducts.

D. Heat Detectors: Heat detectors in hoistways and elevator machine rooms shall be intelligent, low temperature (135ºF-140ºF), rate-compensating detectors.

1. The detectors furnished shall be U.L. listed for use in the FACP and environment conditions.
2. The detector shall be addressed, tested and programmed prior to installation.
3. The detector shall display a steady LED when in the alarm state when the system is operating from normal or standby power.
4. Detectors shall be equipped with screw terminals for each conductor.
5. Detectors shall be hermetically sealed and of the automatically resetting type which will operate when ambient air temperature reaches detector setting regardless of rate of temperature rise.
6. Detector operation shall not be subject to thermal lag.

2.04 AIR SAMPLING SMOKE DETECTOR

A. General:

1. Air Sampling Scanner detector shall be laser based using a piping system and a fan to transport the particles of combustion to the detector.
2. There shall be 2 levels of alarm from each zone covered by the detector and one (1) trouble condition from each detector.
3. The air being sampled shall pass through a filter to reduce the amount of dust before entering the detection chamber.
4. Detector shall have the capability to connect to a network providing all data to the fire alarm control panel. The air-sampling detector shall be connected to the building fire alarm system using interface modules, one for each level of alarm and one for common trouble.
5. All pipe airflow balancing calculations shall be performed using listed calculation software

B. Detector:

1. The Detector, Filter, Aspirator and Relay Outputs shall be housed in a mounting box and shall be arranged in such a way that air is drawn from the fire risk and a sample passed through the Dual Stage Filter and Detector by the Aspirator.
2. The Detector shall have an obscuration sensitivity range of 0.005 – 20% obs/m.
3. The Detector shall have four independent field programmable smoke alarm thresholds per pipe (sector) and a programmable scan time delay.

   The laser based aspirating detection system shall have four (4) alarm thresholds per pipe (sector). The four alarm levels may be used as follows:

   Alarm Level 1 (Alert)
   Activate a visual and audible supervisory alarm.
   Alarm Level 2 (Fire)
   Activate General Building Alarm

   Final detection system settings shall be approved by OSHEM. Initial Detection Alarm Settings shall be:

   Alarm Level 1 (Alert) 0.08% Obs/m
   Alarm Level 2 (Fire) 2.0% Obs/m

   Each pipe shall have its alarm thresholds set by a Sector Factor. The Sector Factor range shall be between 0.5 and 2.0 (where 2.0 doubles the normal alarm threshold settings).

4. The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Twenty-four hours standby battery back up is required followed by 30 minutes in an alarm condition.
5. The Detector shall also incorporate facilities to transmit the following faults:

   Detector
   Air flow
   Filter
   System
   Zone
   Network
   Power

6. Urgent and Minor faults. Minor faults shall be considered as servicing or maintenance signals. Urgent faults indicate the unit may not be able to detect smoke.

7. The detector shall have four in-line sample pipe inlets and must contain a flow sensor for each pipe inlet. Both Minor and Urgent flow faults can be reported.
8. The aspirator shall be a purpose-designed rotary vane air pump. It shall be capable of allowing for multiple sampling pipe runs up to 200m in total, (4 pipe runs per detector) with a transport time of less than 120 seconds or as appropriate codes dictate.
9. The Assembly must contain relays for alarm and fault conditions. The relays shall be software programmable to the required functions. The relays must be rated at 2 AMP at 30 VDC. Remote relays shall be offered as an option and either configured to replicate those on the detector or programmed differently.
10. The Assembly shall be able to be surface mounted to a wall or recessed in the wall cavity (the unit may be inverted in either option).
11. The assembly shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each even shall be recorded. Each detector (zone) shall be capable of storing up to 18,000 events and does not require the presence of a display in order to do so.

