



Smithsonian Institution

Office of Planning, Design & Construction

SPECIFICATIONS

PROJECT NO.:

PROJECT TITLE:

FACILITY:

DATE:

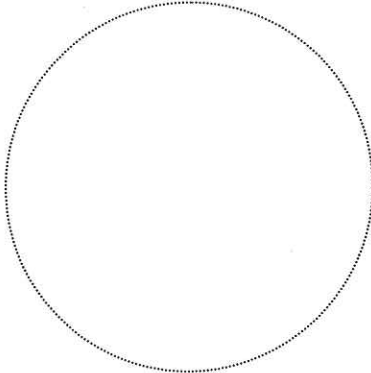
This project is approved as being in conformance with applicable provisions of the Smithsonian Directive (SD) 410.

Michael J. Carrancho, P.E., Deputy Director

Date

SEALS AND SIGNATURES

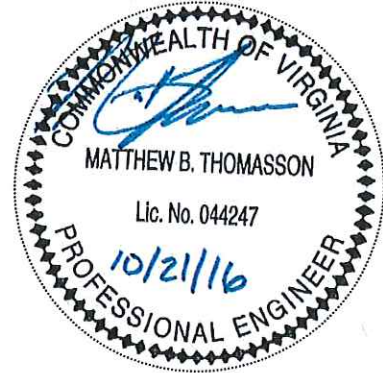
Architect
Ayers/Saint/Gross
T (410) 347-8500



Structural Engineer
Robert Silman Associates
T (202) 333-6230



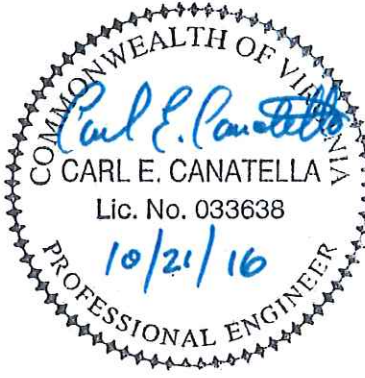
Civil Engineers
Rummel, Klepper & Kahl, LLP
T (410) 728-2900



Mechanical/Plumbing Engineer
Mueller Associates
T (410) 646-4500



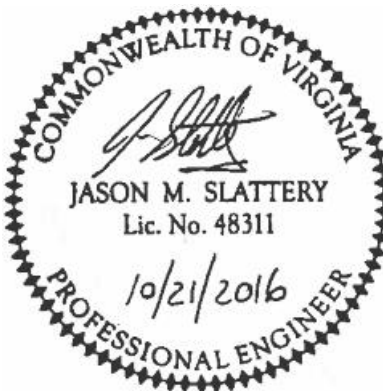
Electrical Engineer
Mueller Associates
T (410) 646-4500



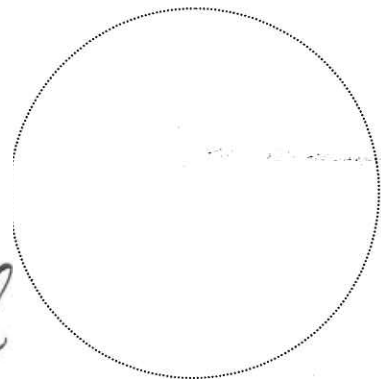
Geotechnical Engineer
Froehling & Robertson
T (703) 996-0123



Fire Protection/ Fire Alarm Engineer
GHD
T (571) 352-5032



Security/Telecom Engineer
GHD
T (571) 352-5032



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SECTION 01 1000

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Related Documents
 - 3. Summary of Work
 - 4. Work covered by Contract Documents
 - 5. Work Sequence
 - 6. Use of Premises
 - 7. Work under Separate Contracts
 - 8. Permits and Responsibilities
 - 9. Contract Time for Completion
 - 10. Bidder/Offeror Examination of Site
 - 11. Availability of Documents
 - 12. Units of Measure
 - 13. Specification and drawing conventions.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

Smithsonian Facilities (SF) Project No. 1454504
DULLES COLLECTIONS CENTER STORAGE MODULE
National Air and Space Museum Steven F. Udvar-Hazy Center
14390 Air and Space Museum Parkway
Chantilly, VA 20151

Smithsonian Institution Contacts:
Contracting Officer (CO), address for Fed Ex and UPS delivery:
Smithsonian Institution
Office of Contracting
MRC 1200
2011 Crystal Drive
Arlington, VA 22202

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 5001
Washington, DC 20024

Contracting Officer's Technical Representative (COTR), address for USPS delivery:
Smithsonian Institution
Office of Planning, Design & Construction
MRC 511
PO Box 37012
Washington, DC 20013-7012 Architect:

1.4 RELATED DOCUMENTS

- A. The Contract Documents in their entirety, Drawings, Specifications, Construction Contract Clauses, and any other documents issued as part of the Contract, apply to this Section.
- B. Other Related Documents include:
 - 1. Smithsonian Institution Construction Contract Clauses for Fixed Price Contracts.
 - 2. Drawings, dated October 21, 2016.
 - 3. Specifications, dated October 21, 2016, Volumes 1 through 33. Each Specification Section is individually numbered with the specification section number and a sequential number (e.g. "08113-10" for Section 08 1113 page 10).
 - 4. Other Documents, as listed in the Table of Contents.

1.5 SUMMARY OF WORK

- A. The Contractor shall furnish all supervision, labor, materials and equipment needed to complete all work for the DULLES COLLECTIONS CENTER STORAGE MODULE, at the Smithsonian Institution's National Air and Space Museum Steven F. Udvar-Hazy Center located at 14390 Air and Space Museum Parkway, Chantilly, VA 20151 as set forth on the Drawings for Smithsonian Facilities Project No. 1454504 sheets I through 244 and in these specifications, both dated October 21, 2016.

1.6 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Project consists of constructing a new addition to the existing National Air and Space Museum, Steven F. Udvar-Hazy Center, located adjacent to Dulles International Airport in order to provide additional collections storage facilities for the museum.

1. Project Location: The existing Steven F. Udvar-Hazy Center is located at 14390 Air & Space Museum Parkway just south of Dulles International Airport, Chantilly Virginia. Visitor only access to Air & Space Museum Parkway is via an interchange exit off Route 28 just north of Route 50.
 2. Construction access will only be off Route 50 at an existing signal-controlled intersection. Entrance to museum property is through a security gate. Storage Module project site access is through two secondary security gates once on site.
 3. Owner: Smithsonian Institution, Washington, DC 20560
 4. Architect/Engineer (A/E) Identification: The Contract Documents, dated October 21, 2016, were prepared for the Project by:
*Ayers Saint Gross
1040 Hull Street, Suite 100
Baltimore MD 21230*
- B. Construction Manager: A construction management team will be selected for this Project to serve as an advisor to the Smithsonian Institution and to provide assistance in administering the Contract for Construction between the Smithsonian Institution and Contractor, according to a separate contract between the Smithsonian Institution and Construction Manager.
- C. Provide all supervision, labor, materials, and equipment needed to complete a fully operational Dulles Collection Center Storage Module facility as described in these contract documents. The work of this Contract includes complete building enclosure, weatherproofing, and architectural treatments; complete interior construction and finishes including certain built-in furnishings and fixtures; special systems for building security and emergency operations; building utilities and services; building climate control systems; and complete, fully operational vertical conveyance systems.
- D. The Work of Project is defined by the Contract Documents and consists of the following:
1. The project consists of one Collections Storage Facility (storage module) addition to the existing Udvar-Hazy Storage Facility & Museum in the support of the storage of museum artifacts. There is also a small mechanical pump house, cooling tower, and generator that will be located on site adjacent the storage module with access aisles to the building.
 2. Storage Module: A three-story 124,887 sf (11,602 sm) building addition that will provide collection storage space for museum artifacts on three levels. All levels will contain large collections storage spaces and will utilize storage racks and compact shelving to organize and protect artifacts. Collections will be brought into the building through overhead coiling doors on the new west façade or via the renovated wall between existing collection storage space and the new storage module. Additionally, the second and third floor will contain environmental chambers (archival rooms: Cool & Cold) for the storage of rubber and plastic artifacts. Each level will also contain building support spaces for building utilities. The building will be a braced structural steel frame, clad in precast architectural concrete panels, and will be fully conditioned to support the preservation and protection of museum artifacts.
 3. Exterior Mechanical Equipment: A mechanical pump house, cooling tower, and generator will be provided to support critical building functions in support of the preservation and protection of collection storage space.
- E. Critical Elements of the Work: The successful Contractor shall be fully qualified to install critical elements of the Work. Upon request of the Contracting Officer, bidders/offerors shall submit a statement of qualifications to address the following critical elements of the Work:

1. Large Steel frame Building Structure
2. Precast concrete panel fabrication and installation
3. Building mechanical systems and fire protection
4. Refrigerated environmental chambers fabrication and installation
5. Large additions to existing buildings; and the ability to adhere to schedule constraints.

F. The Work will be constructed under a single prime contract.

1.7 WORK SEQUENCE

- A. The Work shall be constructed as an addition to an existing museum and collections storage facility that will remain operational every day of the year. Take precautions and coordinate with museum officials to maintain the safety, security, weather-tightness and environmental conditions of affected existing museum spaces at all times.
- B. Removals to existing exterior walls will not be made until adequate protection has been made at both the outside and inside of walls to be removed.
- C. Obtain approval for a workplan to accomplish any sequencing.
- D. Make utility connections without unduly adversely affecting the day-to-day operation of the existing museum and the environmental controls established for its artifacts.

1.8 USE OF PREMISES

- A. General: Contractor shall have access to the premises for construction operations, including use of Project site, during construction period, as described in Division 1, Section 010140, "Work Restrictions". Contractor's use of premises may be limited by the Smithsonian Institution's needs, which take precedent.

1.9 WORK UNDER SEPARATE CONTRACTS

- A. Telephone/Data System: A separate contract will be awarded by the Smithsonian for the installation of a telephone/data system. The Contractor shall furnish and install empty conduits with pull wires, backboards, and other accessories where indicated on the Contract Documents.

1.10 PERMITS AND RESPONSIBILITIES

- A. Permits: The Contractor shall, without additional expense to the Owner, be responsible for obtaining any necessary licenses, fees, inspections, and permits, and for complying with any federal, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence, and shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

- B. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
- C. When required for the safety of the Work or adjoining structures, the Contractor shall shore up, brace, underpin and protect foundations and other portions of existing structures which are in any way affected by the Work. The Contractor, before commencement of any part of the Work, shall give any notice to the Owner.
- D. The Contractor shall, without additional expense to the Owner, be responsible for providing any monetary deposits for the prosecution of the work.

1.11 CONTRACT TIME FOR COMPLETION

- A. 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 540 calendar days. All work, including project closeout activities, shall be completed in every respect within the contract time.
- B. The start date and completion date shall be as stated in the Notice to Proceed issued by the Contracting Officer.

1.12 BIDDER/OFFEROR EXAMINATION OF SITE

- A. Every effort has been made to indicate all work necessary to complete the project as identified. All bidders/offerors shall carefully examine the premises during the *bid/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.
- B. Before the bid/offer opening date, bidders/offerors may view the project site on an appointment basis. Any comments, information or discussion during the site visit shall not modify the contract documents. Bidders/offerors shall make an appointment to view the site by contacting:
Smithsonian Facilities, Construction Division
Associate Director, Derek Ross, (202) 633-6276.
- C. *Pre-Bid/Pre-Proposal Conference and Site Visit. Before the *bid/proposal opening date, a scheduled *pre-bid/pre-proposal conference and site visit will be announced by the Contracting Officer. The purpose of the scheduled meeting is to provide an opportunity for all *bidders/offerors to review the project site. Any comments, information or discussion during the site visit shall not modify the contract documents.
- D. 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.

1.13 AVAILABILITY OF DOCUMENTS

- A. The bidder/offeror may obtain a compact disc with electronic versions of the drawings and specifications from:
 - Smithsonian Institution
 - Office of Planning, Design and Construction
 - 600 Maryland Avenue, SW
 - Suite 5001
 - Washington, DC 20024
- B. All printing and delivery costs for copies of the Drawings, Specifications and all other solicitation documents shall be borne by the bidder/offeror. All of these costs are non-refundable.
- C. The administrative solicitation documents (Request for Proposal, Construction Contract Clauses) are available, at no cost to the bidder/offeror, from the Contracting Officer.

1.14 UNITS OF MEASURE

- A. All fabrication and installation shall be performed in accordance with the units of measure given in the Contract Documents.
- B. All Contractor and subcontractor personnel working on the site shall possess and use metric measuring equipment for all work shown in metric units. Conversion of dimensions shown on contract drawings to English units for use of non-metric measuring equipment is prohibited.

1.15 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC's "MasterFormat" numbering system. For the purposes of this contract the term "Project Manual" shall denote "Specifications".
 - 1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections of the Specifications are in numeric sequence; however, the sequence may be incomplete. Consult the table of contents at the beginning of the Specifications to determine numbers and names of sections in the Contract Documents.
 - 2. Page Numbering: The pages of each Specification Section are numbered sequentially at the bottom of the page (footer).
 - 3. Volumes: Specifications are divided into volumes for ease of handling.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

- a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 1140

WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contract Documents in their entirety, including the Drawings, Specifications, Construction Contract Clauses, and any other documents issued as part of the Contract, apply to this Section.

1.2 USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated. 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.
- C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.
1. Existing Occupied Spaces: The premises will be occupied during the performance of the Work. The Contractor shall schedule work activities to minimize interruption of occupants and occupied spaces. Efforts will be made to temporarily move employees and contents out of specific areas under construction, as needed, during the times requested by the Contractor. However, the needs of the Smithsonian Institution take precedence and free access for the Contractor cannot always be guaranteed. The Contractor may work in collection storage and existing mechanical spaces only in the presence of authorized Smithsonian staff or guard personnel.
 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.
 3. Space for Contractor Use: The space available for Contractor's use is limited to areas indicated on the Contract Drawings as the project site. Space allocation and availability are subject to change, at the discretion of the Smithsonian, to meet the needs of all parties requiring access and space within the building and the surrounding areas.
 4. Contractor Parking: Parking is available at the project site for Contractor use during the contract period. Contractor parking will be along the haul road adjacent to the project site unless otherwise directed by the COTR. It may be necessary to restrict parking at times in order to accommodate special museum events and needs. The Contractor shall arrange for alternate parking as coordinated with, and approved by, the COTR. No parking is allowed in the public lot, bus lot, loading dock area, or other public side areas unless authorized by the COTR.

- D. Contractor Deliveries, Hauling and Access:
5. The Contractor's materials and equipment shall be delivered, received, and handled by the Contractor's personnel.
 6. Primary Contractor access to the Udvar-Hazy Center site for all deliveries and Contractor personnel is at the south end of the property via a security gate located off Route 50. Access to the project site is through two additional security gates. All deliveries must be scheduled at least 24 hours in advance through the COTR. A valid SI Contractor Badge or acceptable picture I.D. must be presented to enter the site. Vehicle company names and tag numbers may also be required as deemed necessary by the SI. Personnel/vehicles failing to comply with the above will be denied access to the site. The Contractor is responsible for ensuring compliance with SI requirements for site access as well as any delays or additional costs resulting from non-compliance.
- E. Work Within Existing Museum Facilities:
1. Access to the existing museum building for Contractor personnel, on- and off-loading of all material, structures, and equipment shall be at the loading dock located at the south end of the building.
 - a. Access to the building for on- and off-loading of all material, structures and equipment shall be between 7am – 5pm or coordinated with COTR 48 hours in advance of delivery.
 2. The transportation of hazardous materials or hazardous waste into or out of the building shall be limited to the following routes and freight elevators: coordinate with COTR and Facility Hazardous Waste Coordinator. 48 hours advance notice is required. All hazardous materials shall be transported through the building in secondary containment and properly secured to transport carts to prevent breakage or spills.
 3. The transportation of hazardous materials or hazardous waste into or out of the museum building shall be limited to routes and freight elevators identified by the COTR. All hazardous materials shall be transported through the building in secondary containment and properly secured to transport carts to prevent breakage or spills.
 4. 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.
 5. The Contractor shall identify to the COTR as soon as possible, but no less than two 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:
 - a. Restricted areas to be accessed.
 - b. Specific reason for needing access.
 - c. Nature of the work to be performed.
 - d. Date(s) and hours needed to complete construction work activity.
 6. Temporary protection of the Smithsonian Institution National Air and Space Museum's artifacts and storage equipment to remain in place during construction.
- F. Museum Artifacts and Scientific Research Materials
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.

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.
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.

1.3 SUMMARY:

- A. General: The work of this Contract occurs upon property owned by the Metropolitan Washington Airports Authority (MWAA) and is adjacent to Dulles International Airport Property. It is therefore subject to controls and restrictions imposed by the authority managing airport operations and maintenance.
 1. The work of this Contract occurs within the boundaries of controlled airspace and is therefore subject to certain height limits and restrictions.
- B. Airport Authority: Dulles International Airport is operated and managed by the Metropolitan Washington Airports Authority (MWAA) and all operations performed on the site of this project are subject to MWAA regulations, controls, inspections, and verifications. The Metropolitan Washington Airports Authority is the authority having jurisdiction at the National Air and Space Museum Steven F. Udvar-Hazy Center. All work under this project must be completed in accordance with the METROPOLITAN WASHINGTON AIRPORTS AUTHORITY BUILDING CODES MANUAL, latest edition, available at the MWAA website, <http://www.mwaa.com/business/building-codes-environmental-department>. The Contractor shall be responsible for ensuring that all applicable requirements are met.
- C. Regulations and Restrictions: Regulations and restrictions applicable to the work and operations of this Contract may include, but are not limited to, the following, and may be applicable to the entire project site, or only to certain portions thereof depending upon proximity to the airport and its operations:
 1. Special requirements for construction site security for sites adjacent to airport property.
 2. Regulations and restrictions regarding access to airport property, temporary penetrations of airport boundaries, and preservation of boundary security.
 3. Regulations regarding materials hauling, and restrictions and prohibitions on the use of airport gates and roads.
 4. Requirements for dust control and protection of airport operations from construction materials and construction wastes, particularly with respect to potential Foreign Object Damage (FOD) to aircraft operating in the vicinity of the site.
 5. Height limitations on construction equipment and operations.
 6. Regulations regarding the use of temporary fixed and portable construction site lighting.
 7. Regulations regarding the use of construction radios, including the type and frequency.
 8. Provision and maintenance of specific radio systems linked to MWAA airport security communications

9. Provision of a Contractor's Safety Manager to coordinate with MWAA.
- D. Contractor Responsibility: This Contractor is responsible to obtain and become familiar with all MWAA rules, regulations, and restrictions applicable to this Contractor's operations on the project site. For an outline of restrictions, refer to the MWAA "Construction Safety Manual" latest edition. See also the information found on the MWAA web site, <http://www.mwaa.com/business/contracting-manuals-forms-and-other-resources>
- E. Welding, and Cutting: Perform no welding or torch cutting without adequate fire protection. Maintain a "fire watch" for the duration of the welding, cutting, and heating operations and for at least 30 min. after the "hot" work has stopped. Provide adequate ventilation to prevent air contamination or the accumulation of toxic fumes. Provide access to a fire extinguisher (minimum 10 pounds, dry-chemical type, typical) during and after welding, cutting, and heating operations.
- F. Hours of Work, Workdays, and Government Holidays: Observe the following restrictions for normal hours and overtime work operations:
1. Perform Work under this Contract during the normal workdays of Monday through Friday, except Government Holidays as specified herein, and during the normal work hours of 6:00 am to 3:30 pm.
 2. Smithsonian Institution / Government 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. Official holidays are:

New Year's Day	January 1
Martin Luther King Jr.'s Birthday	January, third Monday
President's Day	February, third Monday
Memorial Day	May, last Monday
Independence Day	July 4
Labor Day	September, first Monday
Columbus Day	October, second Monday
Veteran's Day	November 11
Thanksgiving Day	November, fourth Thursday
Christmas Day	December 25
President's Inaguration Day	January 20 2017
- G. Off-Hours Work and Overtime: For each occasion the Contactor chooses to work on Saturdays, Sundays, or Smithsonian holidays, or during hours other than those indicated above, obtain written permission from the COTR at least 3 working days in advance.
1. 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.
 2. 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 that require construction to be accomplished during other than the normal workdays and hours defined for the Project, the Contractor shall assume the cost of any additional security guard or inspection services at overtime rates.

1.4 OCCUPANCY REQUIREMENTS

- A. Partial Owner Occupancy: The Smithsonian Institution reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
1. The COTR will prepare a Notice of Substantial Completion for each specific portion of the Work to be occupied before SI occupancy.
 2. Before partial SI occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, the SI will provide, operate, and maintain mechanical and electrical systems serving occupied portions of building.
 3. On occupancy, the SI will assume responsibility for maintenance and custodial service for occupied portions of building.

1.5 CONTRACTOR BEHAVIOR

- A. 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.
- B. 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.
- C. The consumption of alcoholic beverages by the Contractor's personnel is prohibited in all Smithsonian buildings or leased space.
- D. 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.
- E. 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.

1.6 JOB-SITE SAFETY

- A. Safety Coordinator: Designate a person responsible for safety at the project site for the duration of the project.
- B. Job-Site Safety Plan: Submit a Job-Site Safety Plan within 30 calendar days of the Contract Award and at least 14 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.

- C. 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.
- D. 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.
- E. 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.
- F. 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, notify the appropriate authority (ambulance, police, fire department), Smithsonian Security, and the COTR.
- G. 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.
- H. 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.

1.7 TOXIC AND HAZARDOUS SUBSTANCES

- A. Submit to the COTR, at least ten working days prior to their intended use, a written list of toxic and hazardous substances that will be used on the project. Submit a "Material Safety Data Sheet" similar to OSHA Form No. 20 for these substances to identify the following information:
 - 1. Product Identification
 - 2. Hazardous Ingredients
 - 3. Physical Data
 - 4. Fire and Explosion Hazard Data
 - 5. Health Hazard Data
 - 6. Emergency and First Aid Procedures
 - 7. Reactivity Data

8. Spill or Leak Procedures
 9. Special Protection Information
 10. Special Precautions
 11. Volatile Organic Compound (VOC)
- B. 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.
- C. 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:
- a. "Threshold Limit Values and Biological Exposure Indices" of the American Conference of Governmental Industrial Hygienists, latest revision or
 - b. Title 29 CFR Part 1910, Subpart Z - "Toxic and Hazardous Substances" of the Occupational Safety and Health Standards, latest revision.
- D. 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.
- E. 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.
- F. 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).
- G. The Contractor shall submit, to the COTR and OSHEM, 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.
- H. 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.
- I. 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.

1.8 PERSONAL PROTECTIVE EQUIPMENT

- A. Personal protective equipment for eyes, face, ears, nose, head, extremities, and/or full body shall be provided, used, and 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.
- B. 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.

1.9 BARRICADES, BARRIERS AND WALKWAYS

- A. The Contractor shall provide safety barricades in accordance with the local Building Codes, Authorities having Jurisdiction, 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.
- B. 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 affects 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.
- C. 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.
- D. 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.
- E. Exterior barriers shall be of dimensional lumber and plywood, painted on both sides and supported to prevent overturning. Barriers shall be repainted and maintained as necessary to remain in good condition as long as they are required.
- F. 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.
- G. Temporary protection of the Smithsonian Institution National Air and Space Museum's artifacts and storage equipment to remain in place during construction.

- a. Contractor to submit a work plan to COTR a minimum of 10 days prior to the commencement of work in existing collections storage spaces. Contractor's plan will describe a strategy to protect existing collection storage spaces, and artifacts and storage equipment to remain in place during construction. Contractor's strategy to complete the Work shall meet the following guidelines listed and comply with other Temporary Facilities and Controls:
 - i. When working above stored artifacts, Contractor to provide continuous separation between work area and collections space. Separation of spaces shall prevent the passage of work related debris, dust, vapors, sparks and slag. Contractor to provide details of how artifacts and storage equipment will be protected from work.
 - ii. When performing hot work - drilling, welding, and torch cutting - in collections storage space Contractor shall provide Fire Watch at both collections storage level and at level of hot work (e.g. above ceiling in Rm. 219.01).
 - iii. Where Work is required above artifacts and storage equipment, Contractor to provide redundant non-combustible means of separation between work area and adjacent collections space. This includes, but not limited to, lifts, scaffolding, dance floors erected over collections storage equipment.
 - iv. Provide fire protection and contain hot work debris, Contractor to identify and provide fire resistant materials with a temperature resistance that exceeds temperatures of hot work. Where fire retardant treated plywood is used Contractor shall provide additional layer of noncombustible protection to fire retardant treated plywood to protect from hot work debris.
 - v. Contractor to provide noncombustible protection of collections storage racks and carriages.
 - vi. Contractor to provide strategy to protect existing utilities and building services in areas to receive Work. This includes, but is not limited to, areas where hot work is required. Additionally, where existing sprinkler head coverage is obstructed by Temporary Conditions, like scaffolding, Contractor to provide wire guard protection to existing ESFR heads. Sprinkler heads are to remain active during construction.
 - vii. Contractor required to provide sprinkler coverage for areas above & below work platform.
 - viii. Contractor required to provide smoke detection for areas above & below work platform. Contractor to indicate temporary impairment to existing system (e.g. Beam detection system).
 - ix. Contractor to provide and identify laydown space related to the work in collections storage space in non-collections space. Storage of construction related materials is not permitted within collection spaces.
 - x. Contractor to provide temporary exhaust of areas to receive work that captures dust and vapors generated from Work in collections spaces and maintains the required separation between work space and collections storage space. Provide exhaust measures to protect the environmental conditions of collections storage.
 - xi. Area of work shall be limited to one structural bay at a time within existing collections storage space.
 - xii. For any Hot Work, the contractor must comply with SI Safety Manual Chapter 14 for any hot work and open flames work during the construction.

1.10 EXISTING FIRE PROTECTION SYSTEMS

- A. 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.
- B. 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.

1.11 GENERAL SECURITY REQUIREMENTS

- A. Comply with security requirements imposed by the Smithsonian Institution and Metropolitan Washington Airport Authority, 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.
- B. Prior to the start of work on the site, submit to the COTR for approval, a list of the names, social security numbers, and addresses of all Contractor and subcontractor employees. Identify the Prime Contractor and each subcontractor and trade. Update list as necessary to accurately identify all workers who will be working on the site during the Project.
- C. Provide the name and telephone number of the Contractor's Superintendent and authorized alternate individual who can be reached on a 24-hour basis at the Preconstruction Meeting.

1.12 IDENTIFICATION BADGES

- A. **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.
- B. **ID Processing:** Contractor personnel will be issued identification badges for use while on the premises.
 - a. 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.
 - b. 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.
- C. **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 iden-

tification 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.

- D. 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.
- E. Lost ID: If a Contractor or subcontractor 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.
- F. 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.

1.13 SECURITY OF TEMPORARY OPENINGS

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

1.14 EXISTING BUILDING ALARM SYSTEMS

- A. 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.
- B. 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.

1.15 SECURITY GUARD DUTY CHARGES

- A. 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 re-

quired to assume the cost of any additional inspection and guard services at overtime rates.

- B. The current overtime hourly rate is subject to change during the Contract Time without notice. The current security hourly rate is \$38/hr.

1.16 EQUIPMENT HEIGHTS AND WARNING LIGHTS

- A. Comply with FAA Part 77 –Objects Affecting Navigable Airspace. FAA Part 77 involves the allowable heights of objects in proximity to runways. This affects the height and placement of temporary construction equipment and construction materials including cranes and towercranes. Within limits, the further from the end of a runway and from the centerline of that runway, the greater the allowable height of temporary and permanent objects. For reference, the NASM Dulles Center itself is an allowable object per FAA Part 77.
1. Height Restrictions: FAA Part 77 can be obtained from the Federal Aviation Administration (FAA) and found on their website, www.faa.gov/avr/AFS/FARS/far-77.txt . The maximum elevation allowed on Dulles International Airport is elevation 463 (141.122 meters). For reference, the top parapet of the NASM Dulles Center's Observation Tower is at elevation 138.525 meters.
 2. Warning Markings and Lighting: The NASM Dulles Center is not required to have aircraft warning markings or lights per FAA requirements. However, the project design includes warning lights as an added precaution. The Contractor shall contact MWAA to determine the requirements or advisability for warning markings or lights on temporary objects. Instructions for warning markings and lighting can be found in FAA Advisory Circular AC 70/7460-1J "Obstruction Marking and Lighting". See the FAA's website, www.faa.gov/abc/ac-chklst/actoc.htm .
 3. Compliance Responsibility: The Contractor is solely responsible for compliance with MWAA and FAA requirements with regard to his means and methods of construction. Nothing in this Section will relieve the Contractor from review and compliance with MWAA and FAA requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 2300

ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Add Alternate #1: Provide Metal Wall Panels (MWP-2) at east façade recessed keys.
- B. Add Alternate #2: Exterior screen wall at the Mechanical Equipment as shown on drawings.
- C. Add Alternate #3a: Environmental Rooms: Cool Storage Room on Level 2. Cold Storage Room on Level 3.
- D. Add Alternate #3b Additional Generator capacity to support Environmental Rooms.

END OF SECTION

SECTION 01 2500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit substitution request to COTR electronically, in pdf format, by email of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. COTR's Action: If necessary, COTR will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. COTR will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order.
 - b. Use product specified if COTR does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. 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 COTR.
- B. Conditions: COTR will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, COTR will return requests without action, except to record noncompliance with these requirements:
1. Requested substitution offers SI a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities SI must assume. SI's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by SI, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. Substitution request is fully documented and properly submitted.
 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified warranty.
 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
 11. Requested substitution provides sustainable design characteristics that specified product provided.
- C. Substitutions for Convenience: Not allowed unless otherwise indicated.

PART 3 - EXECUTION (Not Used)

END OF SECTION

REQUEST FOR SUBSTITUTION FORM

1. Date: _____ Request No: _____

2. Project Name: Smithsonian Institution, Dulles Collections Center Storage Module

3. Specification Reference: _____

4. Description of specified product or system: _____

5. Trade name, model number, and name of proposed substitution:

6. What effect does substitution have on applicable code requirements?

7. Differences between proposed substitution and specified item? *(Use attachment for additional space, if required.)*

8. Manufacturer's warranty on proposed and specified items are:
Same Different
(Explain on attachment.)

9. Reason for requesting substitution:

10. Monetary considerations:
Specified Product \$ _____
Proposed Substitution: \$ _____

11. Will the Undersigned pay for changes to the building design, including engineering and detailing costs, caused by the requested substitution? Yes No

12. Enclosed data consists of:

Catalog Drawings Samples Tests Reports

13. List availability of maintenance service and replacement materials.

14. State effects of substitution on construction schedule and changes required in other work or product:

15. Any license fees or royalties: Yes No

UNDERSIGNED certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts as applicable is available.
- Proposed Substitution will not affect or delay Progress Schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived by the Contractor.
- Proposed substitution does not affect dimensions or functional clearances.
- Payment will be made for changes to building design, including architectural or engineering design, detailing, and construction costs caused by proposed substitution.
- Coordination, installation, and changes to the Work as necessary for accepted substitution will be complete in all respects.

Submitted by:

For use by Architect:

Signature _____

Accepted: Accepted As Noted:

Firm _____

Not Accepted: Received Too Late:

Address _____

Date _____

Date _____

Remarks: _____

Telephone _____

Approved by (C.M.)

By: _____

END OF FORM

SECTION 01 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - 2. 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.
 - 3. Wages: The contractor shall verify wages and comply with regulated wage scales, i.e. Davis-Bacon, Service Contract Act, etc.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.

- b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the COTR and paid for by Smithsonian Institution.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Scheduling of the Work: By the 25th of each month, inspect the Work with the COTR to determine percentages complete for each item, projected through the end of the month. In the event of a disagreement, the COTR will determine the percent complete. Input these percentages into the latest revision of the Progress Schedule, including all revisions to date.

- C. Payment Application Times: By the last day of the month, submit an Application for Payment based on the determined percentages complete for each item.
- D. Payment Application Forms: Use the standard Smithsonian Institution Application for Payment form.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. The COTR will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- G. Transmittal: Submit three (3) signed original copies of each Application for Payment to the COTR by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
 - 2. Attach one complete set of copies of certified weekly payroll data for the period covered by the Application for Payment.
 - 3. Attach a Construction Progress Schedule identifying the cumulative progress superimposed on the latest revision of the approved Baseline Project Schedule. Clearly indicate the net progress for the month and applicable dates. (See Division 1, Section 01320, "Construction Progress Documentation".)
 - 4. Attach a Change Order Status Report showing the following information for each approved Modification and each pending or proposed change: Proposal Number, Modification Number (if applicable), affected activity numbers for each proposal, and the approved price for each Modification
- H. Assignment of Claims: 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."
 - 1. 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.

- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Products list.
 5. Schedule of unit prices.
 6. Submittals Schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Pre-condition of the site survey.
 15. Performance and payment bonds.
 16. Data needed to acquire SI's insurance.
 17. Initial settlement survey and damage report if required.

- J. Response to Application:
 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.

- K. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

- L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. Evidence that claims have been settled.
 5. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 6. Final liquidated damages settlement statement.

- M. SI Response to Applications for Payment: Payment will be made only for progress agreed upon by the COTR, performed on original Contract Work or approved Modifications, in accordance with the current, approved Construction Progress Schedule.
 1. Failure to submit the Application for Payment in accordance with the requirements will prevent the processing of payments.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Conservation and Salvage.
 - 3. Permits, Licenses, and Fees.
 - 4. Coordination drawings.
 - 5. Requests for Information (RFIs).
 - 6. Project meetings.
 - 7. Pre-Condition Survey of the Site
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, on project web site, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for the COTR and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Correspondence: Correspond (in the English language) with the COTR for all matters related to this construction project, unless otherwise directed. Sign and date all correspondence and reference the project title, OPDC Project Number and the Construction Contract Number.

E. 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.

- F. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.
 2. The SI 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 the bid/offer.
 3. 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 SI, shall become the property of the Contractor. Remove from the premises and dispose of properly.
- G. Permits, Licenses, and Fees: Keep the SI indemnified against all penalties and liability for breach of provisions of any national, provincial, state, district, or city ordinance, or law, and the regulations and bylaws 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.
1. Obtain and pay for all applicable permits and licenses required by regulating agencies, including but not limited to: permits for pedestrian and road markings and barricades, construction fences, sidewalk cuts, utility company connections, elevator certificates, waste containers, and other required items, unless indicated otherwise in the Specifications/Project Manual.
 2. Pay all duties, fees, taxes, and other charges and give all notices necessary and incidental to the due and lawful execution of the Work.
 3. Provide temporary constructions at the site as necessary to maintain access, if required, for persons with disabilities. All provisions for temporary access shall be subject to the approval of the COTR.
 4. Comply with health and sanitation requirements for new construction of food service facilities as cited in the health codes governing the jurisdiction.
 5. Accessibility for Physically-Disabled Persons: The Contractor 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.

1.6 COORDINATION OF TRADES

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

- C. 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.

1.7 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 - 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 - 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 - 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 - 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles,

- door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit **1-1/4 inches (32 mm)** in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
 10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
 2. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
 - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of AIA Document C106.
- D. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

- E. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A or similar. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract

1.8 REQUESTS FOR INFORMATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
 - 1. Contractor is to submit RFI's to SI COTR. SI COTR will forward to Architect.
 - 2. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 - 3. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Project name.
 - 2. Project number.
 - 3. Date.
 - 4. Name of Architect and Contractor.
 - 5. RFI number, numbered sequentially, and identifying building to which it applies.
 - 6. RFI subject.
 - 7. Specification Section number and title and related paragraphs, as appropriate.
 - 8. Drawing number and detail references, as appropriate.
 - 9. Field dimensions and conditions, as appropriate.
 - 10. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 11. Contractor's signature.
 - 12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
 - 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow five working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 - 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.

- e. Requests for adjustments in the Contract Time or the Contract Sum.
- f. Requests for interpretation of Architect's actions on submittals.
- g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly with not less than the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's and Contractor's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- G. The Owner reserves the right to assess the Contractor for the cost, based on time and materials, of an RFI response performed by the Architect, and any of the Architect's consultants, which is deemed by the Owner and Architect as being frivolous, unnecessary, or if the subject of the RFI is clearly addressed in the Contract Documents.