C. Displays:

1. A Display module shall be provided within each detector.
2. Each Display shall provide the following features at a minimum:

   A bar graph display.
   Four independent high intensity alarm indicators, Alert, Action, Fire 1 and Fire2, corresponding to the four alarm thresholds of the indicated sector.
   Alarm threshold indicators for Alert, Action and Fire 1.
   LED indication that the First Alarm Sector is established
   Detector fault and airflow fault indicators.
   Faults originating in the particular zone (Zone Fault) shall be distinguished from those produced by the overall smoke detection system and from those resulting from network wiring errors (Network Fault). LED indicators shall be provided for each fault category.
   Minor and urgent fault LED indicators.

D. Sampling Tubes:

1. The sampling pipe shall be smooth bore with an internal diameter between 5/8 – 1 inch (15-25mm). Normally, pipe with an outside diameter of 1” (25mm) and internal diameter of 7/8 inch (21mm) should be used.
2. The pipe material shall be CPVC and shall meet UL 1887, Fire Test of Plastic Sprinkler Pipe for Flame and Smoke Characteristics.
3. All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.

4. The pipe shall be identified with labels reading: “Aspirating Smoke Detector Pipe – Do not Paint or Disturb” (or similar wording) along its entire length at regular intervals not exceeding the manufacturers’ recommendation or that of local codes and standards.
5. All pipes should be supported at not less than 5 foot (1.5m) centers.
6. The far end of each trunk or branch pipe shall be fitted with an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.

E. Sampling Holes

1. Sampling holes of 5/64 inch (2mm), or otherwise appropriately sized holes shall not be separated by more than the maximum distance allowable for conventional point detectors as specified in the local code or standard. Intervals may vary according to calculations. Sampling hole layouts have been indicated on the plans.
2. Each sampling point shall be identified in accordance with Codes or Standards.
3. Consideration shall be given to the manufacturers recommendations and standards in relation to the number of Sampling Points and the distance of the Sampling Points from the ceiling or roof structure and forced ventilation systems.

2.05 MANUAL PULL STATIONS:

A. Provide double action intelligent manual stations where shown on the drawings, to be flush or surface mounted as required. Manual stations shall be addressable.

B. Stations shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Stations which require the replacement of any portion of the device after activation are not permitted. Stations shall be finished in fire-engine red with molded raised lettering operating instructions of contrasting color. The use of a key or wrench shall be required to reset the station.

C. A polycarbonate tamper cover shall be provided for pull stations located in public spaces.

2.06 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.

C. Strobe lights

1. Provide with red finish plate and with the word "FIRE" 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.

2.07 AMPLIFIERS, PREAMPLIFIERS, TONE GENERATORS:

A. General: Amplifiers, preamplifiers, tone generators, digitalized voice drives and all other hardware necessary for a complete, operational voice/alarm signaling service conforming to NFPA 72 shall be housed in a remote fire alarm control unit, terminal cabinet, or in the fire alarm control panel. Each amplifier shall have two channels; one to broadcast a message and the other for paging.

B. Construction: Amplifiers shall utilize solid state components and shall be provided with output protection devices sufficient to protect the amplifier against any transient up to ten (10) times the highest rated voltage in the system.

C. Inputs: Each system shall be equipped with separate inputs from the tone generator, digitalized voice driver and panel mounted microphone. Microphone inputs shall be of the low impedance, balanced line type. Both microphone and tone generator input shall be operational on any amplifier.

D. Tone Generator: The tone generator shall be of the modular, plug-in type with securely attached labels to identify the component as a tone generator and to identify the specific tone it produces. The tone generator shall produce a slow whoop tone, which shall slowly ascend from low (500 hertz) to high (1200 hertz), and be constantly

repeated until interrupted by either the digitalized voice message, the microphone input or the alarm silence mode as specified. Each slow whoop cycle shall last approximately four (4) seconds. The tone generator shall be single channel with an automatic backup generator per channel such that failure of the primary tone generator causes the backup generator to automatically take over the functions of the failed unit and also causes transfer of the common trouble relay.

E. Protection Circuits: Each amplifier shall be constantly supervised for any condition which could render the amplifier inoperable at its maximum output. Failure of any component shall cause automatic transfer to a designated backup amplifier, illumination of a visual "amplifier trouble" indicator on the control panel, appropriate logging of the condition on the system printer and other actions for trouble conditions as specified.

2.08 [ELECTROMAGNETIC DOOR HOLDERS:

A. Where indicated on the drawings, provide magnetic fire door hold open devices. The electromagnetic holding devices shall be designed to operate on 120 VAC, and require not more than 3 watts of power to develop 1.72 bar (25 psi) of holding force.

B. The initiation of nearby smoke detectors shall cause the release of the electromagnetic door holding device permitting the door to be closed by the door closer. The door hold open devices shall release, allowing the doors to close upon receiving a signal from either: local smoke detectors, listed and labeled for the application; or the fire alarm system when the system receives a fire alarm signal from area detectors.

C. The initiating smoke detectors must be located within 1.5 m (5 ft) of the door hold open device as required by NFPA 72.

D. The device shall be U.L. listed based on U.L. 228 tests.

E. Each automatic door release must be provided with means of manual operation from a position at the door.

F. Door hold open devices must fail open, such that the door closes upon loss of power, or the holding device must have a secondary power source.

G. Where magnet extenders are installed, only the rigid type are permitted.

H. Doors fitted with release mechanisms must be provided with appropriate signage e.g. ‘Automatic Fire Door – Keep Clear’.]

2.09 [REMOTE PANELS

A. Provide remote panels in the locations shown on the panels.

B. Remote panels shall meet the requirements listed under 2.02. Lettering on the nameplate shall say Remote Fire Alarm Control Unit.]

2.10 [GRAPHIC ANNUNCIATOR

A. Annunciator Panel: Provide a graphic annunciator which indicates the building floor plan, including locations of stairs and elevators, control valve locations, and fire walls. The boundaries for Indicating device circuits, HVAC zones, and sprinkler zones shall be clearly marked on the floor plan. Annunciator shall include a north arrow and a "you are here" indicator. The graphic annunciator shall be a minimum size of 3 feet by 3 feet (914 mm x 914 mm).

B. Indicating Lights: Provide the graphic annunciator with individual LED indicating lights for each type of alarm and supervisory device. Provide an amber LED for indicating a system trouble condition and a separate amber LED for indicating a supervisory condition. Provide a green LED to indicate presence of power and a red LED to indicate an alarm condition. The actuation of any alarm signal shall cause the illumination of a boundary LED, a floor LED, and a device LED. System supervisory or trouble shall cause the illumination of a trouble LED. In addition to all of these LED indicators, provide emergency power indicating LED. Provide a push button LED test switch. The test switch shall not require key operation. Annunciator LEDs shall only be extinguished by operation of the system reset switch on the FACP.

C. Material: Construct the graphic annunciator faceplate of smoked plexiglass. The LEDs shall be backlit. All control equipment and wiring shall be housed in a surface mounted backbox. The exposed portions of the backbox shall be bronze plated with knockouts.

D. Programming: Where programming for the operation of the proper LEDs is accomplished by a separate software program than the software for the fire alarm control panel, the software program shall not require reprogramming after loss of power. The software shall be reprogrammable in the field.]

2.11 SYSTEM PRINTER

A. [The system printer shall be mounted within the FACP and visible through an opening in the enclosure door. All printouts shall be automatically wound onto a take up spool.][The system printer shall be an external printer with associated printer stand. Printer stand shall be capable of holding paper stock and shall provide a holding area for printouts.]

B. The printer shall continue to operate from building emergency power or fire alarm system standby batteries in the event of main power loss.

C. The printer shall record all system events including operator commands and shall be capable of providing a printed list of system conditions such as detector sensitivities, thresholds, analog voltages, device type, and custom message. The printer shall automatically perform a self test every 24 hours. A trouble condition shall be generated when printer paper has run out. An internal buffer shall continue to store events when paper is out.