1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify COTR of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Reporting: Record significant discussions and agreements achieved. Attach any updated schedules or other documentation discussed. Distribute the meeting minutes to everyone concerned. Copies for SI personnel and SI consultants, including the Architect/Engineer, shall be delivered to the COTR for distribution. Meeting minutes should be prepared within 5 working days of the meeting.
- B. Preconstruction Meeting:
 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:
 - a. Contract Time: Notice to Proceed date and Completion date;

- b. Scheduling and Submittals;
 - c. Mobilization and Staging;
 - d. Access to the Premises, Haul Routes, Loading Dock;
 - e. Contractor Deliveries;
 - f. Security Requirements/List of Contractor's Personnel;
 - g. Emergency Procedures and Phone Numbers;
 - h. Protection of Site and Historic Preservation;
 - i. Fire Protection and Safety Requirements;
 - j. Utility Interruptions, Rough-in Inspections, Testing;
 - k. Applications for Payment;
 - l. Pre-Condition Survey of the Site;
 - m. Accessibility Requirements;
 - n. Sustainability Requirements;
 - o. Building Systems Commissioning;
 - p. QualityControl;
- C. The Contractor's key staff and representatives of all Subcontractors or Suppliers shall attend the Preconstruction Meeting.
- D. 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:
- 1. Locations of overlap in use of the site by the Contractor and others, including work areas, delivery points, access/egress areas.
 - 2. Specific items of work by others required to support critical milestones in the Contractor's schedule.
 - 3. Coordination with the work of the designated Commissioning Provider.
 - 4. Completion or delivery of work by others that may impact the Contractor's schedule.
 - 5. Portions of the work that create special hazards or disturbances.
 - 6. Portions of the work that affect utilities, fire-protection or detection systems or security systems.
 - 7. Events requiring access to areas outside of the project site or secured spaces.
 - 8. Protection to be provided by the Contractor for work completed by others either before or during this project.
- E. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. . Advise the COTR of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.

- i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- F. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to COTR, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: In addition to representatives of the SI, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Owner's partial occupancy requirements.
 - k. Installation of Owner's furniture, fixtures, and equipment.
 - l. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

- G. Progress Meetings: Conduct progress meetings at regular intervals.
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.
 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.
 3. Meeting Minutes: The Contractor shall promptly prepare minutes of each meeting and transmit, to the COTR, within five (5) working days.
 4. Coordinate dates of meetings with preparation of payment requests.
 5. Attendees: In addition to representatives of Owner, Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 6. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Health and safety progress report.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of proposal requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.

- 19) Documentation of information for payment requests.
7. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- H. Special Topic and Coordination Meetings: Conduct special topic and coordination meetings when technical issues or immediate needs require them. Schedule time, place, and appropriate attendees with the COTR. Special topic and coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences. Provide minutes of meetings within 5 working days.
- I. Monthly Executive Meetings: The COTR will conduct monthly executive meetings at the site established in the Preconstruction Conference for the purpose of briefing senior SI personnel on construction progress.
 1. Attendees: In addition to representatives of the SI (as invited by the Contracting Officer and the COTR) and the Architect/Engineer, the Contractor's Project Manager, Superintendent, Quality Assurance Representative, Project Executive (as needed), other necessary Contractor personnel, and major or otherwise critical subcontractor personnel, shall attend.
 2. Agenda: Review and correct or approve minutes of the previous meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so.
 - b. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - c. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - d. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements between SI activities and construction activities.
 - 2) Special events.
 - 3) Access.
 - 4) Site utilization and security.
 - 5) Hazards and risks.
 - 6) Progress cleaning.
 - 7) Quality and work standards.
 - 8) Change Orders.
 - 8) Other items significant to the participants' responsibilities.

1.10 PRE-CONDITION SURVEY OF THE SITE

- A. After the Preconstruction Meeting and prior to start of the Work on the site, inspect the project site (i.e. building, its contents, grounds, and equipment with major subcontractors, the COTR, and other SI 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 the Smithsonian Institution.

1. Written and Photographic Documentation: Prepare a typewritten and photographic report in triplicate to identify damages or defects of materials, equipment, and the site, in accordance with the requirements in Division 1, Section 01322, "Photographic Documentation". Retain one report and submit one report each to the Contracting Officer and the COTR.
 - a. Video Documentation: A video recording of observations made during the survey of the existing conditions for the buildings, improvements, finishes, utilities, interior surfaces, construction, and other systems, components, or materials which might be affected by the Work, including sidewalks, streets, and adjacent facilities, in accordance with the requirements in Division 1, Section 01322, "Photographic Documentation". Prepare the video report in triplicate. Retain one video report and submit one video report each to the Contracting Officer and the COTR. Submit the complementary typewritten and photographic report and video report together.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 3200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Owner.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file original scheduling software.
 - 2. PDF electronic file.
- B. Startup construction schedule.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at daily intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.
- K. Qualification Data: For scheduling consultant.

1.5 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated. Delivery dates indicated stipulate the earliest possible delivery date.
 - 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Use of premises restrictions.
 - e. Seasonal variations.
 - f. Environmental control.

3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Fabrication.
 - e. Sample testing.
 - f. Deliveries.
 - g. Installation.
 - h. Tests and inspections.
 - i. Adjusting.
 - j. Curing.
 - k. Startup and placement into final use and operation.
 4. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.

2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. CPM Scheduling: The work under this project will be scheduled and reported by the Contractor using the Critical Path Method. Submit Project Schedule in both PDF format and original scheduling software format. The approved Project Schedule(s) shall be used by the Contractor

for planning, organizing, executing and directing the work; for monitoring and reporting progress; and for requesting payment for work completed. All costs shall be identified in US dollars.

1. Order and Inter-Dependence of Activities: The Critical Path Method will be followed to show the order and interdependence of activities and the sequence in which the work is to be accomplished. Each activity shall be tied to all activities that must logically precede or follow it and all paths shall be continuous through to completion date(s).
 2. Work Breakdown Parameters for Activities: The activities shown on the network diagram shall include construction activities, submittal processing by the Contractor, submittal processing by the Smithsonian, procurement activities for major equipment, fabrication of special materials and equipment, installation of special materials and equipment, inspections and tests. All field activities that affect progress toward contractually required dates for completion of all or parts of the Work shall be shown. The level of detail shall be such that the duration of any activity will be no longer than ten (10) working days and no activity will have a dollar value exceeding \$15,000, except as allowed by prior and specific approval of the COTR. All aspects of the contract activities are to be identified and priced accordingly in the proposal. This is to include, but shall not be limited to, separate pricing for bonds, insurance, CQC related work, etc. As-built drawings shall also be priced.
 3. Cost-loading of Activities: The Project Schedule shall include a dollar value (cost) for each work activity. The cost shall include labor, materials, equipment, small tools, incidentals and a prorated portion of overhead and profit. The sum of all activity costs shall be equal to the total Contract Price. Each activity cost shall be coded with a cost code corresponding to a line item on the Schedule of Values.
 4. Computer Software: The Contractor shall use a computerized CPM scheduling software designed for use on IBM personal computers. The name of the software proposed for use shall be submitted to the COTR, along with literature about the program's capabilities, functions and operations, demonstrating that the requirements of the entire section entitled "Scheduling of the Work / Critical Path Method" can be met.
- B. Required Schedules: The Contractor shall prepare and submit a Preliminary Project Schedule, Complete Project Schedule, Condensed Summary Schedule, Progress Schedules and Recovery Schedules as described below.
1. Preliminary Project Schedule: Not later than twenty (20) calendar days after receipt of Notice to Proceed, the Contractor shall submit, for review and approval by the COTR, a Preliminary Project Schedule in time-scaled diagram form, defining in detail the Contractor's planned operations during the first 120 calendar days of the Contract Time. The Contractor shall also provide a time-scaled summary of the general approach for the balance of the project. The requirements set forth under the sub-paragraph entitled "Complete Project Schedule" shall apply to the activities expected to be completed or partially completed during the first 120 calendar days. The Contractor's submission of the Preliminary Project Schedule shall include four (4) copies and one (1) reproducible.
 2. Complete Project Schedule: Within 90 calendar days after receipt of Notice to Proceed, the Complete Project Schedule shall be submitted to the COTR for review and approval. The Contractor's submission of the Preliminary Project Schedule shall include four (4) copies and one (1) reproducible.
 3. Condensed Summary Schedule: Along with each copy of the Complete Project Schedule, the Contractor shall submit, to the COTR for approval, a condensed summary version consisting of not more than 250 activities summarizing major work elements.
 4. Progress Schedules: Each month, the Contractor shall prepare a Progress Schedule by inputting all information regarding actual start and actual finish dates, projected through the end of the month, into the computerized Project Schedule. Complete discussion of

- this requirement is contained in the section "Reporting Progress and Applying for Payment."
5. Recovery Schedule: If the work falls substantially behind the approved Project Schedule the COTR may require the Contractor to submit a Recovery Schedule in accordance with the Construction Contract Clauses paragraphs relating to "Commencement, Prosecution and Completion of Work." Upon request, the Contractor shall submit a Recovery Schedule to the COTR for approval within ten (10) working days. The requirements set forth herein in the sub-paragraph entitled "Complete Project Schedule," shall apply to all activities shown on the Recovery Schedule.
- C. Schedule Preparation: Schedules shall be prepared and submitted as network diagrams with accompanying reports as described below.
1. Diagram Format: Diagrams shall be submitted on sheets at least 30 inches by 42 inches. Each diagram shall show the date of the latest revision, the initials of the preparer of the diagram and the approval signature of the party authorizing its submission. The Contractor shall also provide the COTR with a copy of the personal computer diskette, tape or other recording device containing the Schedule. Diskettes shall be sized 3.5 inches and formatted for high density, double-sided.
 2. Diagram Content: The following information shall be shown for each activity on the diagrams: preceding and succeeding activities, description of the activity, cost of the activity, craft involved, responsibility and activity duration in calendar days. The critical path shall be determined and shall be clearly indicated on the diagram. Network activity numbers shall be assigned in ascending sequence so that preceding event numbers are smaller than the following event numbers.
 3. Schedule Report Data: Computer-generated reports from the CPM schedule shall be a tabulation of all activities on the network and may include any of the following information for each activity:
 - a. Activity number;
 - b. Activity description;
 - c. Responsibility for activity (Contractor, Subcontractor, Supplier, Smithsonian, etc.);
 - d. Total monetary value of activity (TV);
 - e. Total duration in days (TD);
 - f. Percentage completed (PC);
 - g. Contractor's earnings-to-date based on percent of activity completed (ETD);
 - h. Estimated remaining duration in days (RD);
 - i. Earliest start date, by calendar day (ES);
 - j. Earliest finish date, by calendar day (EF);
 - k. Actual start date, by calendar day (AS);
 - l. Actual finish date, by calendar day (AF);
 - m. Latest start date, by calendar day (LS);
 - n. Latest finish date, by calendar day (LF);
 - o. Total float time (TF);
 - p. The Work item from the Schedule of Values used for progress payments of which the activity is a part.
 4. Standard CPM Reports: The following standard reports shall list all activities and the indicated data for each activity, sorted and ordered as described. The Contractor shall provide changes to these reports or creation of additional reports as requested by the COTR at any time.
 - a. Cost Report - sorted by responsibility, ordered by activity numbers (lowest to highest); including activity numbers, activity descriptions, TV, TD, PC, ETD, RD and corresponding item number from the Schedule of Values.
 - b. Activity Report - in order of activity numbers (lowest to highest); including activity numbers, activity descriptions, TD, PC, RD, ES, EF, AS, AF, LS, LF and TF.

- c. Early Start Report - in order of early start dates, further ordered by total float (lowest to highest), then by activity numbers (lowest to highest); including activity numbers, activity descriptions, TD, PC, RD, ES, EF, AS, AF, LS, LF and TF.
 - d. Total Float Report - in order of the amount of total float (lowest to highest), further ordered by activity numbers (lowest to highest); including activity numbers, activity descriptions, TD, PC, RD, ES, EF, AS, AF, LS, LF and TF; and reflecting all activities having less than ninety (90) working days float.
- D. Review and Approval of Project Schedules: The Smithsonian will review the Preliminary and Complete Project Schedules within fifteen (15) calendar days after receipt of each. The COTR will then schedule a meeting with the Contractor to review the Schedule and discuss any questions or recommendations the Smithsonian may have. Any revisions required by the COTR shall be submitted for approval within ten (10) calendar days after the review.
- E. Changes to Project Schedules: During the Contract Period the Project Schedule will be revised and updated to reflect changes to the plan of execution and work progress. Schedule revisions and updates shall be executed and submitted as described below.
 1. Contractor Revisions to Project Schedules: If the execution of the work varies significantly from the Project Schedule or the Contractor desires to make changes to the schedule, the Contractor shall submit a revision of the affected portion to the COTR along with a statement of the reasons for the change. The COTR will review and approve or reject the revision within fifteen (15) calendar days after receipt.
 - a. If the COTR observes work performed in variation from the approved schedule and considers these changes to be major, the COTR will require the Contractor to submit for review and approval, without additional cost to the Smithsonian, revision of all of the affected portions of the network diagrams along with standard reports to show the effect on the entire project.
 - b. A change will be considered major if the COTR determines that the change may impact the contract completion date.
 - c. Changes, which affect activities with adequate float time, shall be considered minor changes. An accumulation of minor changes will be considered a major change when the cumulative effect modifies the contract completion date. The effect of minor changes on logic shall be shown on each monthly update and described fully in the accompanying narrative report.
 2. Changes Related to Requests for Proposals: For all proposals involving requests for time extensions or other significant changes to schedule, the Contractor shall submit a listing of all the activities affected, added or deleted (by code numbers). The effect in time and money shall be described for each activity. If, in the opinion of the COTR, the proposed change may impact the completion date(s), the Contractor shall submit a diagram of that portion of the network schedule affected by the changes, along with standard reports for analysis.
 - a. Diagrams and reports submitted to illustrate the impact of a proposed change shall show the necessary revisions to activities, along with their costs, durations and trade responsibilities. Failure to submit such a diagram with a proposal shall constitute a waiver of any claims for time extensions associated with the subject of that proposal.
 - b. Modification of activity times shall be agreed upon by both the Contractor and the COTR. In the event that agreement on modified activity times cannot be reached, the COTR will direct the specific time adjustments to be entered into the program to determine approved, revised, contract completion dates.
- F. Scheduling Consultant: The Smithsonian reserves the right to retain a scheduling consultant to assist the Smithsonian in performing the Smithsonian functions under this section and will

inform the Contractor of its retention of such a consultant in writing. The Contractor will cooperate with the scheduling consultant by furnishing information contractually required to be furnished to the Smithsonian.

2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.

2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by COTR with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 01 3233

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.
 - 4. Preconstruction Video Recordings
 - 5. Periodic construction Video Recordings
 - 6. Time-lapse sequence construction Video Recordings.
 - 7. Demonstration and training Video Recordings.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting photographic documentation.
 - 2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
 - 3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
 - 4. Section 024116 "Structure Demolition" for photographic documentation before building demolition operations commence.
 - 5. Section 024119 "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For photographer.
- B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- C. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.

3. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier keyed to accompanying key plan.
- D. Video Recordings: Submit two DVD copies within seven days of each recording.
 1. Identification: Label each copy with the following information:
 - a. Smithsonian Institution
 - b. Name of Project.
 - c. SF Project No. and Smithsonian Contract No.
 - d. Name of Contractor and Videographer
 - e. Date of recording.
 - f. Description of subject and vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 2. Transcript: Prepared on letter size (8-1/2-by-11-inch) or A4 paper, punched and bound in heavyduty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with the same label information as the corresponding DVD. Include name of Project and date of DVD on each page.

1.4 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.5 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. The Contractor shall provide photographs of the project site and construction activities throughout the progress of the Work, produced by a commercial photographer, acceptable to the Smithsonian Institution. The COTR shall determine the vantage points from which photographs will be taken.
- B. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

- C. Digital Video Recordings: Provide high-resolution, digital video disc in format acceptable to COTR.

PART 3 - EXECUTION

3.1 PHOTOGRAPHS, GENERAL

- A. Photographer: Engage a qualified commercial photographer to take construction photographs.
- B. Submit all original images, select labeled images and typed index to COTR on CD or DVD.
- C. Negatives, contact sheets and photographs, including the copyright thereto, are the sole property of the Smithsonian Institution and shall be submitted to the COTR before Final Payment processing. The Contractor shall not use Smithsonian property except as authorized in writing by the Contracting Officer.
- D. Field Office Photos: Retain one set of prints of progress photographs in the field office at Project site, available at all times for reference. Identify photographs the same as for those submitted to the COTR

3.2 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- C. Time-Lapse Sequence Construction Photographs: Take 5 photographs as indicated, to show status of construction and progress since last photographs were taken.
 - 1. Frequency: Take photographs monthly, coinciding with the cutoff date associated with each Application for Payment.
 - 2. Vantage Points: Following suggestions by COTR and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time-lapse sequence as follows:
 - a. Commencement of the Work, through completion of subgrade construction.
 - b. Above-grade structural framing.
 - c. Exterior building enclosure.
 - d. Interior Work, through date of Substantial Completion.

- D. Additional Photographs: The COTR may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

3.3 CONSTRUCTION VIDEO RECORDINGS

- A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.
- B. Recording: Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project site.
- C. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
1. Confirm date and time at beginning and end of recording.
 2. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.
- D. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.
- E. Preconstruction Video Recording: Before starting demolition, record video recording of Project site and surrounding properties from different vantage points, as directed by the COTR.
1. Flag construction limits before recording construction video recordings.
 2. Show existing conditions at the Project site before starting the Work. Show existing conditions of buildings, improvements, finishes, utilities, interior surfaces, and other systems, components, or materials which might be affected by the Work.
 3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of demolition.
 4. Show protection efforts by Contractor.
 5. Provide voice or written narration. Retain one DVD copy of the video recording and narration and submit one copy each to the COTR and Contracting Officer.
- F. Periodic Construction Video Recordings: Record video recording monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status

of construction and progress since last video recordings were recorded. Minimum recording time shall be one hour.

- G. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.
1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every five minutes, from same vantage point each time, to create a time-lapse sequence as follows:
 - a. Commencement of the Work, through completion of subgrade construction.
 - b. Above-grade structural framing.
 - c. Exterior building enclosure.
 2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.
 3. Vantage Points: Following suggestions by the COTR and Contractor, photographer shall select vantage points.
- H. Demonstration and Training Video Recordings: Record instruction of Owner's personnel in the operation and maintenance of equipment and systems. Edit video to remove non-instructional conversation. Videographer shall select vantage points to best show equipment, systems, and procedures demonstrated. Minimum recording time shall be eight hours.
- I. Final Completion Video Recording Documentation: Employ a professional photographer/videographer to prepare the Final Completion Video Recording documentation.
1. Prepare video recording with audio narrative of observations made during the inspections for project closeout regarding conditions of new work and adjacent items that were examined for the Pre-Condition of the Site Survey report. Identify any defects and the affect of Contractor operations on the defect. Retain one copy and submit one copy each to the COTR and Contracting Officer within 10 days after the Final Inspection.

END OF SECTION

SECTION 01 3250

BUILDING INFORMATION MODELING (BIM) REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for Building Information Modeling including, but not limited to, the following:
1. Transfer of Design Intent Facility Data.
 2. Development of BIM Execution Plan.
 3. Development of Construction Models.
 4. Development of Fabrication/Shop Drawings at Contractor's option.
 5. Development of Coordination Model(s).
 6. Development of Coordination Report.
 7. Collection and Handover of Facility Data.
 8. As-Built Model and Drawings.
- B. Contractor's Responsibility:
1. Be responsible for developing deliverables required in this Section.
 2. Contractor is solely responsible for the quality and accuracy of all documentation and submittals of this Section.
 3. The intent of BIM deliverables is to avoid interference and conflicts, optimize construction sequencing, and ensure access for maintenance, replacement or repairs and to provide SI with facility data.
 - a. Coordination: Contractor is solely responsible for the coordination of facility systems and equipment.
 - b. Construction sequencing: Contractor is solely responsible to sequence construction activities to facilitate the fabrication and installation of systems and equipment without interference, conflicts or delays in construction, and providing adequate access to effectively maintain and replace systems and equipment.
 - c. Contractor is responsible for providing accurate and complete facility data based on final as-built conditions, as required by SI.
- C. Existing Documents: Revit template data developed by Architect during the design phase will be available to the Contractor.
- D. SI BIM Practice Requirements:
1. The following documents related to are available on the Smithsonian Facilities A/E Center website, under the Codes and Standards section and are applicable to BIM requirements:
 - a. SI BIM Standards: Describes information, procedures, and responsibilities relevant to BIM work completed by architecture, engineering and construction (AEC) consultants in order to assure accurate and consistent deliverables.
 - b. SI Revit Templates: BIM templates developed by the Smithsonian that the Contractor is required to employ in developing the project BIM and populate with accurate project-specific facility, space and equipment data.
 - 1) Provide asset information for all equipment in SI provided format which

includes information such as, specification ID, serial number, brand name, model number, electrical requirements, filter sizes, tonnage, and other required information.

- 2) Scope of required facility data is described in the template and should be modified to reflect actual Project requirements.
- c. SI Revit Template Users Guide: This document, prepared by the Smithsonian, describes how to incorporate and “SI Revit Templates” and develop the project BIM.
- d. SI BIM Project Execution Plan (PxP): Template document that defines the expected BIM deliverables and guides the coordination of the project team, throughout the project lifecycle.

1.2 DEFINITIONS

- A. As-Built Model: Building Information Model(s) developed by the Contractor that represents the installed condition of facility elements.
- B. Building Information Model (BIM): A digital representation of physical and functional characteristics of a facility.
- C. BIM Project Execution Plan (PxP): A document prepared by the contractor, utilizing a standard SI-PxP template that defines the expected BIM deliverables and guides the coordination of the project team, throughout the project lifecycle.
- D. Construction Model: Building Information Model(s) that demonstrates and communicates the facility data necessary to procure, fabricate, schedule or construct the Project.
- E. Coordination: A process implemented to ensure the efficiency and harmony of the relationship of facility elements. Typically performed in a BIM environment by evaluating interferences, also called “clash detection”.
- F. Coordination Model: Building Information Model(s) that demonstrates and communicates the spatial relationship of facility elements.
- G. Coordination Report: A report developed to communicate and demonstrate that the facility elements have been properly coordinated and identify areas where issues may still exist.
- H. Design Intent Model: Building Information Model(s) that demonstrates and communicates the creative objectives of the designer which is a Contract Document and the basis of the Contract Sum.
- I. Fabrication/Shop Drawing: Drawing generated from a Construction Model that communicates the information necessary to fabricate facility elements. Fabrication/Shop Drawings typically contain one system and are intended for use of trade personnel to fabricate, assemble, and install facility elements.
- J. Facility Breakdown Structure: a system-oriented hierarchical decomposition of a facility into smaller components. Typically the facility breakdown structure is based on disciplines, trades, described by MasterFormat.
- K. Facility Data: Non-graphical information attached to an object in a Building Information Model that defines various characteristics of an object.

- L. Furnishings: Built-in or movable cabinets, casework, seating or other appurtenances provided by the Contractor.
- M. Interference: Spatial conflict between facility elements.
- N. Level of Development: The degree to which facility elements have been modeled.

1.3 SUBMITTALS

- A. BIM Project Execution Plan (PxP): Prepare and submit a plan utilizing the “SI BIM Execution Plan” framework document available on the Smithsonian Facilities Architectural-Engineer Information Center website. Submit the PxP in Portable Document Format (PDF) within 60 days after contract award.
- B. Submit plans, sections and other review documents monthly, in .pdf format.
- C. Construction Models: Prepare and submit, on a monthly basis, Construction Models that contain spaces, objects and facility data required to purchase, fabricate, and install project elements. Graphically indicate construction progress in Construction Model.
- D. Coordination Model(s): Prepare and submit Coordination Model(s) on a monthly basis. Coordination Model(s) are to be based on the facility breakdown structure of the Design Intent Model.
 - 1. Coordination Model(s) are to be submitted prior fabrication, and installation of any element within the area represented within the Coordination Model(s).
 - 2. Fabrication/Shop Drawings and Construction Models are to be integrated into the Coordination Model(s) or otherwise referenced in the Coordination Model(s).
- E. CAD Drawings. Export CAD documents from the BIM authoring application in a format conforming to SI requirements. Reference the “SI Revit Templates Users Guide”.
- F. Coordination Report: Prepare and submit a written Coordination Report generated from the Coordination Model(s) prior to fabrication, and installation of any facility element within the area represented within the Coordination Model(s).
 - 1. Coordination Report is to be submitted in Portable Document Format (PDF).
- G. Facility Data: Submit monthly updates of the project BIM that include data, assets and attributes of installed components.
- H. Record Model(s): After installation of all Facility Elements, update and submit Construction Model(s) and Coordination Model(s) to document the condition of the facility upon completion of construction.
- I. As-Built Fabrication/Shop Drawings: After installation of all Facility Elements, update and submit Fabrication/Shop Drawings to document the condition of the facility upon completion of construction.
- J. By submitting the Construction Models, Coordination Model(s), and Coordination Reports, the Contractor confirms that the following have been accomplished:
 - 1. Existing conditions have been adequately identified, documented, and verified.
 - 2. Facility elements are properly represented within the Construction and Coordination Models.

3. Access to maintain, repair, or replace facility elements has been identified and validated.
4. Clearances, such as those required by code and equipment specifications, have been identified and validated.
5. Interferences have been identified and resolved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONTRACT DOCUMENTS AND DESIGN INTENT MODEL

- A. The Contract Documents and Design Intent Model will be provided to the Contractor for reference in the development of the Construction and Coordination Models and Fabrication/Shop drawings. The Contract Documents and Design Intent Model communicate creative objectives of the Architect, and are not intended to be used for fabrication and construction of the facility in that the size, arrangement, and level of development of facility elements may not have the necessary tolerances to allow for fabrication.

3.2 DEVELOPMENT OF BUILDING INFORMATION MODELING PLAN (BIM PxP)

- A. The BIM PxP shall be approved by SI prior to development of Construction Models, coordination of the facility, and development of Facility Data. Information contained in the BIM PxP shall conform to the requirements of the "SI BIM Standards".

3.3 INSPECTION OF EXISTING CONDITIONS

- A. Prior to the development of the Construction Models, inspect and verify accuracy of information communicated in the Contract Documents and Design Intent Model with respect to the existing conditions. Notify Architect if any conflicts among Contract Documents, the Design Intent Model, and existing conditions are discovered. Do not proceed with development of Construction Models until conflicts are resolved to satisfaction of SI.

3.4 FACILITY DATA

- A. Design Intent Facility Data will be provided to the Contractor to be used in the development of Facility Data. The Design Intent Facility Data communicates the creative objectives of the Architect, and is not intended to be used for direct import into Facility Center in that the assets and attributes contained within it are suitable as a basis of design only, and will require verification, updating, and supplementation by the Contractor.
- B. Facility Data shall include attributes for assets as defined by "SI Revit Templates".
- C. The Contractor is responsible for incorporating Design Intent Model and Facility Data revisions into the Construction and Coordination Models in order to maintain an up-to-date basis for Building Information Modeling throughout construction.

3.5 INSPECTION OF EXISTING CONDITIONS

- A. Prior to the development of the Construction Models, inspect and verify accuracy of information communicated in the Contract Documents and Design Intent Model with respect to the existing conditions. Notify Architect if any conflicts among Contract Documents, the Design Intent Model, and existing conditions are discovered. Do not proceed with development

of Construction Models until conflicts are resolved to satisfaction of SI.

3.6 DEVELOPMENT OF CONSTRUCTION MODELS

- A. The intent of the Construction Model is to communicate the necessary information to construct the facility including size, location, and arrangement of both existing to remain and new elements.
- B. Develop Construction Models based upon Contract Documents, Design Intent Model, and verified existing conditions.
- C. Construction Models shall accurately reflect the geometry and details of existing and new elements within the facility.
 - 1. Use manufacturer or custom model elements to accurately reflect the components detailed in documents submitted for approval.
 - 2. Update the model elements to accurately reflect any revisions to geometry or details arising from the submittal review process.
- D. Construction Models are to have a consistent origin that can be referenced to a real world datum or benchmark, located as required in the "SI Revit Template Users' Guide".
- E. Quality Control. The Construction Models should undergo automated model checks utilizing rulesets, as described in the SI BIM Standards document.
- F. The Construction Models are to reflect all necessary access and clearances.
- G. The Construction Models are to include, but not be limited to, the following elements with all necessary intelligence included to produce plans, sections, elevations, riser diagrams, and schedules as applicable:
 - 1. Substructure: All foundations, subgrade enclosures, slabs-on-grade, and water and gas utility connections. Substructure elements shall be depicted with all necessary recesses, curbs, pads, slopes, closure pours, expansion/construction joints, and major penetrations depicted.
 - 2. Shell: All superstructure, exterior vertical enclosures, and exterior horizontal enclosures, including a depiction of expansion/construction joints.
 - a. Superstructure: All columns, primary and secondary framing members, and bracing for the roof and floor systems (including decks).
 - b. Exterior Vertical Enclosures: Exterior vertical enclosures shall be depicted to the exact height, length, width and ratings (thermal, acoustic, fire) to properly reflect element types. Exterior windows, doors and grilles including hardware sets, louvers and vents, and wall appurtenances shall be depicted to represent their actual size, type and location.
 - 3. Interiors: All interior partitions, windows, doors and grilles, louvers and vents, raised floors, and ceilings, depicted to represent their exact location, height, length, width and ratings (thermal, acoustic, fire) to properly reflect element types.
 - 4. Services: All elevators, escalators, plumbing, HVAC, fire protection, electrical, communications, electronic safety and security, and integrated automation elements, including all major openings and penetrations, cable trays, cable bundles and pipe grouping. All clearances and insulation shall be accounted for in the model for use in interference management and maintenance access requirements. Nonpermanent items are not required to be modeled or contain facility data.

- a. Plumbing: All plumbing elements including plumbing piping and fixture layouts, floor and area drains, and related equipment.
 - b. Heating, Ventilation, And Air Conditioning (HVAC): All heating, ventilation, and air conditioning (HVAC) elements including piping, valves, ductwork fixture layouts and related equipment.
 - c. Fire Protection: All fire protection elements including piping, valves, and related equipment.
 - d. Electrical: All electrical elements including conduit, fixture layouts and related equipment (including power for systems furniture).
 - e. Communications: All communications and low voltage systems elements including conduit and related equipment.
 - f. Security: All Electronic Safety and Security elements including conduit and related equipment.
 - g. Integrated Automation: All integrated automation elements including conduit and related equipment.
 - h. Model all elements larger than 1-1/2 inch in diameter for any trade.
5. Equipment and Furnishings: All fixed equipment and furnishings, depicted to represent their exact location, height, length, width, configuration, materials, finishes, and mechanical and electrical requirements. This includes embedded rails and storage equipment.
 6. Special Construction and Demolition: All special construction and demolition including special construction, facility remediation and demolition
 7. Sitework: All sitework elements, including site improvements, liquid and gas utilities, electrical site improvements, and site communications.
- H. Construction Models must be revised and certified by the Contractor prior to installation of facility elements contained within the models.

3.7 DEVELOPMENT OF COORDINATION MODEL(S)

- A. Develop Coordination Model(s) that combine facility elements contained within the Construction Models with other facility elements depicted in the Design Intent Model in order to review the efficiency and harmony of the relationship of the facility elements.
- B. Verify that all facility elements are properly represented within the Construction and Coordination Models prior to coordination.
- C. Conduct the following interferences checks to ensure that there are no conflicts in the installation of facility elements.
 1. Substructure/Shell vs Interiors
 2. Substructure/Shell vs Equipment and Furnishings provided by Contractor
 3. Interiors vs Equipment and Furnishings provided by Contractor.
 4. Substructure vs. Shell
 5. Services vs other components:
 - a. Services vs Substructure/Shell
 - b. Services vs Interiors
 - c. Services vs Equipment and Furnishing
 - d. Services vs Site work
 6. Services
 - a. Plumbing vs HVAC

- b. Plumbing vs Fire Protection
 - c. Plumbing vs Electrical
 - d. Plumbing vs Communications
 - e. Plumbing vs Electronic Safety and Security
 - f. HVAC vs Fire Protection
 - g. HVAC vs Electrical
 - h. HVAC vs Communications
 - i. HVAC vs Electronic Safety and Security
 - j. Fire Protection vs Electrical
 - k. Fire Protection vs Communications
 - l. Fire Protection vs Electronic Safety and Security
 - m. Electrical vs Communications
 - n. Electrical vs Electronic Safety and Security
 - o. Communications vs Electronic Safety and Security
7. ADA Accessibility

- D. Coordination Model(s) shall be free of interferences prior to installation of any associated facility element.
- E. Update the Coordination Model(s) to reflect changes throughout construction prior to installation of any associated facility element.

3.8 COORDINATION REPORT

- A. Develop Coordination Reports identifying outstanding issues after the development of the Coordination Model(s), including but not limited to:
 - 1. Clashes:
 - a. Itemize number of clashes.
 - b. Describe clashes.
 - c. Describe the resolution of clashes and other conflicts.
 - 2. Design changes.
 - 3. Differing site conditions.
 - 4. Hazardous or safety related issues.
 - 5. Assets installed and assets pending installation.
- B. The report shall be organized by CSI specification section or by trade
- C. The issues identified within the Coordination Report are to be addressed by the Contractor in consultation with the SI and the Architect prior to installation of facility elements.
- D. The Contractor is solely responsible for the cost of remedying any clashes that could have been discovered during the clash detection process.

3.9 INSTALLATION

- A. Install facility elements in accordance with approved Construction Models, Fabrication/Shop Drawings, Coordination Model(s), and Coordination Reports. Any variance from these documents shall require approval by the Architect prior to the installation of the associated facility elements.

- B. Adjust Coordination Model(s) throughout construction to reflect all changes made to the approved Contract Drawings and Specs, Design Intent Model, Construction Models, and Fabrication/Shop Drawings.
- C. Maintain an up-to-date Construction Model, Fabrication/Shop Drawing set and Coordination Model for all parties to access while on-site.

3.10 COLLECTION AND HANDOVER OF FACILITY DATA

- A. Collect, verify, and provide Facility Data for import by the SI into the TRIRIGA Facility Center data system. Utilizes templates and procedures described in the "SI Revit Template Users Guide."
- B. Verify and update required data attributes for assets, as needed to conform to As-Built conditions.

3.11 AS-BUILT MODEL AND DRAWINGS

- A. Upon completion of the installation of facility elements, update and deliver Construction and Coordination Models and Fabrication/Shop Drawings to document the condition of the facility upon completion of construction.
 - 1. The updated Construction and Coordination Models are considered the As-Built Model for this facility. These models shall clearly indicated portions of the facility that are constructed and portions where construction is pending.
 - 2. Models and CAD exports are to be delivered in native file formats as well as file formats and naming conventions consistent with SI standards. Reference the "SI Revit Templates Users Guide" and "SI BIM Standards" guidance documents.

END OF SECTION

SECTION 01 3300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

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

- F. 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.
- G. Schedule: A detailed tabulation of components, items, or parts to be furnished for use on this project.
- H. 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.
- I. 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.
- J. 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.
- K. 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.
- L. 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.
- M. Color Charts: Pre-printed brochures showing the color range of a material.
- N. 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 years of the date of award of this contract.
- O. Samples: Physical examples of materials, equipment, assemblies, or workmanship establishing standards for evaluating finished Work.
- P. 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.
- Q. Mock-up: An assembly or sample panel constructed in accordance with specifications to show construction details, finished appearance and/or performance.
- R. Material Safety Data Sheets: Instructions, warnings and recommended and required handling and use procedures for individual hazardous materials published by the product manufacturer.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: 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:
1. Project Name, Project Number, Contractor Name, Contract Number;
 2. Technical Specification Section for each submittal;
 3. Unique Submittal Number;
 4. Description of item to be submitted, as listed in the specifications;
 5. Date item must be submitted to the Smithsonian in order to support the project schedule;
 6. Subcontractor providing submittal (in "Comments" column)

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. General: Electronic copies of CAD Drawings of the Contract Drawings may be provided by the COTR for Contractor's use in preparing submittals. However, electronic data is non-contractual and provided for reference purposes only for the convenience of the Contractor. Neither the Architect/Engineer nor the Smithsonian Institution guarantee that the files are complete, current, and accurate; thus use of electronic data is at the Contractor's risk. By accepting these CAD files, the Contractor agrees to hold harmless both the Architect/Engineer and the Smithsonian Institution for any discrepancies between the electronic data and the Construction Documents. The "hardcopy" Construction Documents (Drawings and Specifications) are the official and legally recognized Contract Documents. In return for CAD files provided by the COTR for the Contractor's convenience, the SI expects to receive CAD files of associated submittals and as-builts, in addition to the Contract-required hardcopy shop drawings and asbuilts. CAD files prepared by the Contractor shall follow the standard AIA layering guidelines.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination. The COTR reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
- C. Submittals Schedule and Control Log: Comply with requirements in Division 1, Section 01 3200, "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. 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 *21 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.

1. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 21 calendar days for initial review of each submittal.
 2. Extended Review: Allow 30 calendar days for initial review of the following submittals:
 - a. HVAC temperature controls.
 - b. HVAC balancing report.
 - c. Coordination drawings.
 - d. Metal wall panel systems.
 - e. Aluminum-Framed Entrances.
 - f. Windows and Curtain Walls.
 - g. Door hardware.
 - h. Electronic Security Systems.
 - i. Fire alarms
 - j. Sprinkler systems
 - k. Life Safety
 - l. If more than five shop drawings of a single trade are received in one week.
 3. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including time for resubmission of items which are initially rejected due to improper submission or non-compliance with the Contract Documents.
- E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide adequate space on label or beside title block to record Contractor's review and approval markings, Architect/Engineer's submittal stamp, and the COTR's submittal stamp. On submittals requiring delegated-design responsibility, provide room for Professional Engineer's stamp and signature.
 3. Include the following information on label for:
 - a. Project name.
 - b. Date.
 - c. Name and address of Contractor.
 - d. Name and address of subcontractor.
 - e. Name and address of supplier.
 - f. Name of manufacturer.
 - g. Unique identifier, including revision number.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 - j. Other necessary identification.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless COTR observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

- I. E-Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. COTR will discard submittals received from sources other than Contractor.
 - 1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by the COTR on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
 - 2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
 - 3. Transmittal Form: Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Submittal and transmittal distribution record.
 - i. Remarks.
 - j. Signature of transmitter.

- J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

- K. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Smithsonian action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. 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:

1. Review each submittal for conformance with requirements of the contract documents and coordination with related work.
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.
3. Assure that all submittals use the appropriate units of measure. All drawings and technical data shall be in SI (metric) units for projects designed in SI units. Preprinted literature in other units shall be accompanied by documentation to show conformance to project requirements.
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.
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.
6. Correct and resubmit submittals according to response from Smithsonian Office of Planning, Design & Construction.
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.

2.2 ACTION SUBMITTALS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. Product Data, Test Reports, Color Charts, etc.: The Contractor will make submittals in electronic format, preferably PDF
 2. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 3. Mark each copy of each submittal to show which products and options are applicable.
 4. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 5. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 6. Submit Product Data before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. 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.

2. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Metric dimensions
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations, with Professional Engineer's stamp as required.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 3. Coordination Drawings: Comply with requirements in Division 1, Section "Project Management and Coordination" and section "Building Information Modeling (BIM) Requirements"
- C. Coordination Drawings: Comply with requirements in Division 1, Section "Project Management and Coordination." Submit in same format and quantity as Shop Drawings. Submit in same format and quantity as Shop Drawings. Comply with Division 1 Section "BIM Requirements".
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Color/Texture Samples: Submit three (3) samples, minimum size 600 mm by 600 mm, unless otherwise specified. After submittal review, one (1) sample may be retained by the Smithsonian, one (1) sample may be retained by the Architect.
 3. 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.
 4. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. COTR will return submittal with options selected.

7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit four sets of Samples. COTR will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- H. 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.
- I. LEED Submittals: Comply with requirements specified in Section 018113.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations."

2.3 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 1. Number of Copies: Submit four copies of each submittal, unless otherwise indicated. COTR will not return copies.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of Contractor, testing agency, or design professional responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of the company.

3. Test and Inspection Reports: Comply with requirements in Division 1, Section 01400, "Quality Requirements."
- B. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- C. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- D. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- E. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- F. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- G. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- H. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- I. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- J. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- K. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- L. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- M. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

- N. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
 2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers' names.
 5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.
- O. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
 2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.
- P. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- Q. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- R. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

- U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.4 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and two paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to the COTR.
 - 1. Assure that all submittals use the appropriate units of measure. All drawings and technical data shall be in metric units for projects designed in metric units.
 - 2. 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.
 - 3. 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, its consultants, or other Contractors.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 SMITHSONIAN INSTITUTION'S ACTION

- A. General: The COTR will not review submittals, nor pass them forward to the Architect/Engineer for review, that do not bear Contractor's approval stamp and will return them without action.
- B. 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."

- C. Action Submittals: The Architect/Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. The Architect/Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken (and recommended to the COTR). The COTR reviews the action recommended by the A/E and provides official action taken on the submittal to the Contractor on the Smithsonian Institution submittal stamp as follows:
1. Approved or No Exception Taken: The Work covered by the submittal may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
 2. Approved as Noted: The Work covered by the submittal may proceed provided it complies with both Architect's and COTR's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.
 3. Resubmit: Do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to Architect's and COTR's notations and corrections.
 4. Disapproved: Do not proceed with the Work covered by the submittal. The work covered by the submittal does not conform to the design concept or meet Contract Document requirements. Prepare a new submittal for a product that complies with the Contract Documents.
- D. Informational Submittals: The COTR and Architect/Engineer will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. The COTR will forward each submittal to appropriate party.
- E. Submittals not required by the Contract Documents will not be reviewed and may be discarded.
- F. Submittal approval by the COTR shall not relieve the Contractor of responsibility for submittal errors, omissions, or deviations from the Contract Documents. Approval of submittals does not constitute acceptance of substitutions, except as covered under subparagraph "Request for Substitutions", above.

3.3 SUBSEQUENT CONTRACTOR'S ACTION

- A. Correct and resubmit submittals according to response from the COTR.
- B. Commence work on items requiring submittals only after all related submittals are reviewed and approved by the COTR. All Work shall conform to approved submittals.
- C. Retain copies of all approved submittals in their entirety for use in compiling Project Record Documents. See Division 1, Section 01 7839, "Project Record Documents".

END OF SECTION

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications (e.g. shop drawings and/or calculations signed, stamped, and sealed by a professional, licensed engineer) by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to the COTR.
 - 2. Shop drawings, calculations, and other submittals that are required by the technical specifications to be prepared and/or reviewed by a registered, licensed design professional shall display the stamp/seal, registration/license number, and signature of the individual taking responsibility. Individual must be registered/licensed in the state or jurisdiction in which the Project is located.

1.5 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data : For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.
 - 3. Identification of applicable standards.
 - 4. Identification of test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - 7. Entity responsible for performing tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- E. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.7 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.

9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and re-inspection.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Smithsonian Institution's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- 1.8 QUALITY ASSURANCE
- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. **Specialists:** Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.
- G. **Testing Agency Qualifications:** 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 329; 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.
- H. **Manufacturer's Technical Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. **Preconstruction Testing:** Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 2. **Testing Agency Responsibilities:** Submit a certified written report of each test, inspection, and similar quality-assurance service to COTR, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by COTR.
 2. Notify COTR seven days in advance of dates and times when mockups will be constructed.
 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Obtain COTR's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Demolish and remove mockups when directed unless otherwise indicated.
- L. Exterior Wall Testing and Inspection Program – On Site:
1. The Contractor shall engage an Independent Testing and Inspection Agency(ies) and Laboratory(ies) to conduct a random field testing and inspection program during the exterior wall erection to check for conformance with the drawings, specifications, and adherence to accepted shop drawings. The testing and inspection shall include:
 - a. Review of all field welder certifications and independently recertify, if required.
 - b. Detailed review of all field welding procedures for compliance with AWS Specifications, as well as good engineering practices.
 - c. Weld Testing:
 - 1) All welds to hot rolled steel shapes shall be visually inspected. 25% at random shall be measured and documented. 5% at random shall be tested.
 - 2) Non-destructive testing of wall supports and anchor welds, utilize one of the following test methods which best suits the type of weld to be tested.
 - a) Liquid penetrant test. ASTM E165.
 - b) Magnetic particle test. ASTM E709.
 - d. All bolted connections shall be visually inspected. Twenty-five (25) percent at random shall be checked by a calibrated torque wrench and documented.
 - e. All screwed connections shall be visually inspected for size, type, spacing and depth of penetration.
 - f. Paint Testing: Perform and document tests to determine the total dry film thickness of coatings applied to all painted ferrous metal support and anchorage members. Prior to being covered up by other components test units at random throughout construction. Check for touch-up of final finish and touch up of defects such as holidays.
 - g. Inspection Compliance: Verification and documentation for the compliance of; or the deficiencies with the following:
 - 1) Building Superstructure: Examination surveys of the superstructure substrates and supports to receive the exterior wall work and applicable corrective work performed, if any. Verification that the supporting structure is properly aligned and within the designed tolerances and without missing or mis-located inserts. Make examination surveys of actual column locations immediately upon completion of every lift of steel, and concrete, and submit same to the Architect. Should column locations vary beyond the allowable tolerances, take necessary corrective measures prior to proceeding to next lift and modify details and/or procedure as required.
 - 2) Framing Components: Verification that the framing components are properly sized and aligned, are without missing or mis-located anchoring provisions and are without structural defects. Verification that all primed and

- 3) painted components are provided with the specified materials. Inspect for touch up of final finish and touch up of defects such as holidays.
- 3) Connections and Anchors: Verification that all anchors are properly placed, welded, screwed or bolted. Verification that correct anchoring and/or materials are used in lieu of others where there are field changes. Inspection of welding and bolting where connections are stressed to 50% or more of allowable values. Verification of the calibration of wrenches, review of bolting procedures and inspection of joint surfaces prior to bolting for all bolted connections related to the exterior wall.
- 4) Exterior Wall Insulation: Verification that insulation is continuous and properly sealed at joints and penetrations to maintain the continuity of the vapor barrier.
- 5) Observation Compliance of Exterior Wall Testing Program: Observation, of field testing of exterior wall assemblies, for the required tests as specified under Division 8 Sections "Window Wall."

1.9 QUALITY CONTROL

- A. 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.
- B. 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.
- C. CQC Representative Designation and Authority: The Contractor shall provide a CQC Representative, supplemented as necessary by additional personnel, who shall be on the jobsite at all times during progress, with complete authority to take any action necessary to ensure compliance with the contract documents. The CQC Representative shall be appointed by a letter addressed to him/her and signed by an officer of the firm and shall not be the same individual as, or be subordinate to, the job superintendent or project manager.
- D. CQC Plan Requirements: The Contractor shall submit for review/approvals CQC Plan within thirty (30) calendar days after Contract Award to the COTR for approval. The Plan shall detail the procedures, instruction and reports to be used to assure compliance with the contract documents. As a minimum, the Plan shall include the following:
1. Designation of the CQC Representative: Identify the person and list duties, responsibilities and authority.
 2. Organization Chart: Show CQC staff and its relationship with other staff members and Subcontractors.
 3. Personnel Matrix: For each specification section, identify who is the authorized submittal reviewer, who will inspect the work, what testing laboratory or person will perform on-site testing, who will perform factory inspections and testing and who will certify the documentation.
 4. Responsibility and Authority: State the responsibility and authority for each individual in the CQC system.
 5. Personnel Qualifications: Provide resumes and descriptions of prior experience on similar work.
 6. Inspection Procedures and Schedule: Identify the inspection and testing procedures and scheduled dates as reflected on the CPM project schedule, organized by technical specification section.

7. Submittal Review Procedures and Schedule: Provide submittal log in accordance with the Submissions section. For each specification section, identify the name(s) of person(s) authorized to review and sign submittals for compliance.
 8. CQC Documentation: Identify the procedures for documenting quality control operations, inspection and testing. Provide samples of each type of required documentation - all forms, logs, reports, etc. Include a testing log listing all tests and inspections required by the contract documents and stating the action to be taken by the Contractor and/or the Smithsonian.
- E. CQC Staffing Requirements: The following listing of minimum staff requirements in no way relieves the Contractor of meeting the basic requirements of the Contractor Quality Control System for this project. The Contractor shall ensure an adequate staff to meet the CQC requirements at all times during construction. When necessary for a proper CQC organization, the Contractor shall provide additional staff at no cost to the Smithsonian.
1. CQC Representative: The CQC Representative shall be a graduate engineer or architect with a minimum of seven (7) years of construction experience on projects similar to this one, including three (3) years experience in Quality Control.
 2. Alternate CQC Representative: The Contractor shall designate an alternate person to act for the CQC Representative in case the CQC Representative is absent from the construction site. The alternate may not act for the CQC Representative for a period longer than fourteen (14) consecutive calendar days without written approval by the COTR.
 3. CQC Submittals Assistant: The Contractor shall assign an assistant, to work until submittals are 95% complete, whose sole duty shall be to assist the CQC Representative in maintaining files and logs for submittals.
 4. CQC Specialized Supplemental Personnel: The Contractor shall provide, as a minimum, a different person in each of the areas listed below to assist and report to the CQC Representative. Supplemental personnel shall be responsible for ensuring that the construction complies with the contract documents in their areas of responsibility. They shall be on the jobsite during all installation and testing in their areas of responsibility and shall be responsible for performing inspections and witnessing testing as required by the contract documents.
 - a. HVAC Systems
 - b. Fire Protection Systems
 - c. Environmental Rooms
 - d. Emergency Generators
- F. CQC Inspection Requirements: As a minimum, the inspection procedures shall include the following:
1. Preparatory Inspection: Preparatory inspection shall be performed before beginning work and before beginning each segment of work. Preparatory inspection shall include a review of the contract requirements, complete review of shop drawings and other submittals for conformance with contract documents, confirmation that all required testing will be provided, physical examination of all materials and equipment for conformance with approved shop drawings and submittals and verification that all required preliminary work has been completed.
 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.

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.
 4. Special Inspection and Documentation: In addition to the above inspection requirements, certain Special Inspection and Documentation requirements may be contained within the technical specification sections. Each Special Inspection shall be performed and documented as required and documentation shall be submitted as soon as possible after performance unless otherwise indicated.
 5. Factory Inspection by the Contractor: The Contractor shall arrange and perform all factory inspections specifically required in the technical specifications sections.
 6. Non-Compliance Check-Off List: The CQC Representative shall maintain a check-off list of work that does not comply with the contract, stating specifically what is non-complying, the date the faulty work was originally discovered and the date the work was corrected. The CQC Representative shall not allow the Contractor to add to or build upon non-complying work unless, in the opinion of the COTR, correction can be made without disturbing the continuing work. The CQC Representative shall submit a copy of the check-off list to the COTR on a monthly basis. Items corrected on the day they are discovered do not need to be included on the submitted list.
 7. Completion and Inspection of Work: The CQC Representative shall sign the written request for Substantial Completion Inspection (discussed in the Project Closeout Requirements section).
- G. Testing Requirements: Except as specifically stated otherwise, the Contractor shall be responsible for all field sampling and in-place testing required by the contract documents.
1. Independent Testing Laboratory: The Contractor shall provide an independent, commercial testing laboratory to perform all sampling and testing services required, unless otherwise specified. The testing services shall be on- or off-site as required. Submit complete documentation of all tests performed in connection with the construction contract.
 2. Smithsonian Acceptance of Laboratories: Except for factory tests, all field sampling and testing normally performed by commercial laboratories shall be performed by an independent commercial laboratory employed by the Contractor and accepted by the COTR. The Contractor shall submit the following information to the COTR for approval:
 - a. Name, registration number and engineering discipline of the Registered Professional Engineer in charge of the laboratory.
 - b. Affidavit of compliance and certification that the laboratory performs work in accordance with requirements as stated in the contract documents.
 - c. A list of testing equipment proposed for each test procedure including latest calibration data.
 - d. A copy of the latest Laboratory Inspection Report by an independent agency with laboratory certification that deficiencies (if any) have been corrected.
 - e. Names and qualifications of persons actually performing testing and sampling. Changes in personnel shall be approved by the COTR prior to performance of work under this contract.
 3. Factory Tests: Unless otherwise specified, the Contractor shall arrange for factory tests when they are required under the Contract. Certified copies of test reports showing that the materials to be incorporated into the work conform to the contract documents will be acceptable, provided they are performed by the manufacturer or by agencies or laboratories acceptable to the COTR.
 4. Test Results: Test results shall cite the contract requirements, the test or analytical procedures used, the actual results and include a statement that the item tested or analyzed conforms or fails to conform to specification requirements. The cover sheet for

each report shall be conspicuously stamped in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, as the case may be. All test reports shall be signed by a testing laboratory representative authorized to sign certified test reports. The Contractor shall arrange for immediate and direct delivery of the signed reports, certifications and other documentation to the COTR.

- H. Documentation: The CQC shall prepare or assist with the preparation of the following documents:
1. Daily Reports: The Contractor's Daily Report, as discussed in the section Contractor Correspondence and Daily Reports, shall be signed by the CQC Representative as well as the Superintendent. The CQC Representative's signature certifies that, to the best of his or her knowledge, the report is complete and correct and that all materials, equipment and work described on the report are in compliance with the contract plans and specifications, except as noted otherwise.
 2. Special Inspection and Documentation: Reports of Special Inspections shall be signed by both the CQC Representative and the CQC Specialized Supplemental Person who witnessed the test or inspection certifying compliance with the specific contract requirement.
 3. As-Builts: The CQC Representative shall ensure that all requirements for as-built record drawings and specifications are met. The CQC Representative or Specialized Supplemental Personnel assigned to inspect that particular portion of work shall initial each as-built drawing or technical specification section to certify its accuracy prior to submission in accordance with the Project Close-Out Requirements section.
- I. Smithsonian Institution Responsibilities: Where quality-control services are indicated as the SI's responsibility, the SI will engage a qualified testing agency to perform these services.
1. SI will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- J. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by SI, unless agreed to in writing by the COTR.
 - b. Contractor shall coordinate SI provided Special Inspection services in accordance with the requirements of the International Building Code, Section 1704.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

- K. Special Tests and Inspections: COTR will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of COTR.
1. Testing agency will notify COTR and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. Testing agency will submit a certified written report of each test, inspection, and similar quality control service to COTR, Architect with copy to Contractor and to authorities having jurisdiction.
 3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 5. Testing agency will retest and re-inspect corrected work
- L. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- M. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- N. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with requirements established by the Contract Documents.
- O. Testing Agency Responsibilities: Cooperate with COTR and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify COTR and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- P. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.

6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- Q. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- R. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice-to-Proceed.
1. Distribution: Distribute schedule to COTR, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 4200

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if

bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

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

AABC	Associated Air Balance Council www.aabc.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABMA	American Bearing Manufacturers Association www.americanbearings.org	(202) 367-1155
ACI	American Concrete Institute (Formerly: ACI International) www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000

AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AHRI	Air-Conditioning, Heating, and Refrigeration Institute (The) www.ahrinet.org	(703) 524-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(607) 256-3313
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute (See AHRI)	
ARI	American Refrigeration Institute (See AHRI)	
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute	

(See ASCE)

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Safety Engineers (The) www.asse.org	(847) 699-2929
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions www.atis.org	(202) 628-6380
AWEA	American Wind Energy Association www.awea.org	(202) 383-2500
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWMAC	Architectural Woodwork Manufacturers Association of Canada www.awmac.com	(403) 453-7387
AWPA	American Wood Protection Association (Formerly: American Wood-Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.gobrick.com	(703) 620-0010
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International	(616) 285-3963

	(Business and Institutional Furniture Manufacturer's Association) www.bifma.com	
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
BOCA	BOCA (Building Officials and Code Administrators International Inc.) (See ICC)	
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.electricity.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CFSEI	Cold-Formed Steel Engineers Institute www.cfsei.org	(866) 465-4732 (202) 263-4488
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(404) 622-0073
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association www.pbmdf.com	(703) 724-1128
CRI	Carpet and Rug Institute (The) www.carpet-rug.org	(706) 278-3176
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(800) 328-6306 (847) 517-1200

CSA	Canadian Standards Association www.csa.ca	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
CWC	Composite Wood Council (See CPA)	
DASMA	Door and Access Systems Manufacturers Association www.dasma.com	(216) 241-7333
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
ECA	Electronic Components Association www.ec-central.org	(703) 907-8024
ECAMA	Electronic Components Assemblies & Materials Association (See ECA)	
EIA	Electronic Industries Alliance (See TIA)	
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (703) 538-1616
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
ESTA	Entertainment Services and Technology Association (See PLASA)	
EVO	Efficiency Valuation Organization www.evo-world.org	(415) 367-3643 44 20 88 167 857
FIBA	Fédération Internationale de Basketball	41 22 545 00 00

	(The International Basketball Federation) www.fiba.com	
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridarroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council U.S. www.fscus.org	(612) 353-4511
GA	Gypsum Association www.gypsum.org	(301) 277-8686
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GS	Green Seal www.greenseal.org	(202) 872-6400
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association (See AHRI)	
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAPSC	International Association of Professional Security Consultants www.iapsc.org	(415) 536-0288
IAS	International Approval Services (See CSA)	
ICBO	International Conference of Building Officials (See ICC)	

ICC	International Code Council www.iccsafe.org	(888) 422-7233 (202) 370-1800
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICPA	International Cast Polymer Alliance www.icpa-hq.org	(703) 525-0511
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IES	Illuminating Engineering Society (Formerly: Illuminating Engineering Society of North America) www.ies.org	(212) 248-5000
IESNA	Illuminating Engineering Society of North America (See IES)	
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 981-0100
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
IGSHPA	International Ground Source Heat Pump Association www.igshpa.okstate.edu	(405) 744-5175
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
Intertek	Intertek Group (Formerly: ETL SEMCO; Intertek Testing Service NA) www.intertek.com	(800) 967-5352
ISA	International Society of Automation (The) (Formerly: Instrumentation, Systems, and Automation Society) www.isa.org	(919) 549-8411
ISAS	Instrumentation, Systems, and Automation Society (The) (See ISA)	
ISFA	International Surface Fabricators Association (Formerly: International Solid Surface Fabricators)	(877) 464-7732 (801) 341-7360

	Association) www.isfanow.org	
ISO	International Organization for Standardization www.iso.org	41 22 749 01 11
ISSFA	International Solid Surface Fabricators Association (See ISFA)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (See CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MCA	Metal Construction Association www.metalconstruction.org	(847) 375-4718
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MMPA	Moulding & Millwork Producers Association (Formerly: Wood Moulding & Millwork Producers Association) www.wmmpa.com	(800) 550-7889 (530) 661-9591
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.org	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591

NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6223 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NelMA	Northeastern Lumber Manufacturers Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFPA	NFPA International (See NFPA)	
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NHLA	National Hardwood Lumber Association www.nhla.com	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393

NOFMA	National Oak Flooring Manufacturers Association (See NWFA)	
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSPE	National Society of Professional Engineers www.nspe.org	(703) 684-2800
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736
NWFA	National Wood Flooring Association www.nwfa.org	(800) 422-4556 (636) 519-9663
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PLASA	PLASA (Formerly: ESTA - Entertainment Services and Technology Association) www.plasa.org	(212) 244-1505
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(706) 882-3833
RIS	Redwood Inspection Service www.redwoodinspection.com	(925) 935-1499
SAE	SAE International (Society of Automotive Engineers) www.sae.org	(877) 606-7323 (724) 776-4841

SBCCI	Southern Building Code Congress International, Inc. (See ICC)	
SCTE	Society of Cable Telecommunications Engineers www.scte.org	(800) 542-5040 (610) 363-6888
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SJI	Steel Joist Institute www.steeljoist.org	(843) 293-1995
SMA	Screen Manufacturers Association www.smainfo.org	(773) 636-0672
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SRCC	Solar Rating and Certification Corporation www.solar-rating.org	(321) 638-1537
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331

STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWPA	Submersible Wastewater Pump Association www.swpa.org	(847) 681-1868
TCA	Tilt-Up Concrete Association www.tilt-up.org	(319) 895-6911
TCNA	Tile Council of North America, Inc. (Formerly: Tile Council of America) www.tileusa.com	(864) 646-8453
TEMA	Tubular Exchanger Manufacturers Association, Inc. www.tema.org	(914) 332-0040
TIA	Telecommunications Industry Association (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance) www.tiaonline.org	(703) 907-7700
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance (See TIA)	
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tilerroofing.org	(312) 670-4177
UBC	Uniform Building Code (See ICC)	
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747

USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122
WDMA	Window & Door Manufacturers Association www.wdma.com	(800) 223-2301 (312) 321-6802
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association (See MMPA)	
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 938-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

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

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, LLC www.icc-es.org	(800) 423-6587 (562) 699-0543

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

COE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
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CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce National Institute of Standards and Technology www.nist.gov	(301) 975-4040
DOD	Department of Defense http://dodssp.daps.dla.mil	(215) 697-2664
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FG	Federal Government Publications www.gpo.gov	(202) 512-1800
GSA	General Services Administration www.gsa.gov	(800) 488-3111 (202) 619-8925
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory Environmental Energy Technologies Division http://eetd.lbl.gov	(510) 486-4000
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742
SD	Department of State www.state.gov	(202) 647-4000
TRB	Transportation Research Board National Cooperative Highway Research Program www.trb.org	(202) 334-2934
USDA	Department of Agriculture Agriculture Research Service U.S. Salinity Laboratory www.ars.usda.gov	(202) 720-3656
USDA	Department of Agriculture Rural Utilities Service www.usda.gov	(202) 720-2791
USDJ	Department of Justice Office of Justice Programs	(202) 307-0703

National Institute of Justice
www.ojp.usdoj.gov

USP	U.S. Pharmacopeia www.usp.org	(800) 227-8772 (301) 881-0666
USPS	United States Postal Service www.usps.com	(202) 268-2000

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

CFR	Code of Federal Regulations Available from Government Printing Office www.gpo.gov/fdsys	(866) 512-1800 (202) 512-1800
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DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
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DSCC	Defense Supply Center Columbus (See FS)	
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FED-STD	Federal Standard (See FS)	
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FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
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Available from Defense Standardization Program
www.dsp.dla.mil

	Available from General Services Administration www.gsa.gov	(800) 488-3111 (202) 619-8925
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	Available from National Institute of Building Sciences/Whole Building Design Guide www.wbdg.org/ccb	(202) 289-7800
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MILSPEC	Military Specification and Standards (See DOD)	
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USAB	United States Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
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USATBCB	U.S. Architectural & Transportation Barriers Compliance Board (See USAB)	
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- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California Department of Consumer Affairs Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation www.bearhfti.ca.gov	(800) 952-5210 (916) 574-2041
CCR	California Code of Regulations Office of Administrative Law California Title 24 Energy Code www.calregs.com	(916) 323-6225
CDHS	California Department of Health Care Services (Formerly: California Department of Health Services) (See CCR)	
CDPH	California Department of Public Health Indoor Air Quality Program www.cal-iaq.org	
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(800) 848-5580 (415) 703-2782
SCAQMD	South Coast Air Quality Management District www.aqmd.gov	(909) 396-2000
TFS	Texas Forest Service Forest Resource Development and Sustainable Forestry http://txforests-service.tamu.edu	(979) 458-6606

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Sewers and drainage.
 - 2. Water service, metering, and distribution.
 - 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
 - 4. Heating and cooling facilities.
 - 5. Ventilation.
 - 6. Electric power service.
 - 7. Lighting.
 - 8. Telephone service.
- C. Support facilities include, but are not limited to, the following:
 - 1. Temporary roads and paving.
 - 2. Wash racks.
 - 3. Dewatering facilities and drains.
 - 4. Project identification and temporary signs.
 - 5. Waste disposal facilities.
 - 6. Field offices.
 - 7. Storage and fabrication sheds.
 - 8. Lifts and hoists.
 - 9. Temporary elevator usage.
 - 10. Temporary stairs.
 - 11. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Environmental protection.
 - 2. Stormwater, sediment, and erosion controls control.
 - 3. Tree, plant, and animal protection.
 - 4. Pest control.
 - 5. Site enclosure fence.
 - 6. Security enclosure and lockup.
 - 7. Barricades, warning signs, and lights.
 - 8. Covered walkways.

9. Temporary enclosures.
10. Temporary partitions.
11. Noise control.
12. Weather protection.
13. Fire protection.
14. Dust control and protection of airport operations from construction materials and construction waste, particularly with respect to potential Foreign Object Damage (FOD) to aircraft operating in the vicinity of project site.

E. Related Requirements:

1. Section 010000 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 321313 "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 DEFINITIONS

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

1.4 TEMPORARY UTILITY SERVICES, EXTENSIONS AND USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to the Smithsonian Institution or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
1. SI's construction forces.
 2. Occupants of Project.
 3. Architect.
 4. Testing agencies.
 5. SI-provided office trailers
 6. Personnel of authorities having jurisdiction.
- B. Water Service from Existing System: Water from Owner's existing water system is available for use subject to coordination with and approval by Fairfax Water. Fairfax Water owns the service lines on the property. Fairfax water may require metering and payment of use charges. Contractor is responsible for coordination with Fairfax Water as well as providing all material and labor required to make temporary connections and extensions of services as required for construction operations. Contractor is also responsible for the removal of such temporary connections and extensions subject to approval by Fairfax Water and the COTR.
- C. Sanitary Sewer Service from Existing System: Sewer service from Owner's existing system is available for use without metering and without payment of use charges. Contractor is responsible for providing all material and labor required to make temporary connections and extensions of services as required for construction operations. Contractor is also responsible for the removal of such temporary connections and extensions subject to approval by the COTR.
- D. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Contractor is responsible for providing all material and labor required to make temporary connections and

extensions of services as required for construction operations. Contractor is also responsible for the removal of such temporary connections and extensions subject to approval by the COTR.

1.5 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- C. Implementation and Termination Schedule: Within 15 days of date established for submittal of Contractor's Construction Schedule, submit a schedule indicating implementation and termination of each temporary utility.
- D. 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
- E. Plan for Construction Facilities, Temporary Controls, and Protection of the Site: Submit a Plan that both graphically and narratively describes the proposed facilities, temporary controls, and protection of the site to the COTR for approval at least 5 working days prior to mobilization or within 10 working days of the effective Notice-to-Proceed, whichever comes first. At a minimum, include the following in the Plan:
 - 1. Proposed method, location, materials, and construction of temporary structures, facilities, walkways, utilities, field offices, storage sheds, trailers, toilet facilities, storage areas, fencing, enclosures, barriers, dust/noise partitions, identification and directional signage, and other temporary controls.
 - 2. Routes of vehicular and pedestrian access and egress for Contractor personnel, SI personnel, the public (where applicable), including those for people with disabilities (where applicable).
 - 3. Location and maintenance of emergency exits.
 - 4. Methods of protection of existing surfaces, occupants, utilities, and other SI property, including protection of existing historic fabric.
 - 5. Means of connection of temporary enclosures/controls to existing historic materials.
- F. Material Safety Data Sheets (MSDS): Submit Material Safety Data Sheets for all toxic and/or hazardous substances proposed for temporary controls prior to use of any such substances.
- G. Temporary Office Trailers for SI: SI will provide COTR office facility & related furnishings.
- H. Project Sign: Submit a shop drawing indicating construction, materials, colors, font, letter sizes, graphics, etc. to scale of the required Project Sign.

1.6 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
 2. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- B. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- 1.7 PROJECT CONDITIONS
- A. Temporary Utilities: At earliest feasible time, when acceptable to the COTR, change over from use of temporary service to use of permanent service.
1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before SI's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
1. Keep temporary services and facilities clean and neat. Operate in a safe and efficient manner.
 2. Relocate temporary services and facilities as required by progress of the Work.
 3. Take necessary fire-prevention measures.
 4. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on site.
- C. Sanitary Facilities: Contractor personnel may not use existing Smithsonian restrooms on the premises. Provide temporary facilities on site in accordance with requirements set forth in Parts 2 and 3 below.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by the COTR. Provide materials suitable for use intended.
- B. Pavement: Comply with Division 32 pavement sections
- C. Fencing: 40 mm x 13 mm slats, preservative treated, 1.2 m high with 12 gage wire and 50 mm spacing between slats, on 1.8 m steel pickets with 1.8 m on center spacing.
- D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

- E. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum **36 by 60 inches (914 by 1624 mm)**.
- F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- G. Plant Protection or "Snow" Fence: Heavy-duty metal posts or pressure-treated 100 mm x 100 mm (4" x 4") wooden posts, 1 meter (3 feet) on center, with a top and bottom stringer of 50 mm x 100 mm (2" x 4") members; fencing fabric to be pressure-treated 40 mm x 13 mm (1-1/2" x 1/2") wood slats. Install minimum 1.4 meter (4'-6") tall fencing at least 300 mm (1 foot) outside the drip-line of trees and shrubs.
- H. Lumber and Plywood: Comply with requirements in Division 6.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. The Contractor shall establish a temporary office at the project site. The Contractor shall provide information about proposed locations of any temporary office, sheds, trailers and staging and storage areas and designation of size, color and materials to the COTR for approval at least five (5) working days prior to mobilization.
- C. 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.
- D. Upon completion of the Work, the temporary offices, trailers and sheds shall be removed and the area returned to its original pre-contract condition.
- E. Field Office: Of sufficient size to accommodate needs of Owner and Architect, in a separate facility from the Contractor, and construction personnel office activities. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and **4-foot- (1.2-m-)** square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Coffee machine and supplies.
 - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of **68 to 72 deg F (20 to 22 deg C)**.
 - 6. Lighting fixtures capable of maintaining average illumination of **20 fc (215 lx)** at desk height.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
 - 1. Arrange with utility company, COTR, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to Project site where SI's easements cannot be used for that purpose.
- B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 2. Connect temporary sewers to municipal system as directed by sewer department officials.
 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures at locations approved by the COTR. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
 2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel.
 3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
 - a. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
 - b. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 7.2 to 12.7 deg C.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.
1. Maintain a minimum temperature of 10 deg C in permanently enclosed portions of building for normal construction activities, and 18.3 deg C for finishing activities and areas where finished Work has been installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
1. Install electric power service underground, unless overhead service must be used.
 2. Install power distribution wiring overhead and rise vertically where least exposed to damage.

- H. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
 - 1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
 - 2. Provide warning signs at power outlets other than 110 to 120 V.
 - 3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
 - 4. Provide metal conduit enclosures or boxes for wiring devices.
 - 5. Provide 4-gang outlets, spaced so 30-m extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.

- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security, emergency egress, and protection requirements without operating entire system.

- J. Telephone Service: Provide temporary telephone service throughout construction period for commonuse facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office and first-aid station.
 - 1. Provide additional telephone lines for the following:
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Architect's office.
 - e. Engineers' offices.
 - f. COTR's office.
 - g. Principal subcontractors' field and home offices.
 - 3. Provide a voice mail service on superintendent's telephone.
 - 4. Furnish superintendent with portable two-way radio for use when away from field office.
 - 5. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
 - 2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 9 m (30 feet) of building lines. Comply with NFPA 241.
 - 3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the COTR.

- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

- C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- D. Traffic and Pedestrian Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
 - 1. Provide safety barricades in accordance with the Fairfax County Building Code and applicable OSHA regulations. Provide barricades, subject to the approval of the COTR, to deter passage of persons and/or vehicles into construction areas as specified or necessary.
 - 2. When construction activities impact on the public right-of-way (e.g. public sidewalks), provide barricades as necessary to create a safe passage for pedestrians around the obstacles and separate from vehicular traffic lanes. Provide appropriate directional signs.
- E. Dewatering Facilities and Drains: Comply with requirements in applicable Division 2 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed
 - 3. Remove snow and ice as required to minimize accumulations.
- F. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs. Submit all sign designs to the COTR for approval.
 - 1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
 - 2. Prepare temporary signs to provide directional information to construction personnel and visitors.
 - 3. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.
 - 4. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
 - 5. For project identification sign, see diagram at end of this section for construction, materials, colors, required wording, and use of SI logo. Camera-ready artwork for logo will be provided by the COTR.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1, Section 01700, "Execution Requirements" for progress cleaning requirements.
 - 1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
 - 2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

- H. Janitorial Services: Provide janitorial services on a daily basis for Contractor's temporary offices, firstaid stations, toilets, wash facilities, lunchrooms, and similar areas.
- I. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.
 - 1. Construct framing, sheathing, and siding using fire-retardant-treated lumber and plywood.
 - 2. Paint exposed lumber and plywood with exterior-grade acrylic-latex emulsion over exterior primer.
- J. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- K. Temporary Elevator Usage: Refer to Division 14 Sections for temporary use of new elevators.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- L. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 STAGING, STORAGE AND WORK AREAS

- A. 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.
- B. Plan for Staging, Storage & Work Areas: The Contractor shall submit a drawing (scale 1:300) of areas proposed for construction operations for approval by the COTR at least five (5) working days prior to mobilization or at the Preconstruction Meeting, whichever is first. The drawing shall show buildings, utilities, temporary toilet facilities, temporary utility extensions, temporary interior walls and barriers to limit unauthorized intrusion and to control noise and dust, pedestrian walkways, vehicular access, temporary fencing, trailers, sheds, storage areas and the Contract's desired route for access and egress to the premises and to the project site.
- C. 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.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
- B. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- C. Animal Protection: The Contractor is prohibited from hunting, collecting, or feeding animals on SI property. Properly dispose of all food and food wrapping brought on the premises in approved containers which are secured from animals.
- D. Noise and Vibration Control: Comply with the regulations of the Fairfax County, MWAA and OSHA Standard 1962.52 and 1910.95 and all other regulations concerning safety noise control.
 - 1. 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.
 - 2. 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.
- E. Fencing: The Contractor shall install a "snow fence" to define the temporary work limits for construction around exterior staging, storage and work areas at no additional cost to the Smithsonian. The snow fence shall consist of 40 mm x 13 mm slats, preservative treated, 1.2 m high with 12 gage wire and 50 mm spacing between slats, on 1.8 m steel pickets with 1.8 m on center spacing.
 - 1. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- G. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights. Provide easily identifiable, accessible walkways around construction activities and obstacles. Post directional signs at decision points to prevent unnecessary travel along changed routes and to deadends. Erect and dismantle barriers in phases so that a clear route is always available. Provide security hardware on doors to construction areas to prevent entry by unauthorized persons.
 - 1. For exterior safety barriers, sidewalk bridges, and similar uses, provide minimum 16-mm- (5/8inch) thick exterior plywood and structurally appropriate dimensional lumber. Provide appropriate supports to prevent overturning. Paint both sides and maintain in good condition, repainting as necessary, for the duration of use.