D. The printer shall have at least 80 characters per line and capable of printing at 120 characters per second.

2.12 REMOTE MONITORING SYSTEM:

A. All equipment device wiring shall be provided for remote monitoring.

B. FACP shall be compatible with remote monitoring station.

C. Communication between FACP and remote monitoring station shall be via [Ethernet][digital dialer].

2.13 POWER SUPPLIES

A. Primary power for the FACP shall be 120VAC service obtained from the emergency power panel board. Red colored breaker locks shall be provided for all fire alarm circuit breakers.

B. Secondary power for the FACP shall be provided by sealed gelled electrolyte batteries. Batteries shall be housed in the control cabinet or a separate cabinet with adequate cell separation to prevent accidental discharge.

C. Battery Capacity: Battery supply shall be calculated to operate its load in a supervisory mode for twenty four hours with no primary power applied, and after that time, operate its alarm mode for five minutes. (In addition, an alarm reserve correction of 1.3 shall be included.)

D. Battery Charger: Secondary power battery chargers shall be obtained from the emergency power panel board. Provide battery charging circuitry for each standby battery bank in the system low voltage power supply or as a separate circuit. The charger shall be automatic in design, adjusting the charge rate to the condition of the batteries. Battery charge rate and terminal voltage shall be read using the fire alarm control panel LCD display in the service mode, indicating directly in volts and amps. Charger shall be housed in the main fire alarm control panel or the battery cabinet.

2.14 LOAD CONTROL RELAYS:

A. Relays for the control of air handler contactors and elevator recall circuits shall be rated for use with circuits up to 240VAC at 7A inductive. Relays shall be of the sealed pluggable type, and terminations shall be made to pressure type screw terminals.

2.15 INTERFACE MODULES:

A. Furnish intelligent analog signaling circuit interface 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. 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.

2.16 [FIREFIGHTER TELEPHONE COMMUNICATION SYSTEM

A. Provide a firefighter telephone communication system with complete, common talk, closed circuits. The system shall include, but not be limited to, a master control station mounted in the fire alarm control panel, a power supply and standby battery system, and remote telephone stations.

B. Provide a master control station which shall provide all power, supervision and control for all wiring, components, and circuits. The act of lifting any remote telephone handset from its cradle shall cause both a visual and audible signal to annunciate at the master control station. Removing the handset at the master control station and depressing a button at the remote telephone handset shall cause the automatic silencing of the audible signal.

C. Communication between the master control station handset and any/or all remote handsets shall require the depressing of a push-to-talk switch located on any/all remote handsets. During the time that the master control handset is removed from its cradle it shall be possible to communicate between 5 remote handsets and the master control station.

D. Handsets shall be able to monitor any conversation in progress and join the conversation by pressing the push-to-talk button. It shall not be possible to communicate between two or more remote handsets with the master control station handset in its cradle. The master control station handset shall be red in color and equipped with a 5 foot (1524 mm) long strain-relieved coiled cord. All wiring connections shall be made to terminal strips.

E. The master control station shall monitor all wire and connections for any opens, shorts or grounds which would render the system inoperable or unintelligible. The master control station shall be equipped with a silencing switch and ring-back feature such that any audible trouble signal can be silenced and will be so indicated by the lighting of an amber LED. Once any trouble condition has been corrected, the amber LED will be extinguished and the silence switch will sound again until the switch is restored to its original position.

F. The master control station shall be equipped with a separate, LED annunciated switch for each telephone circuit. In addition, LEDs shall provide for the annunciation of operating and supervisory power. The loss of operating or supervisory power shall cause an audible and visual indication at the master control station and shall also cause the fire alarm trouble signal to sound on the FACP.

G. All switches, LEDs and controls shall be fully labeled.

H. Provide surface or flush mounted remote telephone stations as indicated on the drawings. Each station shall be equipped with a hinged door that is magnetically locked. Each handset shall be permanently wired in place with a coiled cord. Each handset shall be red high-impact cycolac and shall be equipped with a push-to talk switch which, when operated, will signal the master control station and a switch-equipped, storage cradle.]

PART 3 - EXECUTION

3.01 PRIMARY POWER:

A. Make the service connection for the FACP at the emergency distribution panel where shown. Provide a separate NEMA 1 "General Purpose Enclosure" for the circuit breaker. The circuit breaker enclosure shall be painted red, marked "FACP", and provided with a lockable handle or cover.

3.02 SYSTEM FIELD WIRING AND CONDUIT

A. Wiring Within Cabinets and Junction Boxes: Provide wiring installed in a neat and workmanlike 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.	120VAC Circuits:	12AWG, Type THHN, solid copper
4.	Interfaced Circuits:	16AWG, Type FPLR, solid copper, shielded
5.	Speaker Circuits:	16 AWG, Type FPLR, solid copper, twisted pair, unshielded
6.	Firefighter Telephone Circuits:	18 AWG, solid copper, twisted pair
7.	Battery Cable:	14 AWG, stranded

C. Connectors: All conductors shall be terminated at a screwed connector on a securely mounted approved pressure type terminal block. The use of wire nuts 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 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. Signaling Line and Notification Appliance Circuits

1. Signaling Line, notification appliance, and power circuits shall each be in separate conduit.
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.

H. Circuit Loading:

1. Spare capacity shall be in accordance with 1.07.
2. Circuits operating at 24VDC shall not operate at less than 21.6volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10% of nominal voltage.

I. Spare Circuits: Provide one spare signaling line and notification appliance circuit for each terminal box placed at each floor on each riser. Spare capacity shall also be provided in the FACP for these circuits. FACP control boards shall be provided to permit 2 spare initiation circuits and 2 spare indicating circuits. Spare circuits are not to include those provided on the mother board.

J. Wiring to a Central Station: Provide a dedicated telephone line from the FACP modem to the central monitoring panel in the South Quadrangle building.

K. Conduit:

1. All conductors shall be in grounded metal conduit. Conduit shall be Rigid metal or EMT. Flexible metal conduit not exceeding six foot lengths shall be permitted from junction box to initiating device. On flexible metal conduit, use only insulated throat connectors.
2. Run conduit or tubing concealed unless specifically shown otherwise on the drawings.
3. Minimum conduit size shall be 3/4-inch.

L. Circuits to Interfaced Equipment:

1. Circuits to smoke management systems, fan shutdown systems, door locking systems, A/V shutdown, 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.

M. Load Control Relays:

1. All relays shall be supervised as required by NFPA 101 and mounted within three feet of the device controlled.

3.03 FIRESTOPPING:

A. Seal all holes caused by penetrating conduit, 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 shall be painted. Metal conduit 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 Section 099000.

B. Red bands shall be applied every 10 feet (3.05m) when not using red-colored conduit.

C. Prior to acceptance testing each fire alarm initiating device must be labeled with the device address.

3.05 DEVICE INSTALLATION:

A. FACP: Locate the FACP where indicated on the drawings. Surface mount the enclosure with the top of the cabinet 6 feet (1829 mm) above the finished floor or center the cabinet at 5 ½ feet (1676 mm), whichever is lower.

B. Manual Pull Stations: Mount the manual pull stations so that their operating handles are 4 feet (1219 mm) above the finished floor.

C. Strobes: Wall mount strobes shall be a minimum of 80 inches (2032 mm) above the finished floor or 6 inches (152 mm) below the ceiling whichever is lower.