- H. Scaffolding and Platforms: Erect temporary scaffolding in accordance with OSHA 29 CRF 1926.451 and ANSI A10.8.
 - 1. Provide landing platforms with stairways or ladders for proper access and egress to and from all work areas.
 - 2. For all frame scaffolding greater than 4 m in height, submit shop drawings, signed and sealed by a Professional Engineer, to the COTR a minimum of 10 working days prior to erection.
 - 3. During non-working hours, close and lock scaffolding with a physical barrier to prevent access by unauthorized persons.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Temporary Enclosures: 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
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
 - 2. Vertical Openings: Close openings of 2.3 sq. m or less with plywood or similar materials.
 - 3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with loadbearing, wood-framed construction.
 - 4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
 - 5. Where temporary wood or plywood enclosure exceeds 9.2 sq. m in area, use fire-retardant-treated material for framing and main sheathing.
- K. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Construct dustproof, floor-to-ceiling partitions of not less than nominal 101 mm studs, 2 layers of 3-mil polyethylene sheets, inside and outside temporary enclosure. Cover floor with 2 layers of 3mil polyethylene sheets, extending sheets 450 mm up the side walls. Overlap and tape full length of joints. Cover floor with 19 mm fire-retardant plywood.
 - a. Construct a vestibule and airlock at each entrance to temporary enclosure with not less than 1200 between doors. Maintain water-dampened foot mats in vestibule.
 - 3. Insulate partitions to provide noise protection to occupied areas.
 - 4. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - 5. Protect air-handling equipment.
 - 6. Weather-strip openings.
 - 7. Paint face of visible partitions a color acceptable to the SI, and provide partitions with an applied base material likewise acceptable to the Authority.
- L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

3.8 PROJECT SIGN

- A. All signs, including signs identifying the Contractors, shall be submitted at least five (5) working days prior to erection for approval by the COTR. The Contractor shall maintain and relocate the signs, as necessary, during the progress of the Work. The Contractor shall remove all signs, framing and foundations at the completion of the Work.
- B. Construction Site Information and Direction: Informational signs required to indicate the location of the Contractor's office and directional signs for safety, vehicular control, pedestrian right-of-ways, detours to facilities, etc. shall be furnished and installed by the Contractor as requested and approved by the COTR.
- C. SI Project Identification: The Contractor shall furnish and erect two 3 m² project identification signs at the project site within 30 calendar days after the effective date of the Notice to Proceed. The exact lettering, graphics, content and location shall be determined by the Smithsonian Institution. Requirements for sign construction include:

1. Structure, Framing and Hardware: New metal structurally adequate to withstand 80 km/h winds, braced on secure foundation. Aluminum hardware. Sign attached to posts with screws from behind the sign.
2. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 25 mm thick, standard large sizes to minimize joints.
3. Primers and Paint: Exterior quality, three coats. Colors to be selected by Smithsonian. Flat enamel. Polyurethane clear topcoat on all surfaces.
4. Lettering and Graphics: Exterior quality paint. Contrasting colors to be as selected by Smithsonian. Lettering should be sized for viewing from a minimum of 6 m. Smithsonian logo to be provided by Smithsonian.
5. Content and Layout: Smithsonian shall approve Wording and layout prior to fabrication. Minimum border at the top, bottom and sides is 100 mm. Wording may include:
 - Facility logo, 175 mm
 - Facility name, 75 mm caps
 - Project title, 2 lines, and 100 mm caps
 - "Smithsonian Institution Owner", 65 mm caps
 - "Ayers Saint Gross" 65 mm caps
 - "_____ Contractor," 65 mm caps

END OF SECTION

SECTION 01 5600
ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY:

- A. General: This section specifies requirements and procedures for environmental protection to be performed and maintained for the duration of construction operations at the project site.

1.2 REFERENCES:

- A. The latest edition of 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.

CODE OF FEDERAL REGULATIONS - DEPARTMENT OF TRANSPORTATION (DOT)

- 49-CFR-178 Regulations for Shipping Container Specifications

CODE OF FEDERAL REGULATIONS ENVIRONMENTAL PROTECTION AGENCY (EPA)

- 40-CFR-260 , General Regulations for Hazardous Waste Management
- 40-CFR-261 , Regulations Identifying Hazardous Waste
- 40-CFR-262 , Regulations for Hazardous Waste Generators
- 40-CFR-263 , Regulations for Hazardous Waste Transporters
- 40-CFR-264 , Regulations for Owners and Operators of Permitted Hazardous Waste Facilities

VIRGINIA STATE ENVIRONMENTAL REGULATIONS

- For all issues concerning environmental protection including but not limited to water, land and air.

VDEQ Virginia Department of Environmental Quality

VAC Virginia Administrative Code

VIRGINIA STATE DIVISION SOIL and WATER CONSERVATION

VSDSWC Virginia Erosion and Sediment Control Handbook

VSEC Virginia State Environmental Council Department of Environmental Quality

CODE OF FEDERAL REGULATIONS DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

29-CFR-1910.94, Subpart G Occupational Health and Environmental Control

1.3 DEFINITIONS:

- A. Erosion: Soil being dislodged from one location and carried to another location by the action of water or wind.
- B. Sediment: Soil and other debris that have eroded and have been transported by runoff water or wind.
- C. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials, except hazardous waste as defined in the paragraph entitled, "Hazardous Waste," resulting from industrial, commercial, and agricultural operations and from community activities.
- D. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.
- E. Debris: Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, leaves, and tree trimmings.
- F. Chemical Waste: This includes salts, acids, alkalies, herbicides, pesticides, and organic chemicals.
- G. Sanitary Wastes:
 - 1. Sewage: Waste characterized as domestic sanitary sewage.
 - 2. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.
 - 3. Hazardous Waste: Hazardous substances as defined in 40-CFR-261 or as defined by applicable State and local regulations.
 - 4. Oily Waste: Petroleum products and bituminous materials.

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS:

- A. Provide and maintain during the life of the contract, environmental protection as defined herein. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including but not limited to water, air, and noise pollution, hazardous waste, and solid waste pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SEDIMENT AND EROSION CONTROL:

- A. Do not remove sediment control measures until the areas served are stabilized, have established vegetative cover and Contracting Officer approves removal.
- B. When pumping sediment-laden water, direct discharge to an approved sediment trapping measure prior to release from the site.
- C. Locate all temporary stockpiles within areas protected by sediment control measures, and temporarily stabilize.
- D. Temporarily seed all sediment control dikes, swales, basins and flow lines to basins immediately upon installation to reduce contribution to sediment loading.
- E. Install temporary soil erosion control and sediment control measures prior to grading operations. Make location adjustments in the field as necessary. Disturb the minimum area practical for the minimum possible time.
 - 1. If grading is completed out of a seeding season, temporarily stabilize graded areas by mulch and mulch anchoring. Mulch material will be unweathered, unchopped small grain straw spread at the rate of 1 1/2 to 2 tons per acre. Accomplish mulch anchoring by an approved method, such as a mulch anchoring tool where possible.
- F. Implement sediment control measures in accordance with applicable requirements of the current edition of the Virginia Erosion and Sediment Control Handbook published by Virginia State Division Soil and Water Conservation.
- G. Erosion and Sedimentation Control (ESC) Plan: If the work under this contract involves disturbance of the site grounds, the Contractor shall prepare an Erosion and Sedimentation Control (ESC) Plan conforming to the erosion and sedimentation requirements of the most recent version of the EPA Construction General Permit OR local erosion and sedimentation control standards and codes, whichever is more stringent, and shall submit the Plan to the COTR prior to the start of construction for approval. The Plan shall describe the measures implemented to accomplish the following:
 - 1. Prevention of loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
 - 2. Prevention of sedimentation of storm sewers and receiving streams.
 - 3. Prevention of air pollution from dust and particulate matter.
 - 4. The Contractor is responsible to implement and maintain all measures necessary to control, filter, or prevent sediment from leaving the site as shown on the drawings and as described in the Project Manual.
- H. Protect all points of construction ingress and egress to prevent tracking of mud onto public ways. If conditions on the site are such that the majority of the mud is not removed by the vehicles traveling over the stone of the site access road and construction entrance, then the tires of the vehicles must be washed before entering the public road.
 - 1. Wash water must be carried away from the entrance to an approved settling area to remove sediment. All sediment shall be prevented from entering storm drains, ditches, or watercourses. A wash rack may also be used to make washing more convenient and effective.

- I. Existing stormwater management structures are a part of the site, do not remove sediment control structures before the contributing drainage area to the stormwater management structure is stabilized. Properly dewater sediment basins to prevent loss of sediment from the site.
 1. On sites where infiltration techniques are utilized for the control of stormwater, take extreme care to prevent all runoff from entering the structure during construction.

- J. Sediment control for utility construction in areas outside of designed controls:
 1. Place excavated trench material on high side of trench.
 2. Immediately following pipe installation backfill, compact and stabilize trench at the end of each working day when approved by the Contracting Officer.
 3. Place temporary silt fence or straw bale dikes immediately downstream of any disturbed area intended to remain disturbed longer than one day.

3.2 PROTECTION OF NATURAL RESOURCES:

- A. Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified.

- B. Land Resources: Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages, unless specifically authorized by the Contracting Officer. Where such use of attach ropes, cables, or guys is authorized, the Contractor shall be responsible for any resultant damage.
 1. Protection: Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Remove by approved excavation, trees with 30 percent or more of their root systems destroyed.
 2. Replacement: Remove trees and other landscape features scarred or damaged by equipment operations, and replace them with equivalent, undamaged trees and landscape features. Obtain the Contracting Officer's approval before replacement.
 3. Temporary Construction: Remove traces of temporary construction facilities such as stockpiles of excess or waste materials, and other signs of construction.

- C. Water Resources:
 1. Oily Wastes: Prevent oily or other hazardous substances from entering or leaching into the ground, groundwater, drainage areas, or local bodies of water. Surround temporary fuel oil or petroleum storage tanks with a temporary plastic-lined earth berm of sufficient size and strength to contain the contents of the tanks in the event of leakage or spillage and minimize contamination of the soil. Bituminous material waste may not be used as fill or base material.
 2. If more stringent: Oily waste is to be managed under Federal Regulations as Hazardous Waste according to 40 CFR 260-265 or as Used Oil

according to 40 CFR 279, whichever is appropriate for the waste. Virginia Hazardous Waste management Regulations found in Virginia Administrative Code (9VAC 20-60) in either case may be more stringent. The more stringent of either the state or the Federal regulations must be followed.

3.3 EROSION AND SEDIMENT CONTROL MEASURES:

- A. General Work Requirements:
 - 1. Burnoff: Burnoff of ground cover is not permitted.
 - 2. Protection of Erodible Soils: Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork in such a manner so as to minimize the duration of exposure of unprotected soils.

- B. Erosion and Sediment Control Plan: Implement erosion and sediment control measures and maintain erosion and sediment control measures during the life of the contract in accordance with pertinent regulations. After construction, and when the site has been stabilized and protected from erosion, temporary erosion and sediment control devices shall be removed and those areas stabilized to prevent any further erosion.

3.4 CONTROL AND DISPOSAL OF SOLID AND SANITARY WASTES:

- A. Pick up solid wastes, and place in containers which are regularly emptied. Do not prepare, cook, or dispose of food on the project site. Prevent contamination of the site and other areas when handling and disposing wastes. On completion, leave the areas clean. Control and dispose of waste.
 - 1. Disposal of Rubbish and Debris: Dispose of rubbish and debris in accordance with the requirements specified.
 - a. Remove and dispose of rubbish and debris from Government property.
 - 2. Garbage Disposal: Place garbage in approved containers, and move to a pickup point or disposal area, where directed.
 - 3. Sewage, Odor, and Pest Control: Dispose of sewage through use of chemical toilets or comparably effective units, and periodically empty wastes into an approved municipal sanitary sewage system by an authorized sanitary sewer cleaning service, or construct and maintain an approved type of adequate sanitary convenience for the use of persons employed on the work. Include provisions for pest control and elimination of odors.

3.5 CONTROL AND DISPOSAL OF HAZARDOUS WASTE:

- A. Hazardous Waste: All hazardous waste is to be managed according to 40 CFR 260-265 and Virginia Hazardous Waste Management Regulations found in 9VAC 20-60. Containers of hazardous waste may be removed from the project site only by a permitted hazardous waste hauler. All spills of hazardous materials are to be reported immediately to the COTR. A contingency plan for spill of hazardous materials is required as specified in 40 CFR Subpart D (265.50-265.56.) Store hazardous waste in approved containers (49-CFR-178) properly

labeled to identify the type of waste and the date that the waste was first placed in the container.

- B. Petroleum Products: Conduct the fueling and lubricating of equipment and motor vehicles so as to protect against spills and evaporation. Waste lubricants and any excess oil are to be managed under Federal Regulations as Hazardous Waste according to 40 CFR 260-265 or as Used Oil according to 40 CFR 279, whichever is appropriate for the waste. Virginia hazardous Waste management Regulation found in Virginia Administrative Code (9VAC 20-60), in either case may be more stringent. The more stringent of either the State or the Federal regulations must be followed.

3.6 DUST CONTROL:

- A. Keep dust down at all times, including during nonworking periods. Sprinkle or treat with dust suppressants the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming is not permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing is permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting is permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.
 - 1. Blast Cleaning: Minimize or eliminate the use of sandblasting or other blast cleaning operations at the construction site. Provide tarpaulin drop cloths and windscreens under and around sandblasting or other type blast cleaning operations to confine and collect dust, sand, paint, and other debris for disposal in accordance with the requirements specified.
 - a. Notify in advance and obtain written approval of the Contracting Officer's Representative for any blast cleaning operations proposed to be performed on the construction site.
 - b. Where sandblasting operations are deemed necessary, perform with blasting sand of less than 1.0% silica content.
 - 2. Existing paved roadways shall be kept free and clear of dirt, mud and stone. Contractor shall maintain a vehicle wash rack at construction entrance and require all vehicles to utilize same. Contractor shall sweep, wash or clean existing roadways after any accumulation of dirt or debris.
- B. Disposal Requirements: Collect dust, sand, paint, and other debris resulting from sandblasting operations and store in 55-gallon drums with watertight lids. Take a representative sample of this waste, and test according to TCLP test procedures for lead, chromium, and cadmium content. The sampling and testing shall be performed in accordance with 40-CFR-261. Handle debris resulting from the sandblasting operations as a hazardous waste, and dispose of in accordance with 40-CFR-262, 40-CFR-263, and 40-CFR-264. Meet all applicable requirements in this process. Transport hazardous waste only by a transporter licensed and permitted for transportation of hazardous waste. Dispose of hazardous waste in an EPA-approved and -permitted facility specifically designated for hazardous waste disposal.

3.7 NOISE

- A. Make the maximum use of low-noise emission products, as certified by the EPA.

3.8 HAZARDOUS WASTE GENERATION

- A. Hazardous waste is to be managed in accordance with 40 CFR 260-265 and State and local hazardous waste regulations. Virginia Hazardous Waste Management Regulations are found in Virginia Administrative Code (9VAC 20-60).

3.9 PROTECTION OF FLORA, FAUNA AND CENTRAL COMPUTER CONTROLLER IRRIGATION SYSTEM

- A. Flora Protection: The Contractor is expressly prohibited from collecting plant materials on Smithsonian property.
- B. The Contractor shall not store materials inside the drip-line of trees or shrubs. Prior to the start of the work on site, the Contractor shall surround trees within the project site and adjacent areas with a protective fence ("snow fence"), 1.4 m high (minimum), 300 mm outside the drip line (minimum). The protective fencing shall be constructed of heavy-duty metal posts or pressure-treated 100 mm X 100 mm wooden posts, 1 m on center, with a top and bottom stringer of 50 mm X 100 mm members. The fencing fabric shall consist of 40 mm X 13 mm slats, pressure-treated.
- C. Vehicular traffic inside the drip-line of trees, on turf areas or on flowerbeds is not permitted without prior approval of the Smithsonian Gardens through the COTR. If flowerbeds must be crossed by vehicles, bridging is required. Bridging shall be 2 layers of ¾ inch exterior grade plywood or 2" x 10" or 1" protective plastic decking such as Bravo mat or equal to help prevent soil compaction of the soil in the lawn areas and flowerbeds. No parking on the turf will be permitted at any time.
- D. Where aerial work is being performed above flower/shrub beds, the Contractor shall protect them with an approved protective framework installed at least 300 mm above the tops of the plant materials. The Contractor shall submit the proposed method of protection to the COTR and Smithsonian Gardens for approval. Trees and shrubs shall only be tied back with the approval of the COTR and Smithsonian Gardens.
- E. Any damage to the existing irrigation systems during construction shall be repaired by the Contractor within two calendar days from when the damage occurred. All repairs to the irrigation system shall be made by a certified irrigation contractor to work on Rain Bird Maxicom computer controlled irrigation systems. Certification is required.
- F. Damaged piping shall be replaced using approved materials per section Division Two, "Site Work, Irrigation Systems."
- G. The Contractor shall bear all costs for repairs to the damaged irrigation system. Where the low voltage control wiring is damaged due to construction, then said wiring shall be replaced from the zone valve to controller. No splicing will be permitted.

- H. Identification tape, when damaged, shall be replaced with an identification wire from valve to controller.
- I. All damaged irrigation piping shall be cleared of debris prior to making the permit connections.
- J. The Contractor shall bear all costs for replacement of damaged plant materials. Replacement plant materials shall meet the criteria established by the Smithsonian Gardens Division of the Office of Facilities Management and Reliability.
- K. Plant material removed by the Contractor for reuse shall be balled, bagged and protected in accordance with instructions prepared by the Smithsonian Gardens.
- L. Turf areas damaged during construction shall be repaired by the Contractor by rototilling a minimum depth of 6 inches, backfilled with sandy-loam topsoil. Sod shall be certified sod, none netted and a minimum of one year old. Sod shall be 90:10, consisting of a minimum of three varieties tall fescues and one Kentucky Bluegrass. Smithsonian Gardens, through the COTR, must approve the source of the sod. The Contractor shall bear all costs for these repairs. Suggested sources are:

Oakwood Sod Farm, Inc.
29307 Waller Road
Delmar, MD 21875
Phone: (410) 896-4009
Toll-Free: (800)379-8488

Collins Wharf Sod
25361 Collins Wharf Rd
Eden, MD 21822
Phone: 410-334-6676
Fax: 410-749-3815
cwsod@collinswharfsod.com

Summit Hall Sod Farm
21300 River Road
Poolesville, MD 20837-9114
Phone: 301-948-2900
Fax: 301-349-2668

- M. The Contractor shall be responsible for the daily removal of trash and construction debris from turf and flower/shrub beds within the limits of construction.
- N. Any plant material destroyed and/or damaged by the Contractor during construction shall be replaced with like genus and species of the same size, at no additional cost to the Smithsonian. The damaged plant materials must be replaced prior to final payment. The same applies to artifacts or furniture collection pieces. Smithsonian Gardens requires five (5) working days notice

should any of the artifacts or furniture collection need to be removed to facilitate construction.

- O. Any construction scaffolding on turf and planted beds must be coordinated with the Smithsonian Gardens through the COTR to ensure that its installation will not damage or destroy existing plant materials or turf area or interfere with daily maintenance of the grounds. Trees may be tied back to permit scaffolding erection, no more than 4 feet if possible. The tying back must be performed by a certified Arborist with the approval of Smithsonian Gardens and the COTR. Where scaffolding is necessary to facilitate construction, Smithsonian Gardens requires a three (3) workday notice for said work.

- P. Due to structural weight limits, vehicular traffic is permitted inside the Smithsonian's Enid A. Haupt Garden only with prior approval by the COTR and Smithsonian Gardens. SI analysis assumes that a contractor will not physically disturb the existing waterproofing system for the facility and that large amounts of soils or stone not be piled up on the structure, in addition to the vehicle weights. The allowable live load on the existing structure is 100 pounds per square foot. The following load values should not be exceeded without prior SI review:
 - 1. The first is the Gross Axle Weight Rating (GAWR) of 9,000. pounds. This is the maximum allotted load on one vehicle axle or piece of equipment axle. This includes summation of the vehicle or equipment weight, the load carried and personnel on the individual axle.
 - 2. The second is the Gross Vehicle Weight Rating (GVWR) of 14,000. pounds. This is the maximum allotted overall vehicle weight or equipment weight that includes the summation of the total vehicle or equipment weight, the total amount of material carried and personnel weights.
 - 3. The following is a list of common equipment models, which embody the maximum sizes of vehicle or equipment conforming to the weight ratings above:
 - a. Deere Landscape Loader 210LJ
 - b. Deere Tractor J165M
 - c. Caterpillar Compact Wheel Loader 906H
 - d. Ford Truck F350
 - e. Ford Truck F450
 - 4. Before either of the two listed load values (GAWR or GVWR) is exceeded by a truck or piece of equipment, the Office of Planning, Design and Construction (OPDC) shall be contacted for review. All cranes or lifts must also be reviewed by OPDC before using them in the area.

- Q. Fauna Protection: The Contractor is prohibited from hunting, collecting or feeding animals on Smithsonian property. All food and food wrapping brought on the premises must be properly disposed of in approved containers, which are secured from animals.

- R. If a generator is placed on the turf, SG must have approval of its placement. Generator shall be placed on anti-compactor boards. The generator must be placed in a drip containment basin.

- S. A schedule of values for plant material is not required.

- T. Topsoil: ASTM D 5268, fertile, naturally sandy loam as defined by USDA Handbook no. 18, Figure 38. It shall be natural, surface soil in a friable condition and contain less than 3% subsoil. The topsoil shall be free of hardpan material, stones and clods larger than ½ inch in diameter, sticks, tree or shrub roots, debris, toxic substances (e.g. Residual herbicides) and other material detrimental to plant growth. The area and the topsoil shall be free of plant or plant parts of undesirable plants such as, but not limited to, Bermuda grass, nut sedge, mugwort, Johnsongrass, Quackgrass, Canada Thistle or noxious weeds as set forth in the Federal Seed Act. It shall be certified free of Southern Blight.
1. Contractor shall notify COTR of location of all sources of the topsoil and furnish the COTR a certified report from the agricultural experiment station or approved agricultural laboratory of an analysis performed not more than 60 days prior to the date of submission. The topsoil shall be certified to meet the following requirements:
 - a. Shall be a natural, original surface soil of a sandy loam texture with a mechanical analysis of 60-65% sand, 15-25% silt and 10-15% clay.
 - b. Shall have at least 2%, but not more than 5%, organic matter.
 - c. Soil pH shall be 5.5 to pH 6.5 inclusive unless otherwise specified.
 - d. Soil salinity by electrical conductivity measurement shall not exceed 600 parts per million (ppm) as determined by Black, Editor "Method of Soil Analysis," Part 2, published by the American Society of Agronomy, 1965.
 - e. The soil nutrient level shall be greater than 100 lbs./acre of magnesium, 150 lbs./acre of phosphorous and 120 lbs./acre of potassium.
 2. Agricultural limestone at not more than 5 pounds per cubic yard of top soil may be used to adjust an acidic condition provided it is well mixed in a manner, which does not destroy the structure of the soil.
 3. Topsoil that has been synthesized by blending materials which individually do not meet the requirements of this specification will not be accepted even though the resulting blend meets the organic matter, mechanical analysis, pH and soluble salts requirements.
 4. The COTR reserves the right to inspect and sample all topsoil at the source and at the time of delivery. These inspections will be made without cost to the Contractor.
 5. Topsoil must not be delivered or handled in a frozen or muddy condition.
 6. Shipment and Delivery - All soil must be approved by the COTR before delivery to the site. Any material not meeting requirements of this specification will be rejected on or after delivery.

3.10 SCREENED LEAF MOLD

- A. As available through Maryland Environmental Services, 2020 Industrial Drive, Annapolis, MD 21401 (301/261-8596) or approved equal, completely composted and free from all materials such as glass, paper, plastics, etc. Composted sewage sludge shall not be used.

3.11 SOIL MIX AGGREGATE

- A. Aggregate shall be Solite 3/8 as manufactured by Solite Corp., 2508 Chamberlayne Avenue, Richmond, VA or approved equal. Lightweight aggregate shall be expanded shale or slate expanded by the rotary kiln process. The

aggregate shall meet the requirements of the American Society of Testing Materials C331-81 and C33-80.

3.12 BACKFILL

- A. When existing soil is acceptable for use: Existing topsoil shall be used unless so directed otherwise by the COTR. The following mixture in accordance with the specifications herein, thoroughly mixed by volume shall be used as backfill:
 - 6 parts existing soil
 - 2 parts leaf mold
 - 2 parts solite #388

- B. When existing soil is not acceptable for use: If so determined by the COTR that the existing soil is not acceptable for use, the Contractor shall excavate all soil to a depth of 24 inches and disposed of off site. The following backfill mixture, thoroughly mixed by volume in accordance with the specifications herein, shall replace the excavated soil.
 - 60% sandy loam topsoil
 - 20% Solite #388
 - 20% Composted leaf mold

- C. Backfill shall be mixed off site. If requested, backfill shall be mixed in the presence of the COTR. Backfill must be approved by the COTR before delivery to the job site.

3.12 GROUND LIMESTONE

- A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80% calcium carbonate equivalent with a minimum 99% passing a No. 8 (2.36 mm) sieve and a minimum 75% passing a No. 60 (250 micrometer) sieve.

- B. Provide lime in the form of dolomitic limestone.

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 2. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

- D. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
 - 1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 - 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 - 3. Completed List: Within 60 days after date of commencement of the Work, submit electronic copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - 4. COTR's Action: COTR will respond in writing to Contractor within 21 calendar days of receipt of completed product list. COTR's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. COTR's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
- B. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 6. Protect stored products from damage and liquids from freezing.
 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

- a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. COTR's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements.
1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect (through the COTR) will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 2. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect (through the COTR) will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
- E. Codes, Standards, and Regulations: Select products that are in compliance with the Project specifications, as well as with construction standards and all applicable codes and regulations.
- F. 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.
- G. Prescriptive Requirements: Provide products that have been produced in accordance with prescriptive requirements, using specified ingredients and components, and comply with specified requirements for mixing, fabricating, curing, finishing, testing, and other operations in the manufacturing process.
- H. 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.
- I. Provide products complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation for intended use and effect.

- J. 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.
- K. Product selection shall be done in accordance with the following requirements:
 - 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.
 - 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.
 - 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.
 - 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.
 - 5. Avoidance of banned materials: The Contractor will commit to not using the following toxic and hazardous materials:
 - a. Products containing asbestos, added urea formaldehyde, polychlorinated biphenyls (PCBs) and/or chlorinated fluorocarbons;
 - b. Products containing lead content, including solder 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.

2.2 COMPARABLE PRODUCTS

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

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 7300

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting surveys.
 - 2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 3. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
 - 4. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 3. Products: List products to be used and firms or entities that will perform the Work.
 4. Dates: Indicate when cutting and patching will be performed.
 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure. Do not cut or alter structural members except where noted on the drawings, without approval of the cutting and patching proposal and authorization of the COTR.
 7. COTR's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 INFORMATIONAL SUBMITTALS

- A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- B. Qualification Data: For professional engineer to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.
- D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- E. Certified Surveys: Submit two copies signed by professional engineer.
- F. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.6 QUALITY ASSURANCE

- A. 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.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: Do not cut and patch structural elements in a manner that could change their load carrying capacity or load-deflection ratio.
2. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
 - a. Foundation construction.
 - b. Bearing and retaining walls.
 - c. Structural concrete.
 - d. Lintels.
 - e. Stair systems.
 - f. Miscellaneous structural metals.
3. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - a. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - 1) Primary operational systems and equipment.
 - 2) Fire separation assemblies.
 - 3) Air or smoke barriers.
 - 4) Fire-suppression systems.
 - 5) Mechanical systems piping and ducts.
 - 6) Control systems.
 - 7) Communication systems.
 - 8) Fire-detection and -alarm systems.
 - 9) Conveying systems.
 - 10) Electrical wiring systems.
 - 11) Operating systems of special construction.
 - 12) Electronic security systems.
4. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - a. Obtain approval of the cutting and patching proposal before cutting and patching the following elements:
 - 1) Water, moisture, or vapor barriers.
 - 2) Membranes and flashings.
 - 3) Exterior windows, entrances, and storefronts.
 - 4) Equipment supports.
 - 5) Piping, ductwork, vessels, and equipment.
 - 6) Noise- and vibration-control elements and systems.
5. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 - a. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
 - 1) Processed concrete finishes.
 - 2) Ornamental metal.
 - 3) Matched-veneer woodwork.
 - 4) Preformed metal panels.
 - 5) Roofing.
 - 6) Fire stopping.

- 7) Window system.
 - 8) Stucco and ornamental plaster.
 - 9) Carpeting.
 - 10) Fluid-applied flooring.
 - 11) Wall covering.
 - 12) HVAC enclosures, cabinets, or covers.
- C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- D. Call unknown conditions exposed by removal of existing work that do not match new finishes or align with new work to the COTR's immediate attention. Necessary corrective work directed by the COTR will be subject to adjustment provisions as stated in the Contract.
- E. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.
- F. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Existing Utility Interruptions: Any planned interruption in utility service must be approved by and coordinated through the COTR. The Contractor shall submit a written request as far in advance of scheduled interruption as possible, but no less than two (2) full working days in advance. The Contractor shall make the necessary temporary provisions to supply continuous electrical power, HVAC space conditioning and security as required during periods when service is interrupted.
- C. The Contractor's work efforts to restore service shall be continuous until the interrupted utility is back in service.

- D. A fire watch shall be provided for the time periods when fire suppression and detection systems are out of service.
- E. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- F. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- G. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

3.4 FIELD ENGINEERING

- A. Identification: Existing benchmarks, control points, and property corners are shown on the Contract Documents accurately to the best of the SI's knowledge.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of the COTR. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to COTR before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.
- E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of **96 inches (2440 mm)** in occupied spaces and **90 inches (2300 mm)** in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. 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.
- B. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- C. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- D. Temporary Support: Provide temporary support of work to be cut.

- E. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- F. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- G. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- H. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- I. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition and ensures thermal and moisture integrity of building enclosure.

J. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

K. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.

3.7 SI-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for SI's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by SI's construction personnel.

1. Construction Schedule: Inform COTR of Contractor's preferred construction schedule for SI's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify COTR if changes to schedule are required due to differences in actual construction progress.

2. Preinstallation Conferences: Include SI's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by SI's construction personnel if portions of the Work depend on SI's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Maintain Project site in as neat and orderly a manner as is consistent with normal operations. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

5. 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.

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

7. 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

B. Site: Maintain Project site free of waste materials and debris.

- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 DUST AND AIR QUALITY CONTROL

- A. 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.
- B. 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.
- C. 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.

- D. No open fires or burning of trash are permitted.

3.10 VERMIN, PEST AND RODENT CONTROL incorporate into 017300 EXECUTION

- A. 32.1. The Contractor shall develop an Integrated Pest Management (IPM) plan and provide regularly scheduled inspection services by a licensed Pest Management Professional to manage and, when possible, to eliminate insects, rodents, birds, arachnids and other miscellaneous pests invading the project site or premises for the duration of the project. In general, preventative pesticide applications are prohibited. Preventative pesticide applications may be made when there is a surveillance-based indication of pest infestation. Such applications shall be made on a case-by-case basis and only upon written approval of the COTR prior to such application. The IPM plan must address all the specific IPM requirements listed in the Leadership for Energy and Environmental Design (LEEDTM) Existing Buildings: Operations & Maintenance Indoor Environmental Quality (IEQ) Credit for Green Cleaning: Indoor Integrated Pest Management, including preferred use of nonchemical methods, the use of least toxic pesticides as identified by San Francisco Tier 3 Low Hazard pesticides (SF Pesticide Hazard Screening List), the definition of emergency conditions (defined as a threat to landscape, building integrity or human occupancy after non-chemical methods have been exhausted) and universal notification (advance notice of not less than 72 hours under normal conditions and 24 hours in emergencies before a pesticide, other than a least toxic pesticide, is applied in a building or on surrounding grounds that the building management maintains). Any outdoor IPM plan must also be integrated with any indoor IPM plan for the building, as appropriate.
- B. Throughout the term of this contract, all Contractor personnel providing on site pest control service must maintain pesticide certification(s) as a Commercial Pesticide Applicator in the appropriate EPA category (Industrial, Institutional, Structural and Health Related Pest Control). Minimum pesticide certification is to include General Pest Control and Rodent Pest Control categories.
- C. The Contractor shall describe methods and procedures to be used for identifying sites of pest harborage and access and for making objective assessments of pest population levels throughout the term of the contract.
- D. The Contractor shall provide photocopies of state-issued Commercial Pesticide Applicator certificates for every Contractor employee who will be performing on site pest management services under this contract, as well as current Pesticide Business Licenses for the state(s) in which these services are to be performed.
- E. All employees of the Contractor performing pest control services on the site(s) specified in this solicitation shall carry with them, as required by law, their personal pesticide identification card.
- F. Other employees of the Contractor who are not certified in any applicable pest control category shall, as a condition to performing pest management services under this contract, meet one of the following requirements:
 1. Shall perform pest management services under the direct and immediate supervision of the Contractor's certified pesticide applicator(s).
 2. Will have obtained a written waiver of this provision from the COTR based upon the employees' special qualifications and /or exigent circumstances. The COTR shall have complete discretion to approve or disapprove such waiver.

- G. The Contractor shall be responsible for advising the COTR about any structural, sanitary or procedural modifications that would reduce pest food, water, harborage or access.
- H. The Contractor shall obtain the approval of the COTR prior to any application of sealing materials or other structural modifications to prevent the introduction of pests into the project site or premises.
- I. The Contractor shall be responsible for carrying out work according to an approved pest management plan. The Contractor shall receive concurrence of the COTR prior to implementing any subsequent changes to the approved pest management plan, including additional or replacement pesticides and onsite service personnel.
- J. On occasion, the COTR may request that the Contractor perform corrective, special or emergency pest control services that occur outside routine service hours. The Contractor shall respond to all such requests within four (4) hours after receipt of the request.
- K. The Contractor shall submit the following information to the COTR for approval at least ten (10) working days prior to the use of any pesticide or chemical:
 - 1. Material Safety Data Sheets (MSDSs) for the pesticide or chemical being used.
 - 2. Written description of each proposed type of use, targeted species and restrictions on use of the area treated during and after application.
- L. The Contractor shall remove dead rodents from the premises within 24 hours. Dead rodents in inaccessible areas may be treated with dilute sodium hypochlorite, neutroleum alpha or similar disinfecting or deodorizing agent. Trapping devices are the preferred method for the control of commensal rodents. The Contractor shall be responsible for disposing of all trapped rodents and all rodent carcasses in an appropriate manner.
- M. The Contractor shall use the safest means to protect Smithsonian property during pest management operations. If damage to artifacts, collections or any SI property occurs, the Contractor must not attempt any remedial action. The collections manager, COTR and/or building manager must be notified immediately.
- N. Pesticides that constitute an extreme hazard to the environment, such as rodenticides, shall be placed in locations not accessible to children, pets and non-target wildlife or in EPA approved "tamper-resistant" bait boxes. Tamper-resistant boxes shall be constructed of sturdy materials, have a means for locking lids and be capable of being anchored securely to prevent unauthorized efforts to move the box or to displace its contents.
- O. All bait boxes shall be maintained in accordance with EPA regulations, with an emphasis on the safety of non-target organisms. The Contractor shall adhere to the following points regarding bait box policy:
 - 1. All bait boxes shall be placed out of the general view, in locations where they will not be disturbed by routine operations.
 - 2. The lids of all bait boxes shall be securely locked or fastened shut.
 - 3. All bait boxes shall be securely attached or anchored to the floor, ground, wall or other immovable surface, so that the bait box cannot be picked up or moved.
 - 4. Rodenticide bait shall always be secured in the feeding chamber of the bait box and never placed in the runway or entryways of the bait box.
 - 5. All bait boxes shall be labeled on the inside with the Contractor's business name, address and dated by the Contractor's service specialist at the time of installation and with each service.

- P. Application of rodenticide outside of buildings shall emphasize direct treatment of rodent burrows, with the application of tracking powder favored over application of anticoagulant type rodenticides.
- Q. The Contractor shall minimize the use of and potential exposure to pesticide wherever possible through the use of nonchemical control methods and materials.
- R. When it is determined that a pesticide must be used in order to obtain adequate control, the Contractor shall utilize the least hazardous material, most precise and species-targeted application and the minimum quantity of pesticide necessary to achieve control.
- S. The Contractor shall be required to maintain an accurate, up-to-date pest activity logbook(s) to document pest sightings, pest control procedures and any communications to staff regarding IPM or pesticide use. The logbook(s) shall be kept on site and maintained on each visit by the Contractor.
- T. The Contractor shall observe all pesticide safety precautions throughout the performance of this contract. All work shall be in strict accordance with all applicable Federal, State and Local safety and health regulations. Where a conflict between applicable regulations arises, the most stringent will apply.
- U. The Contractor is prohibited from storing any pesticide product in the buildings specified in this contract.
- V. The Contractor shall establish a complete Quality Control (QC) program to assure the requirements of the contract are provided as specified in accordance with this solicitation. The QC program shall include at least the following items:
 - 1. Inspection System: The Contractor's quality control inspection system shall cover all the services stated in this contract. The purpose of the QC program is to detect and correct deficiencies in the quality of workmanship before the level of performance becomes unacceptable and/or the COTR identifies the deficiencies.
 - 2. A quality control checklist shall be used in evaluating contract performance during regularly scheduled and unscheduled inspections. The checklist shall include every building or site serviced by the Contractor as well as every required task.
 - 3. A Quality Control (QC) file shall contain a record of all inspections conducted by the Contractor and any corrective actions taken. The QC file shall be maintained throughout the term of the contract and made available to the COTR or authorized SI staff personnel, upon request.
 - 4. The Contractor shall state the name(s) of the individual(s) responsible for performing the Quality Control (QC) inspections.

3.11 DRILLING, WELDING AND TORCH CUTTING

- A. Daily Permits: When welding, torch cutting or other heating operations are to occur inside existing structures, the Contractor shall obtain a daily HOT WORK PERMIT from the Building Manager's Office. Permit must be obtained no more than 24 hours in advance, including for days following holidays, Mondays and off-hours (night) work. Reference attached Hot Work Permit form and General Instructions for required permit process. The PAI (Permit Authorizing Individual) will be available in the Building Management Office and/or throughout the Facility. Building Management Office hours are from 8am to 4pm. The permit must be posted at the job site prior to beginning the scheduled work. During the course of the Work, all existing smoke

and heat detectors and sprinklers heads must remain operable. Coverings may be applied to protect them from spray coatings or other hazardous conditions only during the actual operations. Coverings must be removed immediately after the operations have concluded, but at the end of each working day at a minimum. When work produces dust or other airborne contaminants, e.g. spray painting, that could impair existing fire suppression or detection system(s) or when the system itself is otherwise impaired (drained down, etc.), the Contractor shall obtain a daily FIRE SYSTEM IMPAIRMENT PERMIT. Fire System Impairment Permit must be obtained a minimum of 48 hours in advance. Reference attached Fire System Impairment Permit form and General Instructions.

- B. 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.
- C. 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.
- D. 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.

3.12 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.13 COMMISSIONING

- A. Comply with requirements of Division 1 Section 01810, "Commissioning Requirements."

3.14 PROTECTION OF INSTALLED CONSTRUCTION

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

3.15 CORRECTION OF THE WORK

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

END OF SECTION

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes required salvage and recycling of the following waste materials and applies to all such listed waste materials produced during the course of this Contract:

1. Land Clearing Debris: Solid waste generated solely from land clearing operations, such as stumps and trees.
2. Concrete, Masonry, and Other Inert Fill Material: Concrete, brick, rock, clean soil not intended for other on-site use, broken up asphalt pavement containing no ABC stone, clay, concrete, or other contaminants, and other inert material.
3. Metals: Metal scrap including iron, steel, copper, brass, and aluminum.
4. Untreated Wood: Unpainted, untreated dimensional lumber, plywood, oriented strand board, masonite, particleboard, and wood shipping pallets.
5. Gypsum Wallboard Scrap: Excess drywall construction materials including cuttings, other scrap, and excess materials.
6. Salvaged Materials: Reusable lumber, fixtures, and building supplies
7. Cardboard: Clean, corrugated cardboard such as used for packaging, etc.
8. Paper: Discarded office refuse such as unwanted files, correspondence, etc.
9. Plastic Buckets: Containers for various liquid and semi-solid or viscous construction materials and compounds.
10. Beverage Containers: Aluminum, glass, and plastic containers.
11. Other Mixed Construction and Demolition Waste: Solid waste resulting solely from construction, remodeling, repair, or demolition operations on pavement, buildings, or other structures exclusive of waste materials listed herewith.
12. Non-Recyclable Waste: Collect and segregate non-recyclable waste for delivery to a permitted landfill site.
13. Mixed Solid Waste: Solid waste usually collected as a municipal service, exclusive of waste materials listed above.
14. Hazardous Waste: Control and disposal of hazardous waste is specified in Division 1 "Environmental Protection" section.

- B. Related Requirements:

1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

- A. Waste Materials are defined as large and small pieces of the materials indicated which are excess to the contract requirements and generally include materials which are to be salvaged from existing construction and items of trimmings, cuttings and damaged goods resulting from new installations, which cannot be effectively used in the WorkDisposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- B. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- C. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- D. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 ACTION SUBMITTALS

- A. Construction Waste Management Plan: Before start of construction, submit for the approval of the COTR a construction waste management plan indicating how Contractor proposes to collect, segregate, and dispose of all construction wastes and debris produced by the work of this Contract. Show compliance with regulations specified under "Quality Assurance" article below. Include a list of recycling facilities to which indicated recyclable materials will be distributed for disposal. Identify materials that are not recyclable or otherwise conservable that must be disposed of in a landfill or other means acceptable under governing State and local regulations. List permitted landfills and/or other disposal means to be employed. Indicate any instances where compliance with requirements of this specification does not appear to be possible and request resolution from the Smithsonian Institution through the COTR.
- B. Delivery Receipts: Provide to the COTR delivery receipts for waste materials salvaged and sent to permitted waste materials processors or recyclers within 48 hours of delivery that indicate the location and name of firm accepting recyclable waste materials, types of materials, net weights of each type, date of delivery and value of materials.

1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use forms acceptable to Architect and Owner. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste by weight or volume.
 - 4. Quantity of waste salvaged, both estimated and actual by weight or volume.
 - 5. Quantity of waste recycled, both estimated and actual by weight or volume.
 - 6. Total quantity of waste recovered (salvaged plus recycled) by weight or volume.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

- B. Recycling and Processing Facility Records: Before request for Substantial Completion, submit receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- C. Landfill and Incinerator Disposal Records: Before request for Substantial Completion, submit receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with all applicable requirements of Commonwealth of Virginia and applicable local ordinances and regulations concerning management of construction, demolition, land clearing, inert, and yard trash debris and any and all subsequent modifications and amendments to same.
- B. Disposal Sites, Recyclers, and Waste Materials Processors: Use only facilities properly permitted by the Commonwealth of Virginia, and by local authorities where applicable.
- C. Pre-Construction Waste Management Conference: Prior to beginning work at the site, schedule and conduct a conference to review the Construction Waste Management Plan and discuss procedures, schedules and specific requirements for waste materials recycling and disposal. Discuss coordination and interface between the Contractor and other construction activities. Identify and resolve problems with compliance with requirements. Record minutes of the meeting, identifying all conclusions reached and matters requiring further resolution.
 - 1. Attendees: The Contractor and related Contractor personnel associated with the work of this section, including personnel to be in charge of the waste management program; the Contractor's Construction Quality Manager; the COTR; and such additional Owner personnel as the Owner deems appropriate.
 - 2. Plan Revision: Make any revisions to the Construction Waste Management Plan agreed upon during the meeting and incorporate resolutions agreed to be made subsequent to the meeting. Submit the revised plan to the COTR for approval.
- D. Implementation: Designate an on-site party responsible for instructing workers and implementing the Construction Waste Management Plan. Distribute copies of the Construction Waste Management Plan to the job site foreman and each subcontractor. Include waste management and recycling in worker orientation. Provide on-site instruction on appropriate separation, handling, recycling, and salvaging methods to be used by all parties at the appropriate stages of the work at the site. Include waste management and recycling discussion in pre-fabrication meetings with subcontractors and fabricators. Also include discussion of waste management and recycling in regular job meetings and job safety meetings conducted during the course of work at the site.
Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.7 STORAGE AND HANDLING:

- A. Site Storage: Remove all indicated recyclable materials from the work location to approved containers daily. Failure to remove waste materials will be considered cause for withholding payment and termination of Contract.
- B. Position covered containers for recyclable waste materials at a designated location on the Project Site. Select a location for the recyclable materials containers separated from that of general waste and rubbish containers. Provide separate collection containers for a minimum of the following materials:
 - 1. Untreated lumber.
 - 2. Gypsum wallboard.
 - 3. Paper, paper products, and cardboard.
 - 4. Plastics.
 - 5. Metals.
 - 6. Glass.
 - 7. Other salvageable materials.
- C. Change out loaded containers for empty ones as demand requires, but not less than weekly.
- D. Handling: Deposit all indicated recyclable materials in the containers in a clean (no mud, adhesives, solvents, petroleum contamination), debris-free condition. Do not deposit contaminated materials into the containers until such time as such materials have been cleaned.
- E. If the contamination chemically combines with the material so that it can not be cleaned, do not deposit into the recycle containers. In such case, request resolution by the COTR as to disposal of the contaminated material. Directions from the COTR do not relieve the Contractor from compliance with all legal and regulatory requirements for disposal, nor shall such directions cause a request for modification of the Contract.

1.8 PROJECT/SITE CONDITIONS:

- A. Environmental Requirements: Transport recyclable waste materials from the Work Area to the recycle containers and carefully deposit in the containers without excess noise and interference with other activities, in a manner to minimize noise and dust. Reclose container covers immediately after materials are deposited.
 - 1. Do not place recyclable waste materials on the ground adjacent to a container.

1.9 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction and work plan. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste or other approved form. Include estimated quantities and assumptions for estimates.

- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste or other approved form. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Source Separation: Separate, store, protect, and handle at the project site all identified recyclable and salvageable waste products to prevent contamination of materials and maximize recyclability and salvageability of materials.
- C. Arrange for the regular collection, transport from the site, and delivery to respective approved recycling centers of indicated recyclable waste materials. Maintain records accessible to the COTR for verification of construction waste materials recycling.
- D. Delivery Receipts: Arrange for timely pickups from the site or deliveries to approved recycling facilities of designated waste materials to keep construction site clear and prevent contamination of recyclable materials. Keep and maintain records of all deliveries to recycling facilities and all pickups of waste materials at the site by others as specified above.
- E. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
1. Distribute waste management plan to everyone concerned within three days of submittal return.

2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

F. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

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 installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

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

C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

E. Plumbing Fixtures: Separate by type and size.

F. Lighting Fixtures: Separate lamps by type and protect from breakage.

G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE MATERIALS HANDLING

- A. General: The following paragraphs supplement handling requirements for various of the materials identified for classification and recycling listed in Part 1 "Summary" article above.
- B. Paper: Classify and handle waste paper goods as follows:
 - 1. Bond Paper: As generally found in the construction offices and used for specifications, correspondence, copiers, PC laser printers and FAX machines. Collect in a separate container at each workstation and deposit loose in the appropriate recycle container daily.
 - 2. Newsprint: Newspapers and tabloid style advertising (slick finish magazines and advertising materials are not typically recyclable). Collect in a single location and deposit daily in the appropriate recycle container.
 - 3. Diazo Prints (drawings): Set up a single location for collection. Roll together to minimize space. Deposit daily in the appropriate recycle container.
- C. Packaging materials:
 - 1. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 2. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
 - 3. Cardboard and paperboard cartons and boxes: Knock-down, fold flat and deposit in the appropriate recycle container.
 - 4. Paper packing materials (separators, stiffeners, etc.) shall be placed in the same container.
 - 5. Newsprint, used as packing (shredded or whole), shall be deposited in the recyclable container for newsprint.
 - 6. Plastic (polystyrene peanuts and other shapes) shall be deposited in the recyclable container for plastics.
 - 7. Metal and plastic banding materials shall be deposited in the appropriate container.

- D. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
- E. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
- F. Wood Materials:
 - 1. Sort and stack members according to size, type, and length.
 - 2. Separate lumber, engineered wood products, panel products, and treated wood materials.
 - 3. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 4. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- G. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- H. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- I. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- J. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- K. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- L. Conduit: Reduce conduit to straight lengths and store by type and size.
- M. Metals: Cut all items to lengths and sizes to fit within the container provided, when necessary. Where there is sufficient quantity of a specific recyclable waste item (for example; salvaged metal roofing or duct work), make special arrangements for items to be bundled, banded or tied, and stack in a designated location for a special pick-up. Coordinate all special arrangements with the Contractor's Construction Quality Manager.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- N. Plastics: Collect recyclable plastics (polystyrene and others specifically marked for recycling) daily from work areas and deposit in designated containers.
- O. Glass: Remove waste glass products (sheet, bottles, etc.) daily from the work area and deposit in designated containers. Where glass containers are marked for separation by color or type, segregate glass accordingly. Glass containing imbedded wire (typical in some fire rated doors having glazed lights) is usually not reprocessed; verify with the COTR that wire glass is not recyclable.
- P. Gypsum Board:
 - 1. Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

2. Separate gypsum wallboard from other wastes. Dispose of waste gypsum wallboard off-site at a gypsum reclamation or recycling facility, or on-site as a soil amendment.
 - a. For on-site application as a soil amendment, incorporate waste gypsum wallboard in landscape areas under construction, at a rate of 50 pounds per 1000 square feet, or approximately one ton per acre.
 - 1) Material must be unpainted gypsum wallboard from new construction, ground to reduce material to a fine particle size (70% passing a 100 mesh screen), and must be fully incorporated into the soil surface.

Q. Other Items: Where recyclability classification of any given waste material is unclear, verify with the COTR.

3.5 DISPOSAL OF WASTE

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

3.6 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-3 for construction waste reduction work plan.
- D. Form CWM-4 for demolition waste reduction work plan.
- E. Form CWM-7 for construction waste
- F. Form CWM-8 for demolition waste.

END OF SECTION

FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION

MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED* (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C = A x B)	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

FORM CWM-2: DEMOLITION WASTE IDENTIFICATION

MATERIAL DESCRIPTION	EST. QUANTITY	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
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				
Glazing				
Acoustical Tile				
Carpet				
Carpet Pad				
Demountable Partitions				
Equipment				
Cabinets				
Plumbing Fixtures				
Piping				
Piping Supports and Hangers				
Valves				
Sprinklers				
Mechanical Equipment				
Electrical Conduit				
Copper Wiring				
Light Fixtures				
Lamps				
Lighting Ballasts				
Electrical Devices				
Switchgear and Panelboards				
Transformers				
Other:				

FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN

MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

FORM CWM-4: DEMOLITION WASTE REDUCTION WORK PLAN

MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
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						
Glazing						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						

FORM CWM-8: DEMOLITION WASTE REDUCTION PROGRESS REPORT

MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
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								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Instructions of Owner's Personnel
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for progress cleaning of Project site.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 PROJECT CLOSEOUT

- A. Definition: 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).

1.4 SUBSTANTIAL COMPLETION

- A. 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.

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
- B. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 2. Advise COTR of pending insurance changeover requirements.
 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Obtain and submit releases permitting COTR unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 5. Prepare and submit Project Record Documents, Operation and Maintenance (O&M) manuals, Final Completion construction photographs and photographic negatives, damage or settlement surveys, property surveys, and similar final record information.
 6. Deliver tools, spare parts, extra materials, and similar items to location designated by the COTR. Label with manufacturer's name and model number where applicable.
 7. Make final changeover of permanent locks and deliver keys to COTR. Advise SI's personnel of changeover in security provisions.
 8. Complete startup testing of systems, including completion of all Functional Testing activities associated with commissioning of systems. Refer to Division 1 Section 01810, "Commissioning Requirements," for system to be commissioned.
 9. Submit test/adjust/balance records.
 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 11. Advise Owner of changeover in heat and other utilities.
 12. Submit changeover information related to SI's occupancy, use, operation, and maintenance.
 13. Schedule required training sessions for SI personnel.
 14. Complete final cleaning requirements, including touchup painting.
 15. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- C. Inspection: 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.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.
- D. Other Prerequisites for Substantial Completion Inspection: The Contractor shall also complete the following prior to requesting inspection for certification of substantial completion:
1. Testing and start-up of systems.
 2. Installation of all signage, including accessibility related signs, equipment instructions, identification labels and permanent directional signs.
 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.

4. Scheduling of training sessions for Smithsonian personnel.
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.
6. Disposition of samples and mock-ups not incorporated into the work.
7. Arrangement for permanent utility connections and billing responsibility transfer to Smithsonian's Office of Facilities Operations (OFO).
8. Arrangement for transfer of security responsibility for the project site and changeover of locks by Smithsonian's Office of Protection Services (OPS).
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. The Hazardous Waste Manifest must be reviewed and signed by the Facility Hazardous Waste Coordinator (Matt Gross) for RCRA hazardous waste generated on and shipped from NASM property.
 - a. Hazardous Waste Manifests
 - b. Notification and Certification Forms
 - c. Material Profile Sheet or characterization
 - d. Container Content Sheets
 - e. Certificates of Disposal

1.5 FINAL COMPLETION AND ACCEPTANCE

- A. Definition: The date of Final Completion of the Project is the date, as confirmed by the COTR, when the Work is satisfactorily completed and accepted in accordance with the Contract Documents, as amended and/or modified.
- B. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 1. Submit a final Application for Payment according to Division 1, Section 01290, "Payment Procedures."
 2. Submit certified copy of Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by COTR. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Arrange for final change-over of locks.
 4. Submit evidence of payment and transfer date of utility company accounts for those utilities previously billed to the Contractor during construction.
 5. Submit evidence that all regulatory agency permit and code requirements have been completed and recorded, as necessary.
 6. Submission of a signed, written statement that no damage has occurred to the Site as documented by the Final Photographic/Video Recording Documentation report.
 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 8. Submit pest-control final inspection report and warranty.
 9. Instruct SI personnel in operation, adjustment, and maintenance of products, equipment, and systems. Upon completion of all required training, the COTR will provide the Contractor with written acknowledgement that required instruction was completed. Submit demonstration and training video recordings. Post operating instructions, approved by the COTR, as required by the Specifications. Operating instructions

exposed to the weather shall be suitably weather-protected. Instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling. Coordinate location of posted instructions with the COTR.

10. Final Clean-up.
 - C. 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.
 - D. 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.
 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.
 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.
 - E. Final Application for Payment: Complete all requirements for transmittal of the Final Application for Payment in accordance with Division 1, Section 01290, "Payment Procedures", including submission of:
 1. Final labor data and Construction Progress Schedule update.
 2. Certification, signed by the Contractor, that all Contract requirements, including Contract Modifications, have been met.
 3. Release of assignment of claims or consent of surety submitted, as necessary.
 4. Return of all parking permits and ID badges.
 5. Final Project Record Documents.
- 1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)
- A. 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:
 1. Items requiring additional time;
 2. Amount of time needed to complete each item;
 3. Reasons why the items cannot be completed by the contract completion date
 - B. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 1. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 2. Include the following information at the top of each page:
 - a. Project name.

- b. Date.
 - c. Name of Architect and Contractor.
 - d. Name of Contractor.
 - e. Page number.
3. Submit list of incomplete items in the following format:
- a. MS Excel electronic file.

1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of COTR for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive **8-1/2-by-11-inch (215-by-280-mm)** paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 4. Each warranty certificate or bond shall identify the date(s) for:
 - a. Substantial Completion status in accordance with Project Closeout requirements.
 - b. Beginning and ending of the warranty period.
 5. Provide any coincidental product warranty that is available on a product incorporated in the Work, but for which the warranty is not specifically required by the Contract Documents.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.
- E. 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 SI takes partial occupancy before Final Completion, then the warranty for that portion of the Work shall be in effect for a period of one (1) year beginning on the date of Substantial Completion for that portion of the Work.

1.8 FINAL COMPLETION AND ACCEPTANCE

- A. 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.
- B. 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.
- C. Prerequisites for Final Completion: Prior to requesting the inspection for certification of Final Completion, the Contractor shall complete the following:
1. Submission of a copy of a prior punch-list stating that each item has been completed or otherwise resolved for acceptance.
 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.
 - a. 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.
 - b. 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.
 - c. Upon completion the Contractor shall obtain written acknowledgment from the COTR that the required instruction was completed.
 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.
 4. Provision of equipment demonstrations for each equipment item. The Contractor shall coordinate scheduling of all demonstrations through the COTR.
 5. Submission of original warranties for all products, equipment and systems.
 - a. The Contractor shall assemble original warranty certificates or notarized copies of warranty certificates executed by the Contractor, Subcontractors, suppliers and manufacturers in a tab-indexed, three-ring loose-leaf binder with a durable plastic cover. Provide electronic copy, in PDF format, on CD. The table of contents shall identify the item covered, the location of the item, the date of Substantial

- Completion, expiration date of the warranty and the supplier, vendor and installing contractor. Duplicate notarized copies of warranties shall be provided as required by "Manuals for Operation, Maintenance and As-Built Product Data."
- b. 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.
 - c. 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.
- 6. Submission of construction progress photographs and negatives, property survey and similar final record information.
 - 7. Arrangement for changeover locks through the COTR and Smithsonian Office of Protection Services as required for security for Smithsonian occupancy.
 - 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.
 - 9. Submission of evidence that all regulatory agency permit and code requirements have been completed and recorded, as necessary.
 - 10. Submission of a signed, written statement that no damage has occurred to the site as documented by the pre-condition survey report.
 - 11. Final clean up
- D. 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.
- E. Application for Final Payment:
- 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.
 - 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 underground, under concrete, in chases or above ceilings shall be shown by perpendicular dimensions from at least two available landmarks. As-built drawings shall be neatly marked with colored pencils or ink, marked "As-Built" and signed and dated by the Contractor. Upon completion of the Work and before final payment, the Contractor shall submit the following to the COTR: electronic copies of as-built record drawings in PDF and DWG formats.

- f. As-Built Record Survey of Underground Utilities Submitted: If outside or underground utilities are part of the work, the Contractor shall furnish, to the COTR for approval, an acceptable and accurately dimensioned survey showing location and elevation of underground storage tanks, all utility lines for water, gas, electrical, sewer, steam, etc., including valves, connections and changes in direction, as installed under the contract, within the property lines and outside the building walls. Points where utility lines emerge from the building shall be located from lot monuments. The survey shall be made to scale and must be marked "As-Built" and signed and dated by the Contractor. The Contractor shall furnish a scanned, digital copy to the COTR.
- 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.
- i. Final Videotape Documentation Submitted: The Contractor shall employ a professional photographer to prepare a videotape with audio narrative of the observations made during the inspections for project closeout. Videotape shall include work completed under the project and items examined for the pre-condition survey report. The Contractor shall make the video record in digital and in triplicate copy. Within ten (10) calendar days after the Final Inspection, the Contractor shall submit the digital file and one (1) copy to the Contracting Officer, the digital file and one (1) copy to the COTR and retain the digital file and one (1) copy for the Contractor's files.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Leave Project clean and ready for occupancy.
 - b. 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.
 - c. Remove labels that are not required as permanent labels.
 - d. 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.
 - e. 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.
 - f. Wipe surfaces of equipment clean. Remove excess lubrication and other substances.
 - g. Remove debris and surface dust from limited-access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
 - h. Wet-mop concrete and clean other hard-surface floors according to manufacturers' recommendations.
 - i. Vacuum clean carpeted surfaces and similar soft surfaces.
 - j. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.
 - k. 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.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- E. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 7823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Preparation and submittal of operating and maintenance manuals for building operating systems or equipment.
 - 2. Preparation and submittal of instruction manuals covering the care, preservation and maintenance of architectural products and finishes.
 - 3. Instruction of the Owner's operating personnel in operation and maintenance of building systems and equipment.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 QUALITY ASSURANCE

- A. Maintenance Manual Preparation: In preparation of Maintenance Manuals, use personnel thoroughly trained and experienced in operation and maintenance of the equipment or system involved.
 - 1. Where written instructions are required, use personnel skilled in technical writing to the extent necessary for communication of essential data.
 - 2. Where Drawings or diagrams are required, use draftsmen capable of preparing Drawings clearly in an understandable format.
- B. Instructions for SI Personnel: For instruction of the SI's operating and maintenance personnel, use experienced instructors thoroughly trained and experienced in the operation and maintenance of the building equipment or system involved.

1.5 SUBMITTALS

- A. Submittal Schedule: Comply with the following schedule for submittal of operating and maintenance manuals.
1. Before Substantial Completion, when each installation that requires submittal of operating and maintenance manuals is nominally complete, submit pdf copies electronically of each manual to the Architect for review. Include a complete index or table of contents of each manual.
 - a. The COTR will return one copy of the draft with comments within fifteen working days of receipt.
 2. Submit one copy of data in final form at least fifteen days before final inspection. This copy will be returned within fifteen days after final inspection, with comments.
 3. After final inspection make corrections or modifications to comply with the COTR's comments. Submit the specified number of copies of each approved manual to the COTR within fifteen days of receipt of the COTR's comments.
- B. Form of Submittal: Prepare operating and maintenance manuals in the form of an instruction manual for use by the SI's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder. Submit an electronic copy of all manuals in Adobe Acrobat Portable Document Format (PDF).
1. Binders: For each manual, provide heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 8-1/2" by 11" paper. Provide a clear plastic sleeve on the spine, to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
 - a. Where two or more binders are necessary to accommodate data, correlate data in each binder into related groupings in accordance with the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.
 - b. Identify each binder on the front and spine, with the typed or printed title "OPERATION AND MAINTENANCE MANUAL", Project title or name, and subject matter covered. Indicate the volume number for multiple volume sets of manuals.
 2. Dividers: Provide heavy paper dividers with celluloid covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the Section on each divider.
 3. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
 4. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if it is not available, specially prepared data, neatly typewritten, on 8 1/2" by 11", 20 pound white bond paper.
 5. Drawings: Where drawings or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind in with the text.
 - a. Where oversize drawings are necessary, fold the drawings to the same size as the text pages and use as a fold-out.
 - b. If drawings are too large to be used practically as a fold-out, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a typewritten page indicating the drawing title, description of contents and drawing location at the appropriate location in the manual.

1.6 MANUAL CONTENT

- A. In 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, on CD/DVD. Manuals shall include, as a minimum, the following data:
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.
 2. Wiring and control diagrams with data to explain detailed operation and control of each component.
 3. Control sequence describing start-up, operation and shutdown.
 4. Procedures for starting, operating and shutdown.
 5. Installation instructions.
 6. Maintenance and overhaul instructions.
 7. Lubricating schedule, including type, grade, temperature range and frequency.
 8. Emergency instructions and safety precautions.
 9. On-site acceptance test results for equipment installed under this contract.
 10. Approved product data, shop drawings and system as-builts.
 11. Copies of approved certifications and laboratory test reports (where applicable).
 12. Notarized copies of warranties (originals to be provided as required by "Warranties and Guarantees").
 13. Written instructions for test procedures.
 14. Performance curves and rating data.
 15. Parts list, including source of supply, recommended spare parts and service organization convenient to Smithsonian.
 16. Name, address and telephone number of each subcontractor who installed equipment and systems, local representative for each type of equipment and each system.
 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.
- B. Organize each manual into separate Sections for each piece of related equipment. As a minimum each manual shall contain a title page, a table of contents, copies of Product Data, supplemented by drawings and written text, and copies of each warranty, bond and service Contract issued.
1. Title Page: Provide a title page in a transparent plastic envelope as the first sheet of each manual. Provide the following information:
 - a. Name and address of the Project.
 - b. Name and address of Owner: Smithsonian Institution, Washington, DC.
 - c. Subject matter covered by the manual.
 - d. Date of submittal.
 - e. Name, address, and telephone number of the Contractor.
 - f. Name and address of the Architect/Engineer.

- g. Cross reference to related systems in other operating and maintenance manuals.
2. Table of Contents: After the Title Page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.
3. General Information: Provide a general information Section immediately following the Table of Contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the Subcontractor or installer, and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. In addition, list a local source for replacement parts and equipment.
4. Product Data: Where manufacturer's standard printed data is included in the manuals, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one item in a tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information that is not applicable.
5. Written Text: Where manufacturer's standard printed data is not available, and information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement data included in the manual, prepare written text to provide necessary information. Organize the text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure.
6. Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems, or to provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.
7. Do not use original Project Record Documents as part of the Operating and Maintenance Manuals.
8. Warranties, Bonds and Service Contracts: Provide a copy of each warranty, bond or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to be followed in the event of product failure. List circumstances and conditions that would affect validity of the warranty or bond.

1.7 MATERIAL AND FINISHES MAINTENANCE MANUAL

- A. Submit three copies of each manual, in final form, on material and finishes to the COTR for distribution. Provide one section for architectural products, including applied materials and finishes, and a second for products designed for moisture- protection and products exposed to the weather.
 1. Refer to individual Specification Sections for additional requirements on care and maintenance of materials and finishes.
- B. Architectural Products: Provide manufacturer's data and instructions on care and maintenance of architectural products, including applied materials and finishes.
 1. Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:
 - a. Manufacturer's catalog number.
 - b. Size.
 - c. Material composition.

- d. Color.
 - e. Texture.
 - f. Reordering information for specially manufactured products.
 - 2. Care and Maintenance Instructions: Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information regarding cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.
- C. Moisture-Protection and Weather-Exposed Products: Provide complete manufacturer's data with instructions on inspection, maintenance and repair of products exposed to the weather or designed for moisture-protection purposes.
- 1. Manufacturer's Data: Provide manufacturer's data giving detailed information, including the following, as applicable:
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Installation details.
 - d. Inspection procedures.
 - e. Maintenance information.
 - f. Repair procedures.
 - D. Schedule: Provide complete information in the materials and finishes manual on products specified

1.8 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

- A. Submit three copies of each completed manual on equipment and systems, in final form, to the COTR for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.
- 1. Refer to Specification Sections for additional requirements on operating and maintenance of the various pieces of equipment and operating systems.
- B. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.
- 1. Description: Provide a complete description of each unit and related component parts, including the following:
 - a. Equipment or system function.
 - b. Operating characteristics.
 - c. Limiting conditions.
 - d. Performance curves.
 - e. Engineering data and tests.
 - f. Complete nomenclature and number of replacement parts.
 - 2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment provide the following:
 - a. Printed operating and maintenance instructions.
 - b. Assembly drawings and diagrams required for maintenance.
 - c. List of items recommended to be stocked as spare parts.
 - 3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:
 - a. Routine operations.
 - b. Trouble-shooting guide.
 - c. Disassembly, repair and reassembly

- d. Alignment, adjusting and checking.
- 4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
 - a. Start-up procedures.
 - b. Equipment or system break-in.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Instructions on stopping.
 - f. Shut-down and emergency instructions.
 - g. Summer and winter operating instructions.
 - h. Required sequences for electric or electronic systems.
 - i. Special operating Instructions.
- C. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
- D. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.
- E. Coordination Drawings: Provide each Contractor's Coordination Drawings.
 - 1. Provide as-installed color-coded piping diagrams, where required for identification.
- F. Valve Tags: Provide charts of valve tag numbers, with the location and function of each valve.
- G. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panel boards, including the following:
 - a. Electric service.
 - 1. Controls.
 - 2. Communication.
- H. Schedule: Provide complete information in the equipment and systems manual on products specified:

Pipe Markers:	Section 15190	Mechanical Identification.
Air-Cooled Condensers:	Section 15670	Condensing Units.
Chillers:	Section 15685	Centrifugal Chiller - Water Cooled.
Air-Handling Units:	Section 15855	Air-Handling Units.
Fans:	Section 16860	Centrifugal Fans.
Filters:	Section 15885	Air Cleaning.
Diffusers:	Section 15933	Air Terminals.
Lighting Fixtures:	Section 16515	Interior Lighting Fixtures.
Generator Sets:	Section 16621	Diesel Generator Sets.
Telephones:	Section 16740	Telephone Systems.

1.9 INSTRUCTION OF THE SI'S PERSONNEL

- A. Prior to final inspection, instruct the SI's personnel in operation, adjustment, and maintenance of products, equipment and systems. Provide instruction at mutually agreed upon times.
 - 1. For equipment that requires seasonal operation, provide similar instruction during other seasons.
 - 2. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION

SECTION 01 7839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
1. Record Drawings.
 2. Record Specifications.
 3. Record Product Data.
 4. Miscellaneous record submittals.
- B. Related Requirements:
1. Section 01 3250 "Building Information Modeling (BIM) Requirements".
 2. Section 017300 "Execution" for final property survey.
 3. Section 017700 "Closeout Procedures" for general closeout procedures.
 4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
1. Initial Submittal: Provide 1 hard copy, 1 pdf copy, and 1 CAD copy from corrected Record CAD Drawings and one set of marked-up Record Prints. COTR will return plots and prints for organizing into sets, printing, binding, and final submittal.
 2. Final Submittal: Submit one set of marked-up Record Prints, five sets of record CAD Drawing files on DVD data storage electronic media. Record each Drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit eight printed bound copies of Project Specifications, including addenda and contract modifications, organized sequentially by section number. Submit 1 hard copy and 1 pdf copy in PDF format on DVD data storage electronic media.
- C. Record Product Data: Submit eight printed and bound copies of each Product Data submittal. Submit five electronic copies in PDF format on DVD data storage electronic media.
1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as Record Product Data.

- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit 1 hard copy and 1 annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers.
 7. Mark each sheet with the designation "AS-BUILT", and signed and dated by the Contractor.
 8. Record CAD Drawing plots shall sized the same as the contract drawings.
- B. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with COTR. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings and Shop Drawings.

1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
 2. Refer instances of uncertainty to COTR for resolution.
 3. COTR will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.
 4. Mark each sheet with the designation "AS-BUILT".
 5. Format: Same CAD program, version, and operating system as the original Contract Drawings.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where COTR determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult with COTR for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting. Mark each sheet with the designation "AS-BUILT", and signed and dated by the Contractor.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "AS-BUILT."
 - d. Name of Architect and Contractor.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Project specifications shall be marked 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.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made
 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 5. Note related Change Orders, record Product Data, and record Drawings where applicable.

6. Mark cover sheet with the designation "AS-BUILT", and signed and dated by the Contractor

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
 4. Mark cover sheet with the designation "AS-BUILT", and signed and dated by the Contractor

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.
- C. Failure to Maintain Record Documents and Samples: Record Documents and Samples, including CAD drawings, will be reviewed by the COTR monthly at the time of Application for Payment. If the COTR determines that the Record Documents and Samples have not been properly updated, an additional retainage of up to 1/2 of 1 percent of the value of that period's work may be withheld. Such retainage is in addition to any other retainage required by the Contract.

END OF SECTION

SECTION 01 7900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator instructor and videographer.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Contractor.

- e. Date of video recording.
2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit two complete training manuals for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
 - 5. Adjustments: Include the following:
 - a. Alignments.

- b. Checking adjustments.
- c. Noise and vibration adjustments.
- d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Contractor, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
 - 1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
 - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 - 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 01 8113

SUSTAINABLE DESIGN REQUIREMENTS

LEED FOR NEW CONSTRUCTION AND MAJOR RENOVATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED Silver certification based on USGBC's "LEED 2009 for New Construction & Major Renovations."
 - 1. Other LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
 - 2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
 - 3. A copy of the LEED Project checklist is attached at the end of this Section for information only.
 - 4. Specific requirements for LEED are included in greater detail in other Sections.

1.3 DEFINITIONS

- A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the project's LEED certification application. Document responses as informational submittals.

1.5 COMMITMENT TO SUSTAINABILITY

- A. 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, to the maximum extent practical.

1.6 ACTION SUBMITTALS

- A. General: Submit additional LEED submittals required by other Specification Sections.
- B. LEED Documentation Submittals:
 1. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
 2. Credit MR 4: Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material cost for each product having recycled content.
 3. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 4. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 5. Credit IEQ 3.1:
 - a. Construction indoor-air-quality management plan.
 - b. Product data for temporary filtration media.
 - c. Product data for filtration media used during occupancy.
 - d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management

measures, such as protection of ducts and on-site stored or installed absorptive materials.

6. Credit IEQ 3.2:
 - a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - b. Product data for filtration media used during flush-out and during occupancy.
7. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
8. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
9. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For LEED coordinator.
- B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
 1. Plumbing.
 2. Mechanical.
 3. Electrical.
 4. Specialty items such as elevators and equipment.
 5. Wood-based construction materials.
- C. LEED Action Plans: Provide preliminary submittals within 60 days of date established for commencement of the Work indicating how the following requirements will be met:
 1. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
 2. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 3. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 4. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 5. Credit IEQ 3.1: Construction indoor-air-quality management plan.
- D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
 1. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
 2. Credit MR 4: Recycled content.
 3. Credit MR 5: Regional materials.
 4. Credit MR 7: Certified wood products.

1.8 QUALITY ASSURANCE

- A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

2.2 RECYCLED CONTENT OF MATERIALS

- A. Credit MR 4: Building materials shall have recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content for Project constitutes a minimum of 20 percent of cost of materials used for Project.
 - 1. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
 - 2. Do not include furniture, plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.

2.3 REGIONAL MATERIALS

- A. Credit MR 5: Not less than 20 percent of building materials (by cost) shall be regional materials.

2.4 CERTIFIED WOOD

- A. Credit MR 7: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 - a. Rough carpentry.
 - b. Miscellaneous carpentry.
 - c. Heavy timber construction.
 - d. Wood decking.
 - e. Metal-plate-connected wood trusses.
 - f. Structural glued-laminated timber.
 - g. Finish carpentry.
 - h. Architectural woodwork.
 - i. Wood paneling.
 - j. Wood veneer wall covering.

- k. Wood flooring.
- l. Wood lockers.
- m. Wood cabinets.
- n. Furniture.

2.5 LOW-EMITTING MATERIALS

- A. Credit IEQ 4.1: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Wood Glues: 30 g/L.
 2. Metal-to-Metal Adhesives: 30 g/L.
 3. Adhesives for Porous Materials (Except Wood): 50 g/L.
 4. Subfloor Adhesives: 50 g/L.
 5. Plastic Foam Adhesives: 50 g/L.
 6. Carpet Adhesives: 50 g/L.
 7. Carpet Pad Adhesives: 50 g/L.
 8. VCT and Asphalt Tile Adhesives: 50 g/L.
 9. Cove Base Adhesives: 50 g/L.
 10. Gypsum Board and Panel Adhesives: 50 g/L.
 11. Rubber Floor Adhesives: 60 g/L.
 12. Ceramic Tile Adhesives: 65 g/L.
 13. Multipurpose Construction Adhesives: 70 g/L.
 14. Fiberglass Adhesives: 80 g/L.
 15. Contact Adhesive: 80 g/L.
 16. Structural Glazing Adhesives: 100 g/L.
 17. Wood Flooring Adhesive: 100 g/L.
 18. Structural Wood Member Adhesive: 140 g/L.
 19. Single-Ply Roof Membrane Adhesive: 250 g/L.
 20. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine-covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
 21. Top and Trim Adhesive: 250 g/L.
 22. Plastic Cement Welding Compounds: 250 g/L.
 23. ABS Welding Compounds: 325 g/L.
 24. CPVC Welding Compounds: 490 g/L.
 25. PVC Welding Compounds: 510 g/L.
 26. Adhesive Primer for Plastic: 550 g/L.
 27. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
 28. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
 29. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
 30. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
 31. Other Adhesives: 250 g/L.
 32. Architectural Sealants: 250 g/L.
 33. Nonmembrane Roof Sealants: 300 g/L.
 34. Single-Ply Roof Membrane Sealants: 450 g/L.
 35. Other Sealants: 420 g/L.
 36. Sealant Primers for Nonporous Substrates: 250 g/L.
 37. Sealant Primers for Porous Substrates: 775 g/L.
 38. Modified Bituminous Sealant Primers: 500 g/L.
 39. Other Sealant Primers: 750 g/L.

- B. Credit IEQ 4.2: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Flat Paints and Coatings: VOC not more than 50 g/L.
 2. Nonflat Paints and Coatings: VOC not more than 150 g/L.
 3. Dry-Fog Coatings: VOC not more than 400 g/L.
 4. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
 7. Pretreatment Wash Primers: VOC not more than 420 g/L.
 8. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 9. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 10. Floor Coatings: VOC not more than 100 g/L.
 11. Shellacs, Clear: VOC not more than 730 g/L.
 12. Shellacs, Pigmented: VOC not more than 550 g/L.
 13. Stains: VOC not more than 250 g/L.
- C. Credit IEQ 4.4: Composite wood, agrifiber products, and adhesives shall not contain urea-formaldehyde resin.

PART 3 - EXECUTION

3.1 REFRIGERANT AND CLEAN-AGENT FIRE-EXTINGUISHING-AGENT REMOVAL

- A. Prerequisite EA 3: Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in HVAC Sections.
- B. Credit EA 4: Remove clean-agent fire-extinguishing agents that contain HCFCs or halons and replace with agent that does not contain HCFCs or halons. See Section 212200 "Clean-Agent Fire-Extinguishing Systems" for additional requirements.

3.2 CONSTRUCTION WASTE MANAGEMENT

- A. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

- A. Credit IEQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 015000 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 2. Replace all air filters immediately prior to occupancy.
- B. Credit IEQ 3.2: Comply with one of the following requirements:

1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. (4 300 000 L) of outdoor air per sq. ft. (sq. m) of floor area while maintaining an internal temperature of at least 60 deg F (16 deg C) and a relative humidity no higher than 60 percent.
2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. (1 070 000 L) of outdoor air per sq. ft. (sq. m) of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. (1.52 L/s per sq. m) of outside air or the design minimum outside air rate determined in Prerequisite IEQ 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. (4 300 000 L/sq. m) of outside air has been delivered to the space.

3.4 COMMISSIONING REQUIREMENTS

- A. The Smithsonian requires Fundamental Commissioning (as defined by the LEED NC and CI rating systems) of all eligible design and construction projects, even if the project is not eligible to pursue LEED certification. The Smithsonian additionally requires Enhanced Commissioning (as defined by the LEED NC and CI rating systems) for larger projects and projects pursuing LEED certification, based on the size and complexity of the project
- B. Refer to Division 01 section 01 9113 - General Commissioning Requirements for additional information.

END OF SECTION

See Appendix B for preliminary scorecard

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Government will employ an independent Commissioning Authority. The Commissioning Authority is an independent and knowledgeable third party, hired to verify that the systems work as intended. The Commissioning Authority will inform the COTR and the Architect of the results of the commissioning and provide suggestions, as necessary, to correct deficiencies in observed performance or installation.
- B. Commissioning is the process to verify to the Government that systems, equipment, mechanical, electrical, controls and special systems function together properly to meet performance requirements and design intent, and as described in the Contract Documents. The Contractor shall be responsible for participation in the commissioning process as outlined below and in references and attachments throughout the Contract Documents. The Contractor shall furnish labor and materials sufficient to meet all requirements of building commissioning under this contract.
- C. Various sections in the Division 23 and 26 Specifications as well as specifications in other formats outline the specific commissioning responsibilities of each Contractor for the division and also obligate the General Contractor to coordinate and manage the commissioning responsibility of those subcontractors.

1.2 REQUIREMENTS INCLUDED

- A. Duties of Contractor.
- B. Duties of Commissioning Authority.
- C. Online Commissioning Notebook.
- D. Acceptance Procedures.
- E. Performance Period.
- F. Training and Instruction.

1.3 RELATED SECTIONS

- A. All Division 1 Sections (including Enclosure Commissioning, section 01 9119)
- B. All Division 22 Sections
- C. All Division 23 Sections

- D. All Division 26 Sections
- E. All Division 27 Sections
- F. All Division 28 Sections

1.4 TERMS

- A. **Acceptable Performance:** A component or system being able to meet specified design parameters under actual load including satisfactory documented completion of all functional performance tests, control system trending and resolution of outstanding issues.
- B. **Basis of Design:** The Basis of Design is the documentation provided by the design engineer documenting design decisions that were made to meet the design intent as defined by the Government. The Basis of Design describes the systems, components, conditions and methods to meet the design intent.
- C. **Commissioning Plan:** The Commissioning Plan is prepared by the Government's Commissioning Authority and defines the scope and format of the commissioning process and the responsibilities of all involved parties. The Commissioning Plan is provided to all commissioning team members to inform them of the intent and scope of the commissioning work to ensure inclusion in the project scope and to expedite the commissioning process. The Commissioning Plan will be distributed by the Commissioning Authority during the first third of the construction timeframe.
- D. **Functional Performance Testing:** That full range of checks and tests carried out to determine if all components, sub-systems, systems and interfaces between systems function in accordance with the Contract Documents. In this context, "function" includes all modes and sequences of control operation, all interlocks and conditional control responses and all specified responses to abnormal emergency conditions. The functional performance tests will be prepared by the Commissioning Authority.
- E. **Commissioning:** The process to assure the Government that building equipment, controls and systems function together properly to meet design intent and performance requirements shown in a composite manner in the Contract Documents.
- F. **Resolution Log:** The purpose of this log is to provide a method for tracking and resolution of deficiencies discovered as a result of the commissioning process. This list also includes the current disposition of issues and the date of final resolution as confirmed by the Commissioning Authority. Deficiencies are defined as those issues where products, execution or performance do not satisfy the Specifications and/or the design intent. The Resolution Log will be created and managed by the Commissioning Authority.
- G. **Pre-functional Construction Checklists:** Checklist is prepared by the Commissioning Authority. Checklist shall be for the systems or equipment involved in the commissioning process to verify installation and start-up of equipment is complete and verify that systems are ready for functional testing. These documents require signature by the Contractor prior to continuing with the commissioning process, and are required as a pre-condition of beginning the Functional performance Testing.

1.5 DUTIES OF CONTRACTOR

- A. Provide copies of all shop drawings, manufacturer's literature, maintenance information or other information as may be needed for systems to be commissioned to the Commissioning Authority.
- B. Collect the information requested by Commissioning Authority for development of a complete Commissioning Plan, Online Commissioning Notebook, and functional tests and provide to the Commissioning Authority. The Contractor shall review these documents and confirm in writing to the COTR, Architect and Commissioning Authority any known areas of conflict or areas requiring clarifications.
- C. Collect all proposed start-up and Pre-Functional Construction Checklists documentation and place into the Online Commissioning Notebook. At project substantial completion, verify acceptance by the Commissioning Authority.
- D. Plan for and incorporate commissioning activities into the construction schedule. Provide a sufficient level of scheduling activity detail so as to properly coordinate the trades. Provide a detailed Commissioning Schedule Fragnet to the project schedule, updated monthly.
- E. Provide Commissioning Authority with submittals for all systems to be commissioned including controls system and wiring diagrams and narrative sequences of operation, in time for use in preparing the Functional Test Procedures.
- F. Provide a fully operational system per Specifications, started, verified, debugged, calibrated, balanced, tested and under automatic control.
- G. Provide qualified personnel to participate in the commissioning tests, including seasonal testing.
- H. Cooperate with the Commissioning Authority's personnel.
- I. Provide access to site for the Commissioning Authority for review, verification and testing activities.
- J. Provide office space for Commissioning Authority for preparation of daily reports. Provide internet access for access to the Online Commissioning Notebook, at the project site. Wireless or cellular access is acceptable for this project.
- K. Provide organized storage space for project drawings, Specifications, equipment and materials submittals, shop drawings and operation and maintenance manuals in the job site trailers or job site office space.
- L. Provide updates to all project documentation to reflect all supplemental instructions, addenda or other revisions to the project construction documents. Updates and supplemental instructions must be posted to the master set of documentation for review and reference by all Contractors and for the Commissioning Authority's use.
- M. Provide adequate time and resources to perform functional testing of system to be commissioned in contract. These times and activities shall be reflected in the Commissioning Fragnet schedule, updated monthly.

- N. Coordinate participation of the mechanical, electrical, controls and TAB subcontractors in the commissioning process.
- O. Participate in any efforts to finalize sequences of operations with COTR, Designers and Commissioning Authority.
- P. Verify that coordination, installation, quality control and final testing have been completed such that installed systems and equipment comply with construction documents.
- Q. Review the Commissioning Plan, Project Reports and test results and submit comments to the Commissioning Authority.
- R. In a timely manner, address issues identified during construction that may affect the commissioning process or final system performance.
- S. Perform start-up and testing of mechanical and electrical equipment and systems and document as required with start-up reports and completion of Pre-functional Construction Checklists. These checklists include installation documentation, start-up documentation, controls point-to-point documentation and calibration documentation, verification that controls sequence of operations meets design intent and TAB final documentation. Reports will be stored in the Online Commissioning Notebook. Contractor will coordinate efforts to complete the pre-functional documentation.
- T. Lead verification testing of fire/smoke dampers and direct the resolution of deficiencies. Each damper and all functions of shall be tracked in a matrix spreadsheet. Owner's Authority Having Jurisdiction shall witness and approve all life safety systems including fire / smoke damper operation.
- U. Provide preliminary TAB report, indicating all actual field values recorded to the Commissioning Authority, prior to initiation of functional testing. These reports shall be incorporated in the Online Commissioning Notebook. Provide these "pencil copy" TAB data on a system by system basis, as systems have been finally and completely balanced.
- V. Issue a written Notice of Readiness *for each system* to Commissioning Authority upon completion of all systems work, start-up and Pre-functional Construction Checklists requirements by trade contractors, including balancing where required.
- W. Operate equipment and systems as required in preparation of final functional performance testing. This includes, but is not limited to, manipulating the appropriate controls systems to execute the Functional Test Procedures. Pre-test all systems prior to scheduling the final Functional Performance Test for the record.
- X. Participate in the fine-tuning or troubleshooting of system performance, if either of these measures becomes necessary.
- Y. Compensate Owner for retesting and/or troubleshooting time required by the Commissioning Authority because Contractor's systems do not meet specified performance. Back-charge Contractors as necessary to collect reimbursement for Commissioning Authority compensation.
- Z. Provide and review operating and maintenance data for verification, organization, distribution and conformance to requirement of the Contract Documents. Operation and Maintenance data shall include:

1. As-built system schematics including one-line diagrams
 2. Fire and emergency response matrices
 3. Seasonal operation and shutdown procedures
 4. Recalibration procedures and frequencies
 5. User adjustable setpoints and reset schedules
 6. Training materials
- AA. Submit complete operation and maintenance information and as-built drawings to the Commissioning Authority for compliance review of the requirement of the Contract Documents.
- BB. Provide documentation of training for the systems specified.
- CC. Provide proprietary test equipment required to test all the systems and equipment in this project.
- DD. The Online Commissioning Notebook will be stored in the Contractors field trailer and will be managed by the Contractor. The Contractor shall confirm in writing to the Commissioning Authority that systems are complete, functional and the appropriate subcontractors have completed the specified tasks and signed off all pre function documentation.

1.6 DUTIES OF COMMISSIONING AUTHORITY

- A. Develop the Commissioning Plan and issue to contractor during beginning phase of construction timeframe.
- B. Review the Online Commissioning Notebook with appropriate documentation provided from Contractor. Provide supplemental documentation as necessary to ensure that all aspects of start-up and testing have been complete and documented prior to functional testing.
- C. Develop Functional Test Procedures from Contract Documents and final equipment submittals including narrative sequences of operation, control diagrams and software code for execution with the assistance of Contractor staff as required.
- D. Review the Contractor's submittals relative to the systems to be commissioned. Provide comments on the submittals during the same timeframe as the architect / engineer's review. Architect / engineer shall have final authority of what Commissioning Authority comments are formally incorporated in response back to Contractor.
- E. Perform site observations to follow installation progress and to verify system installation quality and readiness for testing.
- F. Observe the start-up activities and initial testing of selected equipment and systems as required and review Contractor's start-up documentation.
- G. Observe or review documentation of validation activities including: Proper test and balance activities, rotating equipment drive alignment, vibration testing, acoustical testing, electrical testing and functional tests for normal and off-normal operating sequences.

- H. Review submittal of all required pre-functional and start-up documentation provided by Contractor for completeness and reasonableness. This includes installation documentation, start-up documentation, point-to-point checklists and preliminary TAB report, prior to initiation of functional testing.
 - I. Witness a random selection of TAB readings (10%) performed by the TAB contractor. This witnessing activity is during the execution of regular TAB activities. TAB verification shall be a separate activity, occurring prior to the final Functional Performance Testing activities.
 - J. Assist with scheduling, direct and witness complete functional testing as defined in the Commissioning Plan and Functional Test Procedures. All testing shall be performed by the Contractors and documented by the Commissioning Authority.
 - K. Witness and verify satisfactory completion of equipment and system tests and inter-systems functional performance tests.
 - L. Conduct commissioning meetings, and distribute minutes of those meetings to all attendees.
 - M. Provide site observation, functional tests or other project reports in a timely manner.
 - N. Document inconsistencies or deficiencies in system operations and system compliance. System deficiencies shall be forwarded to the COTR and documented in a Resolution Log.
 - O. Coordinate via the General Contractor participation of Government's personnel with equipment, component and systems performance verification and participation in required training.
 - P. When commissioning has been successfully completed, recommend acceptance to the Government, and provide suggestions for those systems not performing as expected.
 - Q. Once all functional tests have been successfully completed and all outstanding issues resolved, the Commissioning Authority will provide the Government with a Final Commissioning Report of all commissioning activities that occurred during the project.
 - R. Provide technically qualified personnel when scheduled.
 - S. The Commissioning Authority will formally communicate with the Contractor via approved project channels. It is expected, however, that informal communication and coordination will be conducted directly with the subcontractors; records of all contacts will be sent to the Architect through the normal channels.
 - T. The Commissioning Authority is not authorized to release, revoke, alter or expand requirements of Contract Documents, to approve or accept any portion of the work or to perform any duties of the Contractor.
- 1.7 COMMISSIONING PLAN
- A. The Commissioning Plan is a tool through which the commissioning process is described and incorporates the COTR, Architect, Contractor and Commissioning Authority roles relative to the commissioning process. Commissioning team members are all

contractors, subcontractors and design professionals whose participation is of benefit in the delivery of a fully functioning building to the Government. The plan shall describe the communication, authority and responsibility of commissioning team members. The Commissioning Plan will include the following:

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

1.8 ONLINE COMMISSIONING NOTEBOOK

- A. The Online Commissioning Notebook (MBPCx) is provided for use by the CxA and is used to store equipment information, design and construction review comments, the commissioning issues log, field reports, progress reports, pre-functional checklists, functional performance tests, and all documentation provided by the contractor as requested by the CxA, including but not limited to operation and maintenance data, as-built drawings and control drawings, final sequences of control, startup reports, and TAB reports. All commissioning team members will be required to update MBPCx with requested documentation, complete pre-functional checklists, and respond to issues assigned to them in the issues log. Documentation contained with the database becomes part of the project record, commissioning final report, and systems manual.

1.9 SYSTEMS TO BE COMMISSIONED

- A. HVAC system (all equipment).
- B. Energy recovery systems and heat recovery chiller.
- C. Chilled water system.
- D. Heating hot water system.
- E. Humidification system.
- F. HVAC energy management control system.
- G. Indoor air quality.
- H. Electrical system power quality, grounding.
- I. Emergency power system.
- J. All communications systems, SI and MWAA.
- K. Plumbing systems.
- L. Building envelope.
- M. Interface for fire alarm.

- N. Interface for fire suppression.
- O. Interface for security systems.

1.10 COMMISSIONING ACTIVITIES

- A. The Commissioning Schedule: This schedule defines the milestones and conditions that must be achieved before system testing and other commissioning activities can commence. The schedule also includes the expected duration of the various tasks so that the commissioning process can be incorporated into the overall construction schedule.
- B. Online Commissioning Notebook: The Online Commissioning Notebook will be developed and used by the Contractor to identify and track all pertinent commissioning documentation required during the installation start-up and check-out phases. This Notebook will be maintained by the Contractor on site and will be made available to all subcontractors for their use. The Notebook provides a central location for the subcontractors and Commissioning Authority to identify, copy, and organize all pertinent information.
- C. Preparation for Testing: To prepare for the system performance testing, the Commissioning Authority will examine the design and Construction Documents, develop with appropriate Contractors Pre-functional Construction Checklists of construction responsibilities that must be completed prior to testing and develop detailed Functional Test Procedures and data forms. Using the Pre-functional Construction Checklists, the Contractor must verify that the systems they install are in compliance with the Construction Documents and are fully functional. Commissioning is not intended to be a testing or inspection function that replaces any of the Contractors' obligations for testing and proof of performance. Functional testing will only begin when checklists are completed by the appropriate subcontractors, initialed, signed and returned to the Commissioning Authority, the TAB process is complete for both air and water balancing, and the controls are completed and all control loops properly tuned.
- D. Functional Testing: Functional testing is performed by experienced and qualified technicians of the Contractor(s), responsible for installation as facilitated by the Commissioning Authority and may be observed by other members of the commissioning team including the Owner. Functional testing will verify proper sequencing, operation and performance of installed equipment and systems under realistic operating conditions. The functional testing will follow with written Functional Test Procedures with test results documented for permanent record.
- E. Documentation: In addition to the Pre-functional Construction Checklists and Functional Test Procedures, written documentation will be maintained for all other commissioning activities. Project communication reports shall be issued by the Commissioning Authority to the Contractor and key members of the commissioning team to document apparent deficiencies identified during examination of design and construction documents, daily activities on-site, construction deficiencies and successful or unsuccessful functional test results. At the end of the commissioning process, all documentation will be assembled and summarized in the Final Commissioning Report.
- F. Deficiency Resolution: When an Issues Log or Field Report is issued to address an identified deficiency, the Contractor shall forward the reports to the appropriate parties to initiate corrective action in an expeditious manner. The designer is relied on for

supplemental instructions or design modifications and issuance of final design details and the Contractors are relied on for implementation of that design. Change orders must be issued through proper contract channels.

1.11 FUNCTIONAL TEST PROCEDURES

- A. The Functional Test Procedures include, but are not limited to, the following:
1. Verification of testing, adjusting and balancing performance.
 2. Verification of all equipment's ability to perform to the design intent.
 3. Verification of the performance of sub-systems consisting of combinations of equipment (e.g., refrigeration cycle, pumps and interconnecting piping).
 4. Verification of the performance of the automatic controls in all seasonal modes.
 5. Verification of the performance of the HVAC system as a whole.
 6. Verification of the performance of all life safety devices and systems that interface with the HVAC systems. Commissioning of life safety systems by the Commissioning Authority shall be limited to the fire alarm interface with the HVAC systems.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Operating equipment and systems shall be tested in presence of Government's Commissioning Authority and Project Officer to demonstrate compliance with specified requirements.
1. Notify COTR, in writing, fourteen (14) days prior to tests, twenty-one (21) days prior if a utility shutdown is required, scheduled under requirements of this Section.
 2. Testing shall be conducted under specified design operating conditions as recommended or approved by COTR and Architect.
- B. Functional performance testing shall be completed and accepted by COTR as a condition of Substantial Completion.
- C. All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by entireties to other major systems.
- D. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment through the installing contractor. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Authority in the commissioning process.
- E. Acceptance Documentation: A copy of the functional performance tests results shall be necessary acceptance documentation along with other specified requirements.

3.2 ACCEPTANCE PROCEDURES

- A. Prior to functional performance testing of each system, the Commissioning Authority shall observe and verify that the physical installation of components and systems being tested is substantially installed in accordance with the Contract Documents.
- B. Contractor's Tests:
 - 1. System shall be checked for proper installation, shall be adjusted and calibrated to verify that it is ready to function as specified.
 - 2. All system elements shall be checked to verify that they have been installed properly and that all connections have been made correctly.
 - 3. All discrete elements and sub-systems shall be adjusted and checked for proper operation.
 - 4. Start-up and operational tests shall be complete, with all required Pre-functional Construction Checklists submitted for review by Commissioning Authority within five (5) days of each activity, prior to starting functional performance testing.
- C. Government-witnessed Functional Tests:
 - 1. Prior to scheduling testing with the Government's Commissioning Authority, all systems to be tested shall be complete and operating automatically prior to testing.
 - 2. Where required or necessary, Testing, Adjusting, and Balancing (TAB) work shall be complete and the TAB report shall be reviewed and approved by the engineer of record prior to beginning functional performance testing.
 - 3. Objective of these tests is to demonstrate that system is operating and complying with specified performance requirements.
 - 4. Government-witnessed functional performance tests shall be performed on complete system. Each function shall be demonstrated to satisfaction of the Architect and Government's Commissioning Authority on paragraph-by-paragraph basis of Commissioning Authority's written test procedure, developed to demonstrate conformance to requirements of the Specifications.
 - 5. Functional performance tests shall be witnessed and endorsed by the Commissioning Authority upon satisfactory completion.
 - 6. Actual testing program shall be conducted in accordance with prior approved procedures and shall be documented as required herein.
 - 7. Contractor shall notify Architect and COTR at least two (2) weeks prior to date of functional performance tests.
- D. The functional performance testing process shall be accomplished for all equipment, sub-systems, systems and system interfaces. All must be tested for acceptances and there shall be a separate checklist for each to ensure documentation specific to each is complete.
- E. Each system shall be operated through all modes of system operation (e.g., seasonal, occupied, unoccupied, warm-up, cool-down, etc., as applicable) including every individual interlock and conditional control logic, all control sequences, both full-load and part-load conditions and simulation of all abnormal conditions for which there is a specified system or controls response. The warm-up and cool-down test shall be a performance test, as applicable.
- F. Temporary upsets of systems, such as distribution fault, control loss, setpoint change, equilibrium upset and component failure, shall be imposed at different operation loads to determine system stability and recovery time.

- G. When the functional performance of all individual systems has been proven, the interface or coordinated responses between systems shall be checked. The systems involved may be within the overall HVAC work or they may involve other systems, such as emergency systems for life safety.
- H. Corrective Measures: If acceptable performance cannot be achieved, the cause of the deficiency will be identified. If it is determined that the deficiency was caused by the system or component not being installed per the manufacturer's recommendations or Contract Documents, the necessary corrective measures shall be carried out by the Contractor. Every check or test for which acceptable performance was not achieved shall be repeated after the necessary corrective measures have been completed. This re-testing process should be repeated until acceptable performance is achieved. The Contractor will be allowed one retest after initial testing of the equipment. If the retest fails the Contractor shall be financially responsible, at standard rates, to reimburse the Commissioning Authority for the additional time taken to achieve acceptable performance.

3.3 TRAINING AND INSTRUCTION

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

3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed, regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.
- B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes, with a fully occupied building. Each Contractor and supplier will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance.
- C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. Each Contractor and supplier will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.
- D. Commissioning team including contractor, subcontractors, commissioning personnel and COTR shall meet at site roughly ten months after Substantial Completion to review any system issues, and correct any operational concerns covered by warranty. Commissioning Authority shall lead this site meeting, and shall summarize findings in a site report.

3.5 SCHEDULE

- A. The schedule includes the probable expected sequence and duration for the various tasks, so that the commissioning process can be integrated with the general construction schedule and refined over the course of the project. Actual sequencing and durations shall be by the Contractor and Sub-Contractors, coordinated with the Commissioning Authority.
- B. Note: Attention to these scheduling needs are important to prevent conflicts that can be problematic within the commissioning process:

Milestone	Duration	Successor	Predecessor
Commissioning Kick off Mtg.	1 day	All contractors on board including Controls and TAB	Before major MEP installation
Review equipment submittals	2 weeks	After receipt of submittals	Before ordering or installation
Develop Pre-functional Construction Checklists (Note 1)	4 weeks	After equipment submittal review and after receipt of O&M literature	Before MEP installation
Walk contractors through Pre-functional Construction Checklists	1 day	After development of Pre-Functional Checklist documentation	Before MEP installation
Write Functional Tests	3 to 5 weeks	After controls submittal review	3 weeks prior to functional testing
Submit Functional Tests for review by COTR and Contractors (Note 1)	1 week	After development of Functional Tests	Before Functional testing
Complete Pre-functional Construction Checklists (contractor task)	On Going	During installation, startup and test, adjust and balance	Before TAB Backcheck and functional testing
Site Observations (CxA)	On-going	After majority of MEP installation	Before TAB Backcheck and functional testing
Test, Adjust and Balance (contractor task) (Note 1)	See CPM schedule	After Start-up and Pre-functional Construction checks. All walls, windows, doors, ceilings must be installed.	Before TAB Backcheck
Test, Adjust and Balance Backcheck (10%)	1 week	After Start-up and receipt of completed Pre-functional Construction Checklists from contractors	Before functional testing
Functional Testing (Note 1)	2 months	After TAB Backcheck and receipt of completed Pre-functional Construction Checklist have been completed by contractors	Testing will commence prior to project final completion, but will require trend review and analysis under design conditions (July/August 2017). This may occur following project final completion, pending schedule and completion date finalization.
Issues Resolution (Note 1)	1 week	After Functional Testing	Before final completion, with possible corrective actions following the summer trend review during the warranty phase.
Final Commissioning Documentation Submittal	8 weeks	After resolution of issues log	2 weeks after resolution of issues log

Note 1: Phased project delivery, intermediate, or temporary delivery of systems and equipment, and phased testing may affect schedule, duration or continuity of items indicated. Phased acceptance will require phased testing. Coordination will be required following the submission of the contractor's project schedule.

SECTION 019119

BUILDING ENCLOSURE COMMISSIONING

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications Sections and Divisions 03 through 09 for facility exterior enclosure commissioning, apply to this Section.
- B. Reference Standards: ASHRAE/NIBS Guideline 3-2012 and referenced standards as identified in the individual building enclosure technical sections of the specifications.

1.2. SUMMARY

- A. This section includes building enclosure commissioning process requirements for above and below grade building enclosure systems and assemblies including:
 - 1. Below grade waterproofing
 - 2. Above grade air and moisture barriers
 - 3. Roofs
 - 4. Wall and roof penetrations and openings
 - 5. Expansion and control joints
- B. Employment of the Building Enclosure Commissioning Professional:
 - 1. The Building Enclosure Commissioning Professional has been contracted by the owner. The Building Enclosure Commissioning Professional has the overall responsibility to direct the building enclosure commissioning process.
- C. The goal of this project is to achieve a standard of design and construction such that the project will achieve LEED certification under the LEED program sponsored by the U.S. Green Building Council. The commissioning process must satisfy LEED requirements for enhanced systems commissioning including optional LEED points for building envelope commissioning.

1.3. DESCRIPTION

- A. The Building Enclosure Commissioning (BECx) process is utilized to validate that the design and performance of materials, components, assemblies, and systems comprising the building enclosure, achieve the objectives and requirements of the Owner. This is accomplished through design review, observation, testing, and documenting the process of selecting and installing the assemblies and components of the building enclosure. It serves as a tool to identify deficiencies in the building enclosure during pre-construction and construction phases to advance the project to a weather-tight assembly that meets the Owner's objectives and requirements.
- B. The Building Enclosure Commissioning process does not take away from or reduce the responsibility of the system designers or the Contractor to provide a finished and fully functioning product.

C. Abbreviations

The following are common abbreviations used in the Specifications and in the Commissioning Plan. Definitions are found in Section 1.8.

A/E	Architect	GC	Contractor
BECx	Building Enclosure Commissioning	LEED	Leadership in Energy and Environmental Design
BECxP	Building Enclosure Commissioning Professional	OE	Owner's Engineer
BECx Plan	Building Enclosure Commissioning Plan Document	OPM	Owner's Project Manager
COTR	Contracting Officer's Technical Representative	Subs	Subcontractors to General
Cx	Commissioning	USGBC	U.S. Green Building Council
CA	Commissioning Authority		

1.4. COORDINATION

- A. Commissioning Team. The members of the commissioning team consist of the Commissioning Authority (CA), Building Enclosure Commissioning Professional (BECxP), Owner's Project Manager (OPM), Contracting Officer's Technical Representative (COTR), Architect (A/E), the Contractor (GC), independent testing agencies, Green Building Specialist (LEED), and any other installing subcontractors or suppliers of enclosure components. When known, the Owner's building or plant operator/engineer will join the commissioning team.
- B. Management. The BECxP is hired by the Owner directly. The BECxP directs and coordinates the BECx activities and reports to the Owner as part of the OPM team. The Contractor completes the BECx activities as outlined in the commissioning plan. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.
- C. Scheduling. The BECxP will work with the GC according to established protocols to schedule the commissioning activities. The BECxP will sufficient notice to the GC for scheduling commissioning activities. The GC will integrate all BECx activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the BECx process.
- D. The BECxP will provide the initial schedule of primary BECx events at the building enclosure commissioning scoping meeting. The BECx Plan—Construction Phase provides a format for this schedule. As construction progresses, more detailed schedules are developed by the BECxP. The BECx Plan also provides a format for detailed schedules.

1.5. BUILDING ENCLOSURE COMMISSIONING PROCESS

- A. Building Enclosure Commissioning Plan: The BECx Plan, provided as part of the bid documents, is binding on the Contractor. The BECx Plan provides guidance in the execution of the Building Enclosure Commissioning process. Following the Building Enclosure Commissioning scoping meeting, the BECxP will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The Specifications will take precedence over the BECx Plan.
- B. Building Enclosure Commissioning Process: The following narrative provides a brief overview of the typical building enclosure commissioning tasks during construction and the general order in which they occur.
1. Building Enclosure Commissioning during construction begins with a scoping meeting conducted by the BECxP where the commissioning process is reviewed with the commissioning team members.
 2. Additional meetings will be required throughout construction, scheduled by the BECxP with all necessary parties attending, to plan, scope, coordinate, schedule future activities, and resolve problems.
 3. Building enclosure component product data, test results, and shop drawings are submitted to the BECxP and the A/E during normal submittals.
 4. The BECxP will review and provide comment to the Owner and A/E, who will then review and incorporate the BECxP comments at their discretion and return to the Contractor. The Contractor shall then copy the BECxP with the reviewed submittal with the A/E submittal review stamp.
 5. Any action taken by the A/E or Contractor based on comments and recommendation provided by the BECxP as part of its submittal review will be the sole responsibility of the A/E or Contractor.
 6. The BECxP and the A/E will review and provide comments on the construction of the building enclosure mock-ups for conformance with the contract documents and coordination between components and trades. The mock-up will be modified as necessary to resolve any issues discovered during the review.
 7. Performance testing of the mock-ups (or first installations) will be conducted to verify that the requirements for air and water infiltration are met. Modifications to the mock-ups may be required if air or water infiltration exceed the required standard.
 8. During the construction phase, the BECxP will conduct site observations to verify the correct installation and coordination of building enclosure components. Deviations from the design documents will be noted and tracked in the construction phase issues log.
 9. Performance testing of building enclosure components and systems will be conducted to verify that requirements are being met.
 10. The BECxP will back-check the noted deficiencies to verify that corrective measures have been completed.
 11. Following the construction phase, the Contractor will provide to the BECxP, as-built drawings, warranty information, maintenance information, and turn-over packages for inclusion into the Building Enclosure Systems Manual and provide training, if required, for the owner's maintenance personnel regarding the maintenance of the building enclosure components and systems.
 12. The BECxP will also include in the systems manual the issues log, the site observation reports, meeting minutes, the BECx plan, and an executive summary.

1.6. RELATED WORK

- A. Specific commissioning requirements or activities are given in the following sections of these specifications. All of the following sections apply to the work of this section.
 - 1. Division 01 Section "General Commissioning Requirements" for general requirements for commissioning including definitions, commissioning team membership, Owner's responsibilities, Contractor's responsibilities, and Commissioning Authority's responsibilities.
 - 2. Divisions 03 through 09 for facility exterior enclosure commissioning requirements specific to the work of each section.

1.7. RESPONSIBILITIES

- A. All Parties
 - 1. Follow the Building Enclosure Commissioning Plan
 - 2. Attend building enclosure commissioning scoping and commissioning meetings.
 - 3. Make resources and personnel available to successfully complete building enclosure commissioning tasks.
 - 4. Provide the required safety training need to accomplish the building enclosure commissioning activities.
- B. Owner's Project Manager (OPM)
 - 1. Manage the contract of the BECxP.
 - 2. Manage the contracts of the A/E and GC.
 - 3. Attend the BECx scoping meeting and selected commissioning team meetings.
 - 4. Arrange for facility operating and maintenance personnel to attend various field building enclosure commissioning activities and field training sessions according to the Building Enclosure Commissioning Plan – Construction Phase.
 - 5. Review and sign off on the completion of construction checklists and performance test results.
 - 6. Provide final approval for the completion of the building enclosure commissioning work.
- C. Architect (A/E)
 - 1. Attend the building enclosure commissioning scoping meeting and selected BECx team meetings and pre-construction meetings.
 - 2. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
 - 3. Coordinate with the GC resolution of system deficiencies identified during building enclosure commissioning according to the contract documents.
 - 4. Assist with the resolution of system deficiencies identified during construction phase commissioning activities.
 - 5. Provide the BECxP through the GC with a copies of all drawings, bulletins, sketches, RFI's, addendums, and any project updates to help keep the building enclosure commissioning plan up to date.
 - 6. Coordinate resolution of design non-conformance and design deficiencies identified during the warranty period building enclosure commissioning. All parties will provide additional resources to resolve any deficiencies Identified.
- D. Building Enclosure Commissioning Professional (BECxP) third party
The BECxP is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The BECxP may assist with problem-solving, non-conformance, or deficiencies, but ultimately that

responsibility resides with the GC and the A/E. The primary role of the BECxP is to develop and coordinate the execution of a testing plan, observe and document installation of building enclosure components and systems, and document that components and systems have been installed with the documented design intent and in accordance with the Contract Documents. The Contractor will provide all tools and personnel to install and test building enclosure components and systems.

1. Coordinate and direct the building enclosure commissioning activities in a logical, sequential, and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
2. Coordinate the building enclosure commissioning work with the GC. Verify that building enclosure commissioning activities are being incorporated into the master schedule.
3. Plan and conduct the building enclosure commissioning scope kick-off meeting.
4. Revise the Building Enclosure Commissioning Plan as necessary.
5. Request and review additional information required to perform building enclosure commissioning tasks including O&M materials.
6. Review normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
7. Provide project-specific construction checklists.
8. Perform site visits, as necessary, to observe component and system installations and attend selected planning and job-site meetings to obtain information on construction progress.
9. May witness performance testing of building enclosure elements and systems. Document testing and notify the owner's project manager of any deficiencies in results or procedures. Coordinate retesting if necessary until satisfactory performance is achieved.
10. Maintain a master deficiency and resolution log and a separate testing record. Provide the BECx team with written progress reports and test results with recommended actions.
11. Review building enclosures component and system warranties to verify that the Owner's responsibilities are clearly defined.
12. Compile and maintain a building enclosure commissioning record.
13. Review of the O&M manuals.
14. Provide a final building enclosure commissioning report.

E. General Contractor (GC)

1. Facilitate the coordination of the building enclosure commissioning work by the BECxP and verify that building enclosure commissioning activities are incorporated into the master schedule.
2. Review and distribute the final Building Enclosure Commissioning plan to the Subcontractors.
3. Provide dedicated personnel required to complete the building enclosure commissioning activities.
4. Attend a building enclosure commissioning scoping meeting and other building enclosure commissioning team meetings.
5. Perform the normal review of Subcontractor submittals.
6. Assure that the BECxP is furnished with copies of all Construction Documents, addenda, change orders, and approved submittals, record drawings, and shop drawings related to building enclosure commissioned components and systems.
7. Provide a summary and schedule of and field quality control tests and inspections required by the Contract Documents to the BECxP.
8. Submit completed construction checklists provided by the BECxP indicating that substrates, installation methods, and environmental conditions comply with the contract documents and manufacturer's installation instructions.

9. Identify and correct any deficiencies found during construction at no additional cost to the owner.
10. Provide a schedule of field quality control tests and inspections as required by the individual specification sections.
11. Provide performance testing as required by the individual specification sections.
12. Observe and witness completion of building enclosure performance testing.
13. Provide test data, inspection reports, and certificates to the BECxP.
14. Review building enclosure commissioning progress and deficiency reports.
15. Update the building enclosure commissioning team of changes in installations due to field conditions.
16. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of building enclosure commissioning.
17. Certify that each phase of the construction of the building enclosure satisfies all manufacturer's installation instructions and contract requirements prior to the installation of the next enclosure element or system.
18. Certify individual building enclosure commissioning tests as completed and passing.
19. Include building enclosure commissioning requirements as appropriate for each sub-contract or purchase order. Include requirements for submittal data, O&M data, commissioning tasks, and owner training if required.
20. Verify that all Subs execute their commissioning responsibilities according to the Contract Documents and project schedule.
21. Provide maintenance training of owner personnel.
22. Prepare O&M manuals according to the contract Documents.
23. Submit maintenance data for systems and components to the BECxP.
24. Include the cost of building enclosure commissioning in the total contract price.
25. Provide warranty service as outlined in the construction documents.

1.8. DEFINITIONS

- A. Acceptance Phase: Phase of construction after installation when performance tests, O&M documentation, review and training occurs.
- B. Approval: Acceptance that a component or system has been properly installed and tested (if required) according to the Contract Documents.
- C. Architect (A/E): The prime consultant (architect) and sub-consultants who comprise the design team.
- D. Basis of Design: The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.
- E. Building Enclosure: Materials, components, systems, and assemblies intended to provide shelter and environmental separation between interior and exterior, or between two or more environmentally distinct interior spaces within a building or structure. The building enclosure includes but is not limited to foundations, slab-on-grade, exterior walls, and roof assemblies.
- F. Building Enclosure Commissioning Authority (BECxP): An independent agent, not otherwise associated with the A/E team members or the Contractor, though he/she may be hired as a subcontractor to them. The BECxP directs and coordinates the day-to-day commissioning activities. The BECxP does not take an oversight role like the GC. The BECxP shall report directly to the OPM.

- G. Building Enclosure Commissioning Plan: An overall plan, developed before or after bidding, that provides the structure, logic, and coordination planning for the building enclosure commissioning process.
- H. Contracting Officer's Technical Representative (COTR): The COTR is the liaison between the Smithsonian Institute and the GC.
- I. Contract Documents: The documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, BECx Plan, etc.)
- J. General Contractor: Refers to all the subcontractors as well. Also referred to as the Contractor in some contexts.
- K. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).
- L. Design Intent: A dynamic document that provides the explanation of the ideas, concepts, and criteria that are considered to be very important to the Owner. It is initially the outcome of the programming and conceptual design phase.
- M. Design Narrative or Design Documentation: Sections of either the OPR or Basis of Design.
- N. Factory Testing: Testing of components or systems on-site or at the factory by factory personnel with an Owner's representative present.
- O. First-installation Mock-ups: Initial installation of specific enclosure materials, components, systems, and assemblies that are part of the work.
- P. Green Building Specialist (LEED): This individual is hired by the owner of A/E to direct the LEED certification for the building. Commissioning is a prerequisite for certification. (Building enclosure commissioning can earn 2 LEED points.) This individual is a member of the commissioning team.
- Q. Integrated Exterior Mock-ups: Integrated mock-ups of the exterior enclosure erected separately from the building but on the project site to demonstrate the coordination of adjacent building enclosure components and assemblies.
- R. Laboratory Mock-ups: Full-size physical assemblies constructed at a testing facility.
- S. LEED: Leadership in Energy and Environmental Design. The program outlined by the U.S. Green Building Council defining a "Green Building".
- T. Non-Compliance: See Deficiency.
- U. Non-Conformance: See Deficiency.
- V. Owner's Project Requirements (OPR): A dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.
- W. Performance Testing: Testing of a building enclosure component or system performed by an independent testing facility certified by ASTM, AAMA or other appropriate agency.
- X. Project Manager (PM): The contracting and managing authority for the owner over the design and/or construction of the project, a staff position.
- Y. Sampling: Functionally testing only a fraction of the total number of identical or near identical components or systems.

- Z. Seasonal Performance Tests: Performance tests that are deferred until the system(s) will experience conditions closer to their design conditions.
- AA. Specifications: The construction specifications of the Contract Documents.
- BB. Subs: The subcontractors to the GC who provide and install building components and systems.
- CC. Test Procedures: The step-by-step process which must be executed to fulfill the test requirements.
- DD. Test Requirements: Requirements specifying tests and parameters
- EE. Warranty Period: Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.
- FF. Water Penetration: Visible evidence of uncontrolled water penetration on or adjacent to the test specimen in a location not intended to collect and drain water to the building exterior.

1.9. SYSTEMS TO BE COMMISSIONED

- A. The systems to be commissioned in the project include but are not limited to:
 - 1. Below-grade waterproofing
 - 2. Slab-on-grade vapor barriers and waterproofing
 - 3. Exterior, opaque wall systems (masonry, concrete, precast, metal, insulation framing, vapor retarder, air barrier, sheathing, etc.)
 - 4. Louvers
 - 5. Roofs/ (parapets, penetrations, curbs, roof drains, etc.)
 - 6. Exterior doors
 - 7. Sealants
 - 8. Flashing
 - 9. Control and expansion joints

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1. MEETINGS

- A. Scoping Meeting: Within 30 days of commencement of construction, the BECxP will schedule, plan, and conduct a commissioning scoping meeting with the entire building enclosure commissioning team in attendance. Meeting minutes will be distributed to all parties by the BECxP. Information gathered from this meeting will allow the BECxP to revise the Commissioning Plan to its construction phase version, which will also be distributed to all parties.
- B. Building Enclosure Commissioning Progress Meetings: The BECxP will schedule, plan, conduct, and document additional building enclosure commissioning meetings with the entire team in attendance. The BECxP will distribute meeting minutes to all parties as required by contract. Meeting will be held as necessary by the BECxP through the course of building enclosure commissioning activities.

- C. Miscellaneous Meetings: Other meetings will be planned and conducted by the BECxP as construction progresses. These meetings will cover coordination, deficiency resolution, and planning issues with particular subs.

3.2. REPORTING

- A. The BECxP will provide building enclosure commissioning site observation reports and commissioning issues logs of non-conforming items, to the PM and copy the GC.
- B. The BECxP will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.
- C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.
- D. A final summary report will be compiled at the conclusion of the building enclosure commissioning process by the BECxP. All acquired documentation, logs, minutes, interim reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report

3.3. SUBMITTALS

- A. The contractor is required to provide the following submittals to the BECxP in addition to the A/E. These submittals are in addition to those specified in Division 1, Section 01 09113, "General Commissioning Requirements".
 - 1. Coordination Drawings: All shop drawings are to include cross references to the shop drawings of adjacent material indicating that the adjacent elements have been referenced and checked by the contractor to ensure that the dimensions and construction tolerances will allow all work at interfaces to be constructible.
 - 2. Qualification Data: Submit for review all qualification data for all installers, fabricators, and testing agencies required by Divisions 03 through 9 of the specifications.
 - 3. Preconstruction Test Reports: Submit all air and water penetration performance test results including deficiencies, remedial actions required and subsequent re-test results. Include QA/QC (quality assurance/quality control) measures to be taken in the field to assure that the remedial work identified through testing is implanted during installation.
 - 4. Manufacturer Quality Reports: Submit manufacturer test procedures and results for products supplied on the project
 - 5. Product data, descriptions and installation instructions
 - 6. Field Performance Test Reports: Submit reports on all water and air penetration and any other required testing relating to the building enclosure.
 - 7. Special Inspection Reports: Submit reports on special inspections required by the A/E in the specifications.
- B. The BECxP will review submittals relating to building enclosure commissioning for conformance to the Contract Documents as it relates to the commissioning process, the functional performance of the component or system. The BECxP will notify the GC, COTR, OPM, and A/E of items that are missing or not in conformance with the Contract Documents or lacking coordinated shop drawings and require resubmission.

3.4. TESTING

- A. Performance testing is included in the specifications as part of the work of the GC included in Division 1 of the specifications, Quality Control and Quality Assurance, this section (Building Enclosure Commissioning Requirements), and the technical sections of the specifications, Divisions 03 through 9, to validate the adequacy of the selection and installation of building enclosure components and systems.
- B. Pre-construction performance testing will be performed on building enclosure mock-ups and on constructed components and system according to the technical specification sections 03 through 09.
- C. The following tests are required:
 - 1. ASTM E783 Opaque Walls - Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors—One test of each exterior, opaque wall system at first installation and one additional test on a randomly chosen wall section is to be completed on each type of opaque wall system. The air leakage rate is not to exceed 0.04 cfm/ft² at 0.3 inches of water gauge.
 - 2. ASTM E783 Windows - Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors—One test is required for each type of exterior door at first installation and one additional test on a randomly chosen door.
 - 3. ASTM 1105 – Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference—This test is to be performed in conjunction with test ASTM E783 described above. The test pressure is 6.24 lbf/sq.ft. No evidence of water penetration is permitted.
 - 4. ASTM C 1193 Standard Guide for Use of Joint Sealants. Appendix X1 – Method A, Field Applied Sealant Joint Hand Pull Tab—Sealant testing, pre-construction and field testing, will be performed as described in the Joint Sealant section, 07 9200.
 - 5. ASTM C 1153, Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging. (Electronic Leak Detection (ELD) or Nuclear Radio-isotopic Thermalization may be used to replace or supplement infrared roof leak detection.)
 - 6. ASTM E 779 –Test Method for Determining Air Leakage Rate by Fan Pressurization—This test (or equivalent) is a whole building test to determine that the air leakage rate does not exceed 0.40 cfm/ft² at a pressure differential of 0.3 inches water gauge (2.0L/s · m² at 75 Pa).
- D. The maximum air infiltration rate for opaque walls, fenestration, and whole building assemblies are per the 2012 International Energy Conservation Code.
- E. Prior to the test, the GC will certify that Field Quality Control procedures have been completed and that quality control reports have been submitted, deficiencies corrected, and corrective work approved. A report including a list of deficiencies and corrections will be forwarded to the BECxP and the A/E.
- F. The results of performance tests will be provided by the GC to the COTR, BECxP and A/E for evaluation and comment.
- G. Testing Reports
 - 1. Test reports will include measured data, data sheets, and a comprehensive summary describing the specific building enclosure system at the time of testing, the test performed, and the test parameters.

2. Deficiencies will be evaluated by the A/E and the BECxP to determine corrective action. Deficiencies will be corrected and the test repeated. All repairs will be documented by the GC and forwarded to the A/E and BECxP.
3. If the component or system tested does not fall within the specified parameters, the A/E and BECxP will determine if the negative result is due to non-conformance with the Contract Documents. If it is determined that the test failure is due to non-conformance with the Contract Documents, the GC will make corrections or modifications to the component or system for re-testing. These corrections/modifications and re-testing will be done at no cost to the owner.
4. If it is determined that the system is constructed according to the Contract Documents, the Owner will decide whether modifications are required or if the test results will be accepted as submitted. If corrective work is performed, the owner will decide if tests will be repeated and a revised report is to be submitted.

End of Section 019119

SECTION 02 4119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 01 7000 "Execution Requirements" for cutting and patching procedures.
 - 3. Section 31 1000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

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

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

1.5 PREINSTALLATION MEETINGS

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

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. 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.
- C. 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 Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Locations of proposed dust- and noise-control temporary partitions and means of egress
 - 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 7. Means of protection for items to remain and items in path of waste removal from building.
- D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- E. Predemolition Photographs or Video: Submit before Work begins.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicated 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.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. C. Standards: Comply with ANSI A10.6 and NFPA 241.
- C. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.
- D. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify COTR of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify COTR. COR will remove hazardous materials under a separate contract. E. Storage or sale of removed items or materials on-site is not permitted.

- E. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

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/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

- E. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- F. Engage a professional engineer to 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.
- G. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and preconstruction videotapes.
 - 1. Comply with requirements specified in Section 01 3233 "Photographic Documentation."
 - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 01 1000 "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated 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. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - c. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - e. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

- A. 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. Comply with requirements for access and protection specified in Section 01 5000 "Temporary Facilities"
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
- C. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
- D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
- E. Temporary Shoring: 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.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of

- hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 7419 "Construction Waste Management and Disposal."
- B. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Store items in a secure area until delivery to Owner.
 3. Transport items to Owner's storage area designated by Owner.
 4. Protect items from damage during transport and storage.
 5. 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 or bid.
 6. 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.
- C. 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.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by COTRt, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS
- A. Concrete: 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, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
 - 1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

- E. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Division 7 Section "Thermoplastic Membrane Roofing" for new roofing requirements.
 - 1. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

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

- B. Burning: Do not burn demolished materials.

- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

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

END OF SECTION

SECTION 03 30 00

CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the work of this Section.

1.2 SUMMARY

- A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Foundation systems including footings, caissons, walls, beams, piers, pilasters, pits and similar concrete.
2. Slabs on grade.
3. Cast-in-place slabs, beams, walls, and columns.
4. Topping slabs
5. Stair pan fills.
6. Furnishing and installing all required anchors and inserts.
7. Placing in the forms all inserts, anchors, anchor bolts, bearing plates and the like furnished by other trades for casting into the concrete and cleaning of same after stripping of forms.
8. Protection of all inserts, anchors, hangers, sleeves and supports furnished and set by others for the attachment of other work to the concrete, or required to permit the passage of other work through the concrete.
9. Supply, fabricate and place all required reinforcing bars, mesh and other reinforcement for concrete where shown, called for, and/or required complete with proper supporting devices.
10. Erection and removal of all formwork required to properly complete the work.
11. Finishing of all concrete work as hereinafter specified.
12. Curing and protection of all concrete work.
13. Site concrete consisting of curbs, walls, pads, boxes and the like as shown on the drawings.
14. Floor sealers and dust-proofing of all areas exposed and/or covered with carpet.
15. Cutting, patching, grouting, repairing and pointing up as required.
16. Vapor barrier system below slabs on grade.
17. Under slab drainage course.
18. Dewatering.
19. Waterproofing.
20. Grouting of all beam bearing plates and column base plates.
21. Embedded plates in all foundation walls.
22. Equipment pads as required.
23. All other work and materials as may be reasonably inferred and needed to make the work of this section complete.
24. Waste Management

- B. Related Requirements:

1. Division 01 Section "Construction Waste Management and Disposal"
2. Division 04 Section "Unit Masonry"
3. Division 05 Section "Structural Steel"
4. Division 05 Section "Metal Deck"
5. Division 05 Section "Metal Fabrications"
6. Division 06 Section "Miscellaneous Carpentry"
7. Division 07 Section "Waterproofing"
8. Division 07 Section "Joint Sealants"
9. Division 07 Section "Expansion Control"

1.3 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Contractor is to implement practices and procedures to meet the Project's Sustainable Design goals. The Contractor shall ensure that the requirements related to these goals, as defined in this Section and in Related Sections of the Contract Documents, are implemented. Substitutions, or other changes to the Work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the Project's Sustainable Design goals.
- B. The Contractor is to efficiently use resources and energy while executing the Work of this Section. Resource efficient aspects to be considered in completing this Project include the use of techniques that minimize waste generation, reuse of construction materials on site where possible, and recycling of waste generated during the construction process.
- C. Performance Requirements: The following criteria are required for the products included in this section
 1. Preference shall be given to cast-in-place concrete containing raw materials harvested or extracted within 500 miles of the project site.
 2. All reinforcing steel, steel anchors, welded wire reinforcement, and other steel items required by the work of this section shall contain a minimum of 50% (combined) pre-consumer/post-consumer recycled content.
 3. Adhesives, sealants, paints and coatings used for the work of this section shall meet the Volatile Organic Compound (VOC) limits specified in Section 018113 "Sustainable Design Requirements," where applicable.
- D. LEED Performance Requirements:
 1. Certification of recycled content, sourcing of materials, and VOC content shall be in accordance with the LEED Submittals requirements of this section.

1.4 LEED SUBMITTALS

- A. Submit LEED Certification items as follows:
 1. LEED Materials Certification Form: For all installed products and materials of this Section, complete the "Environmental Materials Reporting Form" (attached to end of Section 018113 "Sustainable Design Requirements"). Information to be supplied for this Form shall include:

- a. Cost breakdowns for materials included in the Contractor or sub-contractor's Work. Material cost does not include costs associated with labor and equipment.
 - b. The percentages (by weight) of pre-consumer and/or post-consumer recycled content in the supplied product(s).
 - c. Indication of whether the raw materials have been extracted, harvested or recovered, as well as the final product has been manufactured (location of final assembly), within 500 miles of the project site.
- B. VOC Reporting Form: For all installed products and materials of this Section, complete the "VOC Reporting Form" (attached to end of Section 018113 "Sustainable Design Requirements"). Information to be supplied for this Form shall include:
1. Provide generic name by means of product type or application of all field-applied interior adhesives, sealants, paints, and coatings in this Section.
 2. Provide corresponding referenced standard limits.
 3. Provide full name of supplied product(s) and vendor or manufacturer for each product in this Section.
 4. For all field-applied interior adhesives, sealants, paints, and coatings in this Section, provide Volatile Organic Compound (VOC) content in grams/liter or lbs./gallon.
- C. Letters of Certification: Provided by the manufacturer on the manufacturer's letterhead, verifying the amount of recycled content.
- D. Product Cut Sheets: For all materials that meet the sustainable design performance criteria as per the LEED Performance Requirements of this section.
- E. Material Safety Data Sheets (MSDS): For all applicable products. Applicable products include, but are not limited to, adhesives, sealants, paints, and coatings applied to the interior of the building. MSDS shall indicate the Volatile Organic Compound (VOC) content of products submitted. If an MSDS does not indicate VOC content, then product data sheets, manufacturer's literature, or certification letter indicating a product's VOC content can be submitted with the MSDS.
- F. Assemble required LEED Submittal information into one (1) package for each Specification Section or sub-contractor. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submittal products or assemblies.

1.5 SUBMITTALS

- A. Product Data: Submit data for proprietary materials and items, including the following:
1. Reinforcement
 2. Supports for reinforcement
 3. Forming accessories
 4. Admixtures
 5. Patching compounds
 6. Waterstops
 7. Joint systems
 8. Curing compounds
 9. Dry-shake finish materials
 10. Others items as requested by Architect.

- B. Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures. The shop drawings shall be prepared only by competent detailers, checked by the contractor prior to submission.
1. The shop drawings shall show construction, contraction and isolation joint locations and the added reinforcement required at same.
 2. Obtain and coordinate information for sleeves and openings in concrete, which are required for the work of other trades. Make coordinated drawings showing size and location of openings and sleeves and incorporate this information on the reinforcing drawings.
 3. Only those splices indicated on the approved shop drawings will be permitted.
 4. Provide elevations of all foundation walls and other structural elements to a minimum 1/4" scale.
- C. Shop Drawings Formwork: Submit shop drawings for fabrication and erection of specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement, and other items which affect exposed concrete visually. Architect's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility, 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. Shoring and Reshoring layout drawings shall be based on the current plans with explicit layouts. Generic shore and reshore drawings are not acceptable.
 2. Formwork drawings shall be prepared by a licensed Professional Engineer in the Commonwealth of Virginia and shall be signed and sealed. Signed and sealed calculations shall be submitted with the formwork drawings. Both drawings and calculations shall be submitted for Architect/Engineer review and approval.
 3. Formwork drawings shall be full dimensioned and indicated concrete beam locations, concrete drop locations, slab opening locations, slab edge locations, concrete box out locations and embed locations and any change in section or plan of the structure.
 4. All slab, footing, and grade beam penetrations shall have a sleeve and coring is not allowed without prior authorization from engineer of record. Concrete sleeve coordination drawings are required as part of the formwork shop drawing submittal.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect. Proposed construction joint layouts shall be submitted to the Architect/Engineer for review and approval.
- E. Contraction Joint Layout: Indicate proposed contraction joints required per applicable codes and drawings.
1. Location of contraction joints is subject to approval of the Architect. Proposed contraction joint layout shall be submitted to the Architect/Engineer for review and approval

- F. The use of the Architect's or Engineer of Record's electronic drawing files as a base for the reinforcement, formwork, and joint layout shop drawings will be permitted at the request of the detailer/designer upon completion and return of the waiver form. The use of the Architect's or Engineer of Record's electronic drawing files as a base for shop drawing details will not be permitted. The detailer/designer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design team makes no representation regarding the accuracy or completeness of the electronic files given to detailer/designer and their use will be at the detailer/designer's sole risk and without liability to the design team. The detailer/designer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing sections and details. The detailer/designer shall also remove all reference to work not included in the concrete contract.
- G. Scaling of the Architect's or Engineer of Record's drawings is not permitted. This applies to hard paper, electronic, and all other versions.
- H. Samples: Submit samples of materials as requested by Architect, including names, sources and descriptions.
- I. Laboratory Test Reports: Submit laboratory test reports for concrete materials, mix design test and microwave test.
- J. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Architect. Manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements shall sign material certificates. Provide certification from admixture manufacturers that chloride content complies with specification requirements.
- K. Cold Weather and Hot Weather Concreting Procedures: Submit written descriptions of contractor's proposed cold weather and hot weather concreting procedures, when applicable.
- L. Certification that pozzolanic materials conforms to ASTM C 618-01 (noting class C or class F), ASTM C 989 or ASTM C1240.
- M. Certified recycled steel content. Provide cut sheets clearly indicating whether the rebar used meets the minimums for post-consumer OR post-industrial recycled contents. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and if the recycled content is post-consumer or post-industrial.
- N. Formwork: Specify whether reusable, permanent, salvaged or new wood forms are to be used.
- O. Recycled Aggregate: Provide laboratory reports indicating that aggregate conforms to ASTM C33 for structural concrete or ASTM D1241-00 for sub-base material. Provide cut sheets clearly indicating the source, total weight and volume of the recycled aggregate. If aggregate provided is a mix of virgin and recycled aggregates obtain a written affidavit from the manufacturer stating the recycled content percentage
- P. VOC content for curing compounds, sealants and release agents: Provide a cut sheet and a Material Safety Data Sheet (MSDS) for each curing compound, sealant, hardener and release agent used highlighting VOC contents. VOC content must be less than or equal to limits stated under "PRODUCTS".
- Q. Surveys: Submit report certifying that all anchor rods are in their proper location prior to placing concrete at the foundation level.

1.6 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. 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.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- D. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - 1. International Building Code, 2015
 - 2. ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials and Commentary."
 - 3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and mass concrete."
 - 4. ACI 211.2, "Standard Practice for Selecting Proportions for Structural Lightweight Concrete."
 - 5. ACI 214R, "Evaluation of Strength Test Results of Concrete."
 - 6. ACI 232.2R, "Use of Fly Ash in Concrete."
 - 7. ACI 233R, "Guide to Use of Slag Cement in Concrete and Mortar."
 - 8. ACI 234, "Guide for the Use of Silica Fume in Concrete."
 - 9. ACI 301 "Specifications for Structural Concrete."
 - 10. ACI 302.1R "Guide for Concrete Floor and Slab Construction."
 - 11. ACI 304R, "Guide for Measuring, Mixing, Transporting and Placing Concrete."
 - 12. ACI 305R "Hot Weather Concreting."
 - 13. ACI 306R-10 "Guide to Cold Weather Concreting."
 - 14. ACI 308.1 "Standard Specification for Curing Concrete."
 - 15. ACI 309R, "Guide for Consolidation of Concrete."
 - 16. ACI 311.4R, "Guide for Concrete Inspections."
 - 17. ACI 315, "Details and Detailing of Concrete Reinforcement."
 - 18. ACI 318 "Building Code Requirements for Structural Concrete and Commentary."
 - 19. ACI 347 "Guide to Formwork of Concrete."
 - 20. Concrete Reinforcing Steel Institute, (CRSI) "Manual of Standard Practice."
 - 21. CRSI-WCRSI, "Placing Reinforcing Bars."
 - 22. AWS D1.4, "Structural Welding Code Reinforcing Steel."
 - 23. The ACI Field Reference Manual, SP-15 shall be kept at the job site, and the practices set forth therein shall be strictly adhered to.
 - 24. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
 - 25. AASHTO T 318, "Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying."
- E. Concrete Testing Service: Contractor will engage a testing laboratory acceptable to Architect and Engineer of Record to perform material evaluation tests and to design concrete mixes.
- F. Materials and installed work may require testing and retesting at anytime during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.

- G. Mockups: Cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
1. Build panel approximately 200 sq. ft. for slab-on-grade in the location indicated or, if not indicated, as directed by Architect.
 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preconstruction Meeting:
1. At least 35 days prior to the start of the concrete construction schedule, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The Contractor shall send a pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference.
 2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:
 - a. Contractor's superintendent
 - b. Laboratory responsible for the concrete design mix
 - c. Laboratory responsible for field quality control
 - d. Concrete subcontractor
 - e. Ready-mix concrete producer
 - f. Admixture manufacturer(s)
 - g. Concrete pumping equipment manufacturer.
 3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by the contractor to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner or owner's representative, Architect, and Engineer of Record.
 4. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design and placing can produce the concrete quality required by these specifications.
 5. A minimum of a 4 cubic yard trial mixture containing all required admixtures shall be placed at the job site using the accepted methods of placing, finishing and curing. All applicable tests including slump, strength, water content, air content, permeability, and air content will be performed. This shall occur at least four weeks before actual concreting operations with the proposed mix design begins. The admixture manufacturer(s) and inspectors shall be present. The same testing should be done in the laboratory at the same time for comparison. A test sample should be done for each condition that is to be placed.
 6. The Engineer of Record will be present at the conference. The Contractor shall notify the Engineer of Record at least 10 days prior to the scheduled date of the conference.

1.7 PROJECT CONDITIONS

- A. The Contractor, before commencing work, shall examine all adjoining work on which this work is in any way dependent for proper installation and workmanship according to the intent of this specification, and shall report to the Architect or Engineer of Record any condition which prevents this contractor from performing first class work.

- B. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.
- C. Protect adjacent finish materials against spatter during concrete placement.
- D. Provide all barricades and safeguards at all pits, holes, shaft and stairway openings, etc., to prevent injury to workmen and others within and about the premises. Also provide all safeguards as required by the Building Code, OSHA, or any other departments having jurisdiction. Take full responsibility for all safety precautions and methods.
- E. Procedure of Work: The contractor shall keep themselves constantly informed as to the progress of the work in the field, materials and workers ready to start work immediately when conditions of preceding work are available or ready, wholly or in part, so as not to delay the progress of building work or to interfere with the progress of work of other contractors, and in any event the contractor shall, within 24 hours after notice from the Owner, proceed with such work as directed to maintain the uninterrupted progress of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct of plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient strength and thickness to withstand pressure of newly placed concrete without bow or deflection.
 - 1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better mill oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Preference shall go to salvaged or re-used Dimensional Lumber. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Sustainability Requirements For Wood Used For Formwork
 - 1. New Dimensional Lumber for Formwork: Provide wood certification documentation from the manufacturer/distributor, declaring conformance with Forest Stewardship Council (FSC) guidelines for certified wood building components The following independent

certification organizations are accredited by the FSC and provide the manufacturer/distributor with documentation:

- a. Scientific Certification Systems, Inc..
 - b. Smart Wood Certification Program: Rainforest Alliance
2. Salvaged or re-used Dimensional Lumber for Formwork: Provide documentation certifying products are from salvaged wood sources. Provide grading certificate for structural applications. For wood salvage wood resources see GreenSpec.
 3. If new dimensional Lumber is neither Certified nor salvaged: select regionally grown lumber with the lowest grade that meets performance requirements.
- D. Form Coatings: Provide VOC compliant commercial formulation form- coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces. Use biodegradable form release agent listed below or equivalent made from soy or rapeseed oil.
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|-----------------------|-------------------------------------|
| 1. "Clean Strip J1EF" | Dayton Superior |
| 2. "Soy Form Away" | Cure & Seal by Natural Soy Products |
| 3. "Bio-Form" | Leahy-Wolf Company |
| 4. "Duogard II" | W. R. Meadows, Inc. |
| 5. "Atlas Bio-Guard" | Atlas Construction Supply, Inc. |
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Form Ties: Form ties and spreaders: prefabricated assemblies by Richmond; Superior, Dayton or approved equal. Wire ties shall not be used. Ties for foundation work shall be of snap design with removal cones and water seal washer.
1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615 M, Grade 60.
- B. Weldable Reinforcing Bars: ASTM A 706/A 706M, Grade 60.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 775 (as noted on plan and/or in section).
- D. Steel Wire and Welded Wire Reinforcement: ASTM A 1064. Galvanized at exterior locations, conditions permanently exposed to weather and/or water, and where noted on drawings (plan and/or sections).
- E. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 , plain-steel bars, cut true to length with ends square and free of burrs.

- F. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 , plain-steel bars, ASTM A 775/A 775M epoxy coated.
- G. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- H. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- I. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place. Use wire bar type supports complying with CRSI specifications.
 - 1. For epoxy coated reinforcement provide plastic protected chairs and plastic ties. All imperfections in the epoxy coating are to be repaired prior to placement of concrete.
 - a. Use recycled plastic rebar supports (give preference to local supplier if available). Subject to compliance with requirements, provide one of the following:
 - 1) International Plastics Group
 - 2) Eclipse Plastic
 - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2), at a spacing not to exceed 4'-0" on center in either direction.

2.3 CONCRETE MATERIALS

- A. Portland cement: ASTM C 150, Types I, II, or I/II. Total percentage of Portland Cement is NOT to exceed 75% of the cementitious content of each mix. Use one brand of cement throughout project, unless otherwise acceptable to Architect. Provide either fly ash or GGBF in mix per sections below.
 - a. Fly Ash: Cast-in-place concrete shall incorporate fly ash as a replacement for at least 25% (by weight) of the Portland cement. All design mixes must be reviewed and approved by the Engineer of Record. Fly Ash shall not be used in conjunction with Ground Granulated Blast Furnace Slag.
 - b. Ground Granulated Blast Furnace Slag (GGBF): Cast-in-place concrete shall incorporate GGBF as a replacement for at least 40% (by weight) of the Portland cement. All design mixes must be reviewed and approved by the Engineer of Record. GGBF shall not be used in conjunction with Fly Ash.
 - c. Pozzolans and Slags: These must be completely accounted for in the design mix. Mix design must meet minimum design requirements set in the contract documents. Additional admixtures may be required to meet early strength requirements and alternative cementitious material goals. If a "blended cement" is used which already contains a certain percentage of Pozzolans or Slags this content may offset or entirely satisfy the minimum percentage required.
 - 1) Coal Fly Ash: ASTM C 618 (Class C or Class F): ASTM C 618 (Note: Class F fly Ash will require higher amounts or air entraining ad-mixtures than class C).
 - 2) Blast Furnace Slag: ASTM C989

- 3) Silica Fume: ASTM C 1240
 - 4) Rice Hull (or "husk") Ash: ASTM C 618 Blended hydraulic cement, as defined by ASTM C 595 or ASTM C 1157
- B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
1. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.
 2. Normal weight Fine Aggregate: washed, inert, natural or manufactured or combination thereof, sand conforming ASTM C33 gradation.
 3. Normal weight Coarse Aggregate: well graded crushed stone or washed gravel conforming to ASTM C33, sizes 57 for foundations and 67 for slabs and structure.
 - a. Recycled crushed concrete aggregate in concrete mixes is only to be used with approval of Engineer of Record. Recycled aggregate shall be used only as a substitute for coarse aggregate and must also be washed and well-graded, conforming to ASTM C33.
 - b. For sub-base, slabs on grade and non-structural applications and Recycled Aggregate Materials are NOT required to meet the ASTM C 33 standard. In addition to concrete rubble, glass, porcelain, and tire chips can be used as filler material. Any inert material conforming to ASTM D1241 is acceptable for the applications described in this paragraph.
- C. Water: Free from oils, acids, alkali, organic matter and other deleterious material to conform to ASTM C94. ASTM C94 for gray water use in the production of ready mixed concrete per approval by the Engineer of Record.
- D. Air Entraining Admixture: ASTM C 260.
1. Liquid air entrainment: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Air Mix" Euclid Chemical
 - b. "AEA-92" Euclid Chemical
 - c. "Darex AEA" W. R. Grace
 - d. "MasterAir VR 10" Master Builders
- E. Water-Reducing Admixture: ASTM C 494.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "MasterPolyheed 997" Master Builders
 - b. "Euclid MR" Euclid Chemical
 - c. "WRDA 64" W. R. Grace.
- F. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G and containing not more than 0.05 percent chloride ions.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

- a. "Eucon 37, 1037 or Plastol 5000" Euclid Chemical Co.
 - b. "Rheobuild 1000" Master Builders
 - c. "MasterGlenium 7500" Master Builders
 - d. "Daracem-100" W. R. Grace
- G. Water Reducing, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C 494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Accelerating admixtures are not to be used as antifreeze agents. Accelerating admixtures are permitted only upon review by Engineer of Record.
- 1. Products: Subject to compliance with requirements, provide the following or equal approved by Engineer of Record:
 - a. "Accelguard 80" Euclid Chemical Co.
 - b. "Daraset" W. R. Grace
 - c. "Pozzutec 20" Master Builders.
- H. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and contain not more than 0.05 percent chloride ions.
- 1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Eucon Retarder 75" Euclid Chemical Co.
 - b. "Pozzolith 100XR" Master Builders.
 - c. "Plastiment" Sika Chemical Co.
 - d. "Daratard" W.R. Grace.
- I. Microsilica Admixture shall be dry densified or slurry formed. Microsilica shall come from the same source throughout the project. If a single source cannot be maintained, laboratory testing of each new source shall be required before acceptance by the Engineer of Record at no cost to the owner.
- 1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Emsac F 100" Elkem Chemical, Inc.
 - b. "Eucon MSA" Euclid Chemical Co.
 - c. "Force 10,000" W. R. Grace
- J. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
- K. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the Engineer of Record.
- L. Corrosion Inhibitor: 30% calcium nitrite (where called for in the specifications or on the drawings). Subject to compliance with requirements, provide the following at 3 gal/cy:

- | | | |
|----|-----------------|------------------|
| 1. | "Eucon CIA | Euclid Chemical |
| 2. | "DCI" | W. R. Grace |
| 3. | "Rheocrete CNI" | Master Builders. |

- M. Contractor will be required to provide information demonstrating successful use in prior placement involving all admixtures.

2.4 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal approved by Engineer of Record:
 - a. Greenstreak
 - b. Williams Products, Inc.
2. Profile: Ribbed with center bulb .
3. Dimensions: 4 inches by 3/16 inch thick; nontapered.

- B. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal approved by Engineer of Record:
 - a. BoMetals, Inc.
 - b. Greenstreak
 - c. Paul Murphy Plastics Company
 - d. Vinylex Corp.
2. Profile: Ribbed with center bulb.
3. Dimensions: 4 inches by 3/16 inch thick; nontapered.

- C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	"MiraSTOP"	Carlisle Coatings & Waterproofing, Inc.
b.	"Waterstop-RX"	CETCO
c.	"Conseal CS-231"	Concrete Sealants Inc.
d.	"Swellstop"	Greenstreak
e.	"Hydro-Flex"	Henry Company, Sealants Division
f.	"Earth Shield Type 20"	JP Specialties, Inc.

2.5 GROUT

- A. Non-Shrink, Non-Metallic Grout: The non-shrink grout shall be a factory pre-mixed grout and shall conform to ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Euco-NS" Euclid Chemical Co.
 - b. "Five Star Grout" U.S. Grout Corp.
 - c. "Masterflow 713 Plus" BASF
- B. High Flow Grout: Where high fluidity and/or increased placing time is required, use high flow grout. The factory pre-mixed grout shall conform to ASTM C1107, "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 18" x 36" base plate.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Euco Hi-Flow Grout" Euclid Chemical Co.
 - b. "Masterflow 928" BASF
 - c. "Five Star Fluid Grout 100" Five Star

2.6 RELATED MATERIALS

- A. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 1241, Size 57, with 100 percent passing a 1-1/2 inch sieve and 0 to 5 percent passing a No. 8 sieve.
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 1241, Size 10, with 100 percent passing a 3/8 inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.
- C. Non-slip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture, and cleaning materials.
- D. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- E. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Waterproof paper
 - b. Polyethylene film

- c. Polyethylene-coated burlap

- F. Curing Compounds: The compound shall conform to ASTM C 309. Limit VOC content to 130 g/L. Use water-based curing compound. For surfaces receiving both a curing compound and additional flooring, verify that the curing compound and additional flooring are compatible.
 - 1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "SealTight 1100" W.R. Meadows
 - b. "Kurez W VOX" Euclid Chemical Co.
 - c. "Everclear VOX" Euclid Chemical Co.
 - d. "VOCOMP-25" W.R. Meadows

- G. Curing & Sealing Compounds: Only specify for slabs that will remain exposed, i.e. will not receive additional flooring. The compound shall conform to ASTM C1315. Limit VOC content to 130 g/L. Use water-based curing compound.
 - 1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Everclear VOX" Euclid Chemical Co.
 - b. "VOCOMP-25" W.R. Meadows

- H. Sealers/Hardeners: For use on concrete surfaces that will remain exposed. Slabs that will receive additional flooring do not require sealing or hardening. Sealers and hardeners must not yellow under ultra violet light after 500 hours of test in accordance with and have a maximum moisture loss of 0.039 grams per sq. cm. when applied at a coverage rate of 250 sq. ft. per gallon. Limit VOC content to 130 g/L. Use water- or vegetable-based product.
 - 1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Kure-N-Harden" BASF

- I. For concrete floors subjected to heavy vehicular traffic use a Liquid Sealer/Densifier: The product must be a high performance, deeply penetrating concrete densifier conforming to ASTM C836; odorless, colorless, VOC - compliant, non-yellowing silicate based solution designed to harden, dustproof and protect and to resist black rubber tire marks on concrete surfaces. The compound must contain a minimum of 20% solids content of which 50% is silicate

- J. Evaporation Retardant:
 - 1. Products Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Eucobar" Euclid Chemical Co.
 - b. "Confilm" BASF

- K. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F 710,

coordination with flooring manufacturer is required to insure concrete coatings will not obstruct the bond between the concrete and the adhesive. Insure coatings and adhesives are "benignly compatible" -- in other words, do not combine substances whose constituents are reactive. Reactivity releases VOCs and /or other toxic fumes.

- L. Crack Sealer: Elastomeric liquid crack sealer resistant to water, gasoline, oil and salts.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Eucolastic 1NS" Euclid Chemical Co.
Maximum allowable depth of this product is 1/2".
- M. Underlayment Compound: Free flowing, self-leveling, pumpable cementitious base compound.
1. Products: Subject to compliance with requirements, provide the following or equal approved by Engineer of Record:
 - a. "Flo-Top 90 or Super Flo-Top" Euclid Chemical Co.
 - b. "Ardex" Ardex Co.
 - c. "Underlayment 110" Master Builders
- N. Bonding Admixture: The compound shall be a latex, non-rewettable type.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Flex-Con" Euclid Chemical Co.
 - b. "SBR Latex" Euclid Chemical Co.
- O. High Strength Polymer Repair Mortar: For form and pouring or large horizontal repairs, provide the flowable on-part, high strength repair mortar.
1. Products: subject to compliance with requirements, provide the following or equal approved by Engineer of Record:
 - a. "Eucocrete" The Euclid Chemical Co.
 - b. "Euco Speed MP" (Cold Weather) The Euclid Chemical Co.
 - c. "Emaco R" Master Builders.
- P. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- a. "Daraweld C" W.R. Grace
- Q. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Type IV for bonding hardened concrete to hardened concrete, and Type V for bonding freshly mixed concrete to hardened concrete.

- R. 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.
- S. 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.
- T. Vapor Barrier: Provide vapor barrier which conforms to ASTM E 1745, Class A or B. The membrane shall have a water-vapor permeance rate no greater than 0.012 perms when tested in accordance with ASTM E 154, Section 7. The vapor barrier shall be placed over prepared base material where indicated below slabs on grade. Vapor barrier shall be no less than 10 mil thick in accordance with ACI 302.1R. Preferred vapor barriers will be manufactured from post-consumer recycled polymers.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Stego Wrap (15 mil) Vapor Barrier" Stego Industries LLC
 - b. "Griffolyn Vaporguard" Reef Industries
 - c. "Premoulded Membrane with Plastmatic Core" W.R. Meadows.
- U. Expansion Joint Filler: ASTM D 1751.
1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:
 - a. "Homex 300" Homasote Company
 - b. "Standard Cork Expansion Joint Filler" APS Cork
 - c. "Fibre Expansion Joint" W.R. Meadows
- V. Water: Potable.

2.7 PROPORTIONING AND DESIGN OF MIXES

A. Preparation of Design Mixes

1. All mix designs shall be proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and prepared by a licensed testing laboratory approved by the owner, but paid for by the contractor. Submit mix designs on each class of concrete for review.
2. If previously used mixes are submitted, all materials shall be from the same sources and with the same brand names as the previously utilized mix.
3. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1200 psi higher than the specified strength. This over-design shall be increased to $1.10f'c+700$ psi when concrete strengths greater than 5000 psi are used.
4. The proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data.

- B. Submit each proposed mix to the Architect and Structural Engineer for review at least 5 days prior to the pre-concrete conference. Do not begin concrete production until Architect and Engineer of Record has reviewed and approved mixes.

1. Submit Test reports for any pozzolans or slags indicating compliance with ASTM C 618 or ASTM C 989, respectively.
 2. Provide cut sheets clearly indicating the percentages of pozzolans or slags used in the mix design as replacement for Portland cement. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the percentage.
 3. Test reports for recycled aggregate indicating compliance with ASTM C 33. Provide cut sheets clearly indicating the percentage of aggregates used that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.
 4. Provide cut sheets clearly indicating the percentage of sub-base and filler aggregate materials that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.
- C. Design mixes to provide concrete with strength as indicated on drawings and schedules.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect and Engineer of Record. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect and Engineer of Record before using in work.
- E. Admixtures:
1. Use water-reducing admixture or high range water-reducing admixture (superplasticizer) in all concrete as required for placement and workability.
 2. Use non-corrosive, non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50°F (10°C).
 3. Use high-range water-reducing admixture in pumped concrete, architectural concrete, parking structure slabs, fiber concrete, concrete required to be watertight, concrete with ultimate strength of 5,000 psi or more, and concrete with water/cement ratios below 0.50.
 4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Exposure category for exterior concrete is F3. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1-1/2 percent within following limits:
 - a. Concrete structures and slabs exposed to freezing and thawing or deicer chemicals.
 - 1) 1-1/2" maximum aggregate: 4.5 percent (exposure class F1, moderate exposure); 5.5 percent (exposure class F2 and F3, severe exposure)
 - 2) 1" maximum aggregate: 4.5 percent (exposure class F1, moderate exposure); 6 percent (exposure class F2 and F3, severe exposure)
 - 3) 3/4" maximum aggregate: 5 percent (exposure class F1, moderate exposure); 6 percent (exposure class F2 and F3, severe exposure)
 - 4) 1/2" maximum aggregate: 5.5 percent (exposure class F1, moderate exposure); 7 percent (exposure class F2 and F3, severe exposure)
 - 5) 3/8" maximum aggregate: 6 percent (exposure class F1, moderate exposure); 7.5 percent (exposure class F2 and F3, severe exposure)
 - b. Other Concrete: (not exposed to freezing, thawing, or hydraulic pressure): 2 percent to 4 percent air.
 - c. Interior concrete to receive hard troweling shall not be air entrained unless specifically approved by the Engineer.

5. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
- F. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
 1. Concrete for structural topping slab, caissons, poured in place slabs and grade beams, columns and walls, over water, on ground or exposed to weather: W/C 0.40.
 2. "Quick Dry" Concrete: 0.40.
 3. Subjected to freezing and thawing; W/C 0.45.
 4. Subjected to deicers/watertight: W/C 0.45.
- G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 1. Ramp slabs and sloping surfaces: Not more than 3".
 2. Reinforced foundation systems, including mud slabs below hydrostatic slabs: Not less than 1" and not more than 3".
 3. Concrete containing HRWR admixture (superplasticizer): Not more than 9" unless otherwise approved by the architect. The concrete shall arrive at the job site at a slump of 2" to 3", be verified, then the high-range water-reducing admixture added to increase the slump to the approved level.
 4. Other Concrete: Not less than 1" or more than 4".
- H. Chloride Ion Level: Chloride ion content of aggregate shall be tested by the laboratory making the trial mixes. The total chloride ion content of the mix including all constituents shall not exceed the limitations set forth in Table 4.4.1 of ACI 318 for concrete subjected to deicers or exposed to chloride in service (0.15% chloride ions by weight of cement).

2.8 CONCRETE MIXING

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
- B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
- C. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required. When air temperature is between 85°F (30°C) and 90°F (32°C), reduce maximum mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce maximum mixing and delivery time to 60 minutes.
- D. No water shall be added after mixing to concrete containing HRWR (Superplasticizer). If loss of slump occurs, the concrete treated with HRWR may be redosed as long as a "flash set" has not occurred. Redosage procedures must be discussed and approved by the Engineer of Record and the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

CAST-IN-PLACE CONCRETE

- A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 INSPECTION

- A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

3.3 CONCRETE

- A. Concrete shall develop the minimum compressive strengths shown on drawings at 28 days when sampled and tested in accordance with ASTM C 31 and C 39 with the maximum slump in accordance with the approved mix design.
- B. Concrete shall be in accordance with the requirements and specifications of "Building Code Requirements for Structural Concrete" as modified by the building code noted above.
- C. Fly Ash Concrete & Slag Concrete: Concrete mixes containing high volumes of fly ash or Slag have slower set times and may take up to 56 days to reach full strength. The Engineer of Record, agency responsible for concrete mix design, the architect and the concrete subcontractor must coordinate to ensure that the form stripping schedule is consistent with the ability of the structure to support itself and all imposed construction loads.

3.4 FORMS

- A. Design formwork to maximize its reusability, reduce resources devoted to formwork construction and minimize waste generated. Where appropriate choose alternative formwork systems (refer to sections listed above).
- B. Design, erect, support, brace and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shapes, alignment, elevation and position. Maintain formwork construction tolerances complying with ACI 347. Provide Class A tolerances for concrete exposed to view. Provide Class C tolerances for other concrete surfaces.
- C. Design formwork to be readily removable without impact, shocks or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Construct forms to size shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back- up at joints to prevent leakage of cement paste.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom

forms only. Kerf wood inserts for forming keyways, recesses, and the like, to prevent swelling and for easy removal.

- F. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
- G. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
- I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.5 VAPOR BARRIER INSTALLATION

- A. Examine the condition of porous fill and remedy any unsatisfactory portions prior to installing vapor barriers.
- B. Sub-base material to be per above sections.
- C. Following leveling and tamping of sub-base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of pour.
- D. Lap joints 6" and seal with appropriate tape.
- E. After placement of moisture barrier, cover with granular material and compact to depth as shown on drawings.
- F. Avoid cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

3.6 PLACING REINFORCEMENT

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

- D. Place reinforcement to obtain at least minimum coverage's for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
- F. Epoxy-coated reinforcing bars supported from formwork shall rest on coated wire bar supports. Reinforcing bars used as support bars shall be epoxy-coated. In walls having epoxy-coated reinforcing bars, spreader bars where specified by the Architect or Engineer of Record, shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcing bars shall be made of corrosion-resistant material.
- G. Epoxy-coated reinforcing bars shall be fastened with nylon- , epoxy- , or plastic-coated tie wire, or other acceptable materials.
- H. Repair of damaged epoxy-coating: When required, damaged epoxy-coating shall be repaired with patching material conforming to ASTM A775. Repair shall be done in accordance with the patching material manufacturer's recommendations.
- I. Unless permitted by the Engineer of Record, epoxy-coated reinforcing bars shall not be cut in the field. When epoxy-coated reinforcing bars are cut in the field, the ends of the bars shall be coated with the same material used for repair of coating damage.

3.7 JOINTS

- A. Construction Joints: Locate and install construction joints as indicated, or if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.
- B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.
- D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions, using manufacturer's specified welding irons.
- E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals and elsewhere as indicated.
 - 1. Joint filler and sealant materials are specified in the section for "Related Materials"
- F. Contraction (Control) Joints in Slabs-on-Ground: Maximum joint spacing shall be 36 times the slab thickness unless otherwise noted on the drawings. The dry cut saw shall be used immediately after final finishing and to a depth of 1-1/4". A conventional saw shall be used as soon as possible without dislodging aggregate and to a depth of 1/4 slab thickness.

1. Joint sealant material is specified in the section for "Related Materials".

3.8 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.
- C. Embedded Plates at Foundation Walls: Install plate at top of forms so that exterior face of steel plate is level and plumb. Use construction documents for locations, sizes and elevations.

3.9 PREPARATION OF FORM SURFACES

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. If form-release compound is required, coat contact surfaces of forms with a form-coating compound *before* reinforcement is placed.
- C. Thin form-coating compounds only with thinning agent of type, and amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.10 CONCRETE PLACEMENT

- A. Ready-mix concrete shall comply with the requirements of ASTM C 94 and ACI 304. All plant and transporting equipment shall comply with the concrete plant standards and truck mixer and agitator standards of the National Ready Mix Concrete Association.
- B. Cold weather mixing procedures shall be submitted to the architect for approval.
- C. Notify Architect and Inspector at least 36 hours (1 1/2 regular working days) before each pour so that forms and reinforcing may be examined. Do not place concrete until inspection has been made or waived.
- D. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

1. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.
- E. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.
1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- F. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints. Use internal vibrators penetrating both the top and preceding layers.
- G. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- H. Use and type of vibrators shall conform to ACI 309 "Recommended Practice for Consolidation of Concrete." Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- I. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
- J. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- K. Slabs: Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedge, bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. See also "MONOLITHIC SLAB FINISHES" below.
- L. Maintain reinforcing in proper position during concrete placement operations.
- M. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
1. When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Use only a non-corrosive, non-chloride accelerator. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are NOT permitted.

4. Care must be taken to store water-based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.
- N. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F (32°C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 3. Fog spray forms, reinforcing steel and subgrade just before concrete is placed.

3.11 FINISH OF FORMED SURFACES

- A. Concrete mixes containing pozzolans or slags do not set at the same rate or with the same bleed water characteristic as plain Portland cement. Therefore attention must be directed to the proper procedures. Refer to ACI 232.2R and ACI 301.
- B. Rough Form Finish: For formed concrete surface not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- C. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed. Follow all requirements in ACI 301, Chapter 10 for smooth form finish. Surface preparation for surfaces receiving waterproofing must be approved by the waterproofing manufacturer prior to construction.

3.12 FLOOR FLATNESS/LEVELNESS TOLERANCES

- A. FF defines the maximum floor curvature allowed over 24 in. Computed on the basis of successive 12 in. (300 mm) elevation differentials, FF is commonly referred to as the "Flatness F-Number".
- B. FL defines the relative conformity of the floor surface to a horizontal plane as measured over a 10 ft. (3.05 m) distance commonly referred to as the "Levelness F-Number".
- C. All floors shall be measured within 72 hours of being poured and in accordance with ASTM E 1155 "Standard Test Method for Determining Floor Flatness and Levelness Using the "F Number" System (Inch-Pound Units).
- D. All slabs shall achieve the specified overall tolerance. The minimum local tolerance (1/2 bay or as designated by the architect) shall be 2/3 of the specified tolerances.

- E. All elevated slabs shall achieve the specified FL tolerance before the removal of the forms.
- F. All slabs on metal deck shall achieve the specified FF.

3.13 MONOLITHIC SLAB FINISHES

- A. Float Finish: Apply float finish to slabs at crawl spaces, unless otherwise noted. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Surface shall achieve an FF 35 - FL 25 tolerance.
- B. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system, unless otherwise noted. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance and with a surface leveled to an FF 35/ FL 25 tolerance (FL20 for elevated slabs). Grind smooth surface defects, which would telegraph through applied floor covering system.
- C. Sealers, Hardeners and Liquid Densifiers: Apply a coat of the specified compound to all EXPOSED interior concrete floors where indicated on the drawings. This surface must be continuously moist cured by a method satisfactory to the Architect. Apply and mechanically scrub compound into the floor in strict accordance with the manufacturer's printed instructions.

3.14 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
 - 2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
 - 3. In order to avoid plastic or drying shrinkage cracks during warm, dry or windy weather, ACI 302 and ACI 308 shall be followed using wind breaks and sun shades when recommended. Evaporation retardant shall be as specified in Section 2.04.
 - 4. Care must be taken to store water based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.
- B. Curing Methods: Perform curing of concrete by moisture curing, moisture-retaining cover curing, curing and sealing compound, and by combinations thereof, as herein specified.
 - 1. Provide moisture curing by following methods.
 - a. Keep concrete surface continuously wet by covering with water.

- b. Continuous water-fog spray.
 - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
 2. Provide moisture-retaining cover curing as follows:
 - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Provide curing and sealing compound to exposed interior slabs not receiving additional flooring. A clear curing and sealing compound shall be used on exterior slabs, sidewalks and curbs not receiving a penetrating sealer.
 4. Use the specified curing compound on surfaces to be covered with finish or coating material applied directly to concrete, such as liquid densifier/sealer, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials. Apply compound in accordance with manufacturer's direction.
 - C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
 - D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of the specified curing compound or a continuous moist curing method approved by the architect.
 - E. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F710, coordination with flooring manufacturer is required to insure concrete coatings will not obstruct the bond between the concrete and the adhesive. In addition, insure coatings and adhesives are "benignly compatible" -- in other words, do not combine substances whose constituents are reactive.
 - F. Sealer and Dustproofers: Apply a second coat of the specified curing and sealing compound to exposed interior slabs not subjected to vehicular traffic, noted on the drawings. These slabs must have received an initial coat of the curing and sealing compound.
- 3.15 SHORES AND SUPPORTS
- A. Comply with ACI 347 for shoring and reshoring in multistory construction, and as herein specified.
 - B. Extend shoring from ground to third level.
 - C. Shore floor directly under floor being placed, so that loads from construction above will transfer directly to these shores. Space shoring in stories below this level in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimums to ensure proper distribution

of loads throughout structure. Contractor shall provide the services of a registered Professional Engineer to design the shoring, and determine timing of removal.

- D. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection. Reshores are to be placed from ground level to third level.
- E. Keep reshores from ground level to third level in place a minimum of 7 days after placing upper tier(third level), and longer if required, until concrete at third level has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.16 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F (10°C) for 12 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28-days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.17 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are intended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.18 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in- place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
- D. Grout base plates and foundations as indicated using specified free-flowing non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.
- E. Where high fluidity and/or increased placing time is required use the specified high flow grout. This grout shall be used for all base plates larger than 10 square feet.
- F. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screeds, tamp, and finish concrete surfaces as scheduled.
- G. Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.19 CONCRETE SURFACE REPAIRS

- A. Prior to all repairs, an as-built condition sketch and method of repair must be submitted to the Architect and Engineer of Record for review and approval.
- B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.
- C. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with a bonding grout containing the specified bonding admixture. Place patching mortar after while bonding grout is still tacky.
- D. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- E. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discoloration's that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or pre-cast cement cone plugs secured in place with bonding agent.
- F. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- G. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for tureens of slope, in addition to smoothness, using a template having required slope.

- H. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
- I. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days, except at hydrostatic slabs.
- J. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. The specified underlayment compound or repair topping may be used when acceptable to Architect.
- K. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
- L. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
- M. Structural Repair: All structural repairs shall be made with prior approval of the Engineer of Record as to method and procedure, using the specified polymer repair mortar and/or specified epoxy adhesive. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by the manufacturers previously specified shall be used. In addition, all cracks shall be filled with the specified crack sealer or other method as approved by the Engineer of Record. All garage slabs shall be repaired prior to the slab being treated with the specified penetrating anti-spalling sealer.
- N. Underlayment Application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material. Underlayment application shall achieve the tolerances specified in "MONOLITHIC SLAB FINISHES" above.
- O. Specified Polymer Horizontal Repair Mortar: All exposed floors shall be leveled, where required, with the specified self-leveling repair topping.
- P. Repair Methods not specified above may be used, subject to acceptance of Architect.

3.20 FOUNDATION WALLS

- A. The contractor shall form and leave openings in walls as shown on drawings and approved shop drawings for work of other contractors. These openings shall be temporarily closed and when so directed, the contractor shall point up in solid and neat manner with waterproofed cement.

3.21 WORK IN CONNECTION WITH OTHER TRADES AND CONTRACTS

- A. Sleeves, pockets, openings, etc., shall be set in the concrete walls and arches as required for the mechanical trades as shown on approved shop drawings; these shall be encased or built into the concrete work and shall be properly placed and secured in position in the forms before concrete is placed.
- B. Provide all chases, pipe slots, etc., required for the mechanical trades (see mechanical drawings), constructed as shown on the approved shop drawings.
- C. Leave temporary access panels where required to install mechanical equipment as required by trade affected. Panels shall be formed with construction joints as specified. Details for such panels shall be submitted to Architect for approval.
- D. Coordinate all penetrations, cutting, and patching with waterproofing contractor.

3.22 CUTTING AND PATCHING

- A. Contractor for concrete work shall be responsible for all cutting, removing and patching work where concrete surfaces are not installed within the limits shown on the drawings or specified herein. All such work shall meet with the approval of the Architect or Engineer of Record.
- B. Where cutting and patching is required to accommodate the work of other subcontractors, such cutting shall be done at the expense of said subcontractors but shall be performed by the contractor for concrete work.
- C. The location and extent of cutting in completed concrete work and the patching thereof shall meet with the approval of the Architect or Engineer of Record.

3.23 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. The Owner will employ a testing laboratory to perform tests and to submit test reports.
- B. Provide special inspections per the applicable Building Code and the requirements of all applicable ACI standards.
- C. At locations previously indicated in this specification and on the contract drawings, verify the use of non-magnetic materials. No magnetic materials are permitted in locations where prohibited by this specification or the contract drawings.
- D. Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.
 - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - 2. Slump: ASTM C 143; one test at point of discharge for each truck; additional tests when concrete consistency seems to have changed.
 - 3. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each truck of air-entrained concrete.

4. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above; and each time a set of compression test specimens made.
5. Compression Test Specimen: ASTM C 31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
6. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 25 cu. yds. plus additional sets for each 50 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimens tested at 7 days, three specimens tested at 28 days, and one specimens retained in reserve for later testing if required.
 - a. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
 - b. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 - c. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
7. Water Cementitious Ratio Test: Check water content of concrete in accordance with AASHTO T 318 "Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying". Frequency of this test shall be the same as that of compressive strength tests, noted above.
8. Floor Preparation to Receive Resilient Flooring: For any concrete that receives resilient flooring, test concrete in accordance with ASTM F 710 prior to acceptance by owner.
9. Test results will be reported in writing to Architect, Engineer of Record, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.
 - a. Non Compliance: All test reports indicating non-compliance shall be faxed immediately to all parties on the test report distribution list and the hard copies submitted on different colored paper.
 - b. Nondestructive Testing: Windsor probes, sonoscope, or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
10. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

3.24 WASTE MANAGEMENT

- A. Separate and recycle waste materials in accordance with the Section 017419+
- B. Construction Waste Management and Disposal and to the maximum extent feasible.

- C. Collect cut off steel and discarded reinforcement steel and place in area for recycling.
- D. Place materials defined as hazardous or toxic waste in designated containers.
- E. Use trigger operated spray nozzles for water hoses and closed loop system to reduce water consumption.
- F. Reusable forms should be cleaned immediately after removal and non-reusable forms recycled to the maximum extent economically feasible.
- G. Incorporate crushed concrete or masonry materials in sub-base to the maximum extent feasible in accordance with sub-base specifications.
- H. Before concrete pours, designate location or uses for excess concrete. Options include:
 - 1. Additional paving
 - 2. Post footing anchorage
 - 3. Landscaping -- site concrete features
 - 4. Flowable fill
- I. To avoid contamination of the local landscape, before concrete pours, designate a location for cleaning out concrete trucks where run-off can be contained, reused or incorporated. Options include:
 - 1. Company owned site for that purpose
 - 2. On-site area to be paved later in project

END OF SECTION

SECTION 03 4500

PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Architectural precast concrete cladding units.
 - 2. Insulation
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for installing connection anchors in concrete.
 - 2. Section 051200 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
 - 3. Section 055000 "Metal Fabrications" for kickers and other miscellaneous steel shapes.

1.3 DEFINITIONS

- A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
- C. Shop Drawings:
 - 1. Detail fabrication and installation of architectural precast concrete units.
 - 2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
 - 3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
 - 4. Indicate details at building corners.
 - 5. Indicate separate face and backup mixture locations and thicknesses.
 - 6. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
 - 7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 8. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.

9. Include plans and elevations showing unit location and sequence of erection for special conditions.
 10. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
 11. Indicate relationship of architectural precast concrete units to adjacent materials.
 12. Indicate locations, dimensions, and details of stone facings, anchors, and joint widths.
 13. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- D. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately **12 by 12 by 2 inches (300 by 300 by 50 mm)**.
1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
- E. Delegated-Design Submittal: For architectural precast concrete 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. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.
- F. Dew point calculations: Provide calculations complying with the ASHRAE Handbook of Fundamentals – Theory of Water Vapor Migration and confirming the requirements for effective moisture condensation prevention. The construction of the wall panel and the building envelope must include adequate design to prevent the formation of frost or ice on any panel.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator and testing agency.
- B. Welding certificates.
- C. Material Certificates: For the following items:
 1. Cementitious materials.
 2. Reinforcing materials and prestressing tendons.
 3. Admixtures.
 4. Bearing pads.
 5. Structural-steel shapes and hollow structural sections.
- D. Material Test Reports: For aggregates.
- E. Preconstruction test reports.
- F. Source quality-control test reports.
- G. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project in same category as this Project and who can produce an Erectors' Post-Audit Declaration.
- B. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
1. Designated as a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units or designated as an APA-certified plant for production of architectural precast concrete products.
 2. Fabricator is located within 500 miles (800 km) of Project site.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
- E. Comply with Factory Mutual Global (FMG) requirements as follows:
1. ANSI/FMG 4880 Standard for Evaluating Insulated Wall & Roof/Ceiling Assemblies.
 2. ANSI/FMG 4881 Standard for Evaluating Class 1 Exterior Wall Assemblies.
- F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."
- G. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of two sample panels approximately 16 sq. ft. (1.5 sq. m) in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
1. Locate panels where indicated or, if not indicated, as directed by Architect.
 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
 4. Demolish and remove sample panels when directed.
- H. Range Samples: After sample panel approval and before fabricating architectural precast concrete units, produce a minimum of three sets of samples, approximately 16 sq. ft. (1.5 sq. m) in area, representing anticipated range of each color and texture on Project's units. Maintain one set of range samples at Project site and remaining range sample sets at manufacturer's plant as color and texture approval reference.
- I. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of typical wall area as shown on Drawings.

- a. Include a sealant-filled joint at least **16 inches (400 mm)** long in exterior wall mockup.
 - b. Panel to include:
 - 1) Precast types
 - 2) Extruded Aluminum Trim
 - 3) Steel Roof Coping
 - 4) Louver
 - 5) Formed Metal Wall Panels
 - c. Include through-wall flashing installed for a **24-inch (600-mm)** length in corner of exterior wall mockup approximately **16 inches (400 mm)** down from top of mockup, with a **12-inch (300-mm)** length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include metal studs, sheathing, sheathing joint-and-penetration treatment, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
 3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 4. Protect accepted mockups from the elements with weather-resistant membrane.
 5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
- J. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

1.8 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design architectural precast concrete units.
- B. Design Standards: Comply with **ACI 318 (ACI 318M)** and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- C. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Loads: As indicated.
 - 2. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
 - a. Upward and downward movement of **3/4 inch (19 mm)**.
 - 3. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of **120 deg F (67 deg C)**.
 - 4. Window Washing System: Design precast units supporting window washing system indicated to resist pull-out and horizontal shear forces transmitted from window washing equipment.
- D. All panel identification marks will be placed in locations that will be concealed when installed.

2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement, and configuration to match those used for precast concrete design reference sample. Use with manufacturer's recommended form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

2.3 REINFORCING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, **Grade 60 (Grade 420)**, deformed.
- C. Galvanized Reinforcing Bars: ASTM A 615/A 615M, **Grade 60 (Grade 420)**, deformed bars, with ASTM A 767/A 767M, Class II zinc coating and chromate treatment. Galvanize after fabrication and bending.

- D. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, epoxy coated.
- E. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
- G. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain, flat sheet, Type 1 bendable coating.
- H. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.4 CONCRETE MATERIALS

- A. Regional Materials: Precast architectural concrete shall be manufactured from aggregates and cement that have been extracted or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- B. Recycled Content of Cementitious Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent
- C. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.
- D. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin: ASTM C 618, Class N.
 - 3. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- E. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- F. Coloring Admixture: ASTM C 979/C 979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.
- G. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- H. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- I. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.

2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing Admixture: ASTM C 1017/C 1017M, Type I.

2.5 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or Type B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- C. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.
- D. Carbon-Steel Bolts and Studs: **ASTM A 307, Grade A** or **ASTM F 1554, Grade 36 (ASTM F 568M, Property Class 4.6)**; carbon-steel, hex-head bolts and studs; carbon-steel nuts, **ASTM A 563 (ASTM A 563M)**; and flat, unhardened steel washers, ASTM F 844.
- E. High-Strength Bolts and Nuts: **ASTM A 325 (ASTM A 325M)**, Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, **ASTM A 563 (ASTM A 563M)**; and hardened carbon-steel washers, **ASTM F 436 (ASTM F 436M)**.
- F. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.
 1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
 2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.
- G. Welding Electrodes: Comply with AWS standards.

2.6 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A 666, Type 304, Type 316, or Type 201.
- B. Stainless-Steel Bolts and Studs: **ASTM F 593, Alloy Group 1 or 2 (ASTM F 738M, Grade A1 or A4)** hex-head bolts and studs; **ASTM F 594, Alloy Group 1 or 2 (ASTM F 836M, Grade A1 or A4)** stainless-steel nuts; and flat, stainless-steel washers.
 1. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.
- C. Stainless-Steel-Headed Studs: ASTM A 276, Alloy 304 or Alloy 316, with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

2.7 CONNECTORS FOR CONCRETE SANDWICH WALL PANELS

- A. Provide corrosion and alkali resistant fiber composite connectors having the following physical properties:
- B. Structural component of connector comprising long glass fiber composite pultrusion with glass fibers in a thermoset vinyl-ester resin matrix.
- C. Connector shall have been shown by an independent testing laboratory to provide ultimate static pullout capacities exceeding 5600 lbs, ultimate static shear capacities exceeding 2600 lbs and ultimate cyclic shear capacity of the connector exceeding 2400 pounds
- D. Upon request, connector supplier shall provide documentation of long-term shear capacity of connector.
- E. Coefficient of thermal expansion: 3.90×10^{-6} in/in/°F, nominal.
- F. Central body of connector shall be provided with flange to limit insertion depth into insulation.
- G. Central body of connector shall have serrated profile to provide interference fit with pre-formed holes in the insulation so as to prevent connector from backing out of insulation after installation.
- H. Thermal Conductivity: 2.1 Btu/(°F•ft²•h) per inch of length.
- I. Thermoplastic molded sealing collar in the center section of the connectors to provide friction fit with the pre-formed holes in the insulation; and to provide a retention collar at the topside insulation face to assure proper depth of embedment.

2.8 BEARING PADS

- A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:
 - 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.
 - 2. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.

2.9 ACCESSORIES

- A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.10 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

- B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

2.11 INSULATED PANEL ACCESSORIES

- A. Polyisocyanurate Board Insulation: Complying with ASTM C 1289, Type I; with regularly spaced holes identifying connector placement locations, with thickness of 2 inches.

2.12 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Use a single design mixture for units with more than one major face or edge exposed.
 - 2. Where only one face of unit is exposed use either a single design mixture or separate mixtures for face and backup.
- B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.
- C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by **ACI 318 (ACI 318M)** or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.
- E. Normal-Weight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): **5000 psi (34.5 MPa)** minimum.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.
- G. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
 - 1. Compressive Strength (28 Days): **5000 psi (34.5 MPa)**.
 - 2. Unit Weight: Calculated equilibrium unit weight of **115 lb/cu. ft. (1842 kg/cu. m)**, plus or minus **3 lb/cu. ft. (48 kg/cu. m)**, according to ASTM C 567.
- H. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- I. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.13 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished work.
 - 2. Edge and Corner Treatment: Uniformly chamfered.

2.14 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than **10 inches (250 mm)** in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcing steel and prestressing strands to maintain at least **3/4-inch (19-mm)** minimum concrete cover. Increase cover requirements for reinforcing steel to **1-1/2 inches (38 mm)** when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

- F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- G. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- H. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
 - 1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
 - 1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.
- K. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- L. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.
- M. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- N. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.15 INSULATED PANEL CASTING

- A. Cast, screed, and consolidate bottom concrete wythe supported by mold.
- B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation holes, and consolidate concrete around connectors according to connector manufacturer's written instructions.
- C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.
- D. Cast, screed, and consolidate top wythe to meet required finish.

- E. Maintain temperature below 150 deg F (65 deg C) in bottom concrete wythe.

2.16 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
- B. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:
1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. 10 feet (3 m) or under, plus or minus 1/8 inch (3 mm).
 - b. 10 to 20 feet (3 to 6 m), plus 1/8 inch (3 mm), minus 3/16 inch (5 mm).
 - c. 20 to 40 feet (6 to 12 m), plus or minus 1/4 inch (6 mm).
 - d. Each additional 10 feet (3 m), plus or minus 1/16 inch (1.5 mm).
 2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
 - a. 10 feet (3 m) or under, plus or minus 1/4 inch (6 mm).
 - b. 10 to 20 feet (3 to 6 m), plus 1/4 inch (6 mm), minus 3/8 inch (10 mm).
 - c. 20 to 40 feet (6 to 12 m), plus or minus 3/8 inch (10 mm).
 - d. Each additional 10 feet (3 m), plus or minus 1/8 inch (3 mm).
 3. Total Thickness or Flange Thickness: Plus 1/4 inch (6 mm), minus 1/8 inch (3 mm).
 4. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch/72 inches (3 mm/1830 mm) or 1/2 inch (13 mm) total, whichever is greater.
 5. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch (6 mm).
 6. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch (19 mm).
 7. Dimensions of Haunches: Plus or minus 1/4 inch (6 mm).
 8. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch (3 mm).
 9. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch (6 mm).
 10. Bowing: Plus or minus L/360, maximum 1 inch (25 mm).
 11. Local Smoothness: 1/4 inch/10 feet (6 mm/3 m).
 12. Warping: 1/16 inch/12 inches (1.5 mm/300 mm) of distance from nearest adjacent corner.
 13. Tipping and Flushness of Plates: Plus or minus 1/4 inch (6 mm).
 14. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch (3 mm).
- C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
1. Weld Plates: Plus or minus 1 inch (25 mm).
 2. Inserts: Plus or minus 1/2 inch (13 mm).
 3. Handling Devices: Plus or minus 3 inches (75 mm).
 4. Reinforcing Steel and Welded Wire Reinforcement