D. Speakers: Speakers 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. Install speakers in elevator cabs.

E. Smoke Detectors:

1. In raised floor spaces, the smoke detectors shall be installed to protect 225 sq. ft (145161 sq. mm) per detector.
2. In hallways, open areas, and rooms where more than two smoke detectors are located, ionization type detectors and photoelectric type detectors shall be installed. These detectors should be arranged so that every other detector in the room is a different type than the adjacent detector. In single detector rooms install an ionization detector.
3. Photoelectric type detectors shall be installed in elevator machine rooms and elevator hoistways.
4. Install smoke detectors a minimum of 3 feet (914 mm) away from supply air vents.
5. New smoke detectors shall be installed with dust covers. The dust covers shall be removed just prior to acceptance testing.

6. 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.

F. Heat Detectors for Elevator Rooms and Shafts: Heat detectors, provided to meet ANSI A17.1 requirements for elevator power disconnect, shall be located within 2 feet of each sprinkler head.

G. Graphic Annunciator: Surface mount the panel, with the top of the panel 6 feet (1800 mm) above the finished floor or center the panel at 5 ½ feet (1600 mm), whichever is lower.

H. [Firefighter Telephones:

1. Locate wall mounted in each stair at each floor landing, in each elevator lobby and in each elevator cab 4 feet above the finished floor.]

I. Audio-Visual Equipment Shunt Switches:

1. Smoke detectors are to be installed in enclosed AV booths/rooms. Activation of the smoke detector is to shut-down power to the A/V equipment. Self-contained units (not tied to the FACP) with a local alarm are permitted.
2. Activation of the general fire alarm shall shut-down all AV equipment. This is so that audio portions of A/V equipment do not compete with the fire alarm system. This is easily done if the A/V control circuits are central to one panel or area. A circuit is required from the FACP to relays to the central A/V control circuits to shunt power.

J. Door Hold-Open/Release Devices:

1. Relays shall be mounted within three feet of the device controlled.
2. Smoke detectors with integral relays shall control the door hold-open devices.

K. Load Control Relays: Relays for elevator shunt and HVAC control shall be mounted in a NEMA style enclosure, painted red, and appropriately labeled, such as, BRKR SHUNT RELAY.

L. [Elevator Cab Fire Alarms: Elevator cab speakers, strobes, and firefighters telephones shall be turned over to the elevator contractor whose work is described in Division 16. Coordinate provision for traveling cables and other installation accessories for connection of these devices.]

3.06 TESTS

A. Megger Tests: After all wiring has been installed, and prior to making any connections to panels or devices, all wiring 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.

B. Loop Resistance Tests: Measure and record the resistance of each circuit 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.

C. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits 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 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.

D. 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 meggar 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 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. Visually inspect all wiring.
8. Verify that all software control and data files have been entered or programmed into the FACP.
9. Verify that Shop Drawings reflecting as-built conditions are accurate.

10. Measure the current in circuits to assure that there is the calculated spare capacity for the circuits.
11. Measure voltage readings for circuits to assure that voltage drop is not excessive.
12. Measure the voltage drop at the most remote appliance on each notification appliance circuit.

E. Test Equipment: The contractor shall supply personnel, communication devices, and all equipment necessary for performance of the final test.

3.07 TRAINING

A. Instructor: Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing and maintenance of the system provided. The instructor shall train the Smithsonian employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm system.

B. Training sessions shall cover all aspects of system performance, including system architecture, signaling line circuit configurations, sensor and other initiating device types, locations, and addresses, fire alarm control panel function key operation, and other functions as designated by the COTR.

C. Required Instruction Time: Provide 16 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. One training session shall be videotaped by the contractor. Videotapes shall be delivered to the COTR.

D. Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the FACP. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory and trouble. The instructions shall be approved by the COTR.

E. Comprehensive system troubleshooting training shall be provided for a single individual designated by the COTR. This session shall be separate and distinct from the above described sessions.

F. All training sessions shall be conducted following final system certification and acceptance. Three additional training sessions shall be provided for all security personnel on all shifts six months after final system certification.

G. All training sessions shall be conducted by an authorized fire alarm system distributor representative, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided.

3.08 KEYS

A. Keys and locks for all equipment shall be identical where possible. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

END OF SECTION 283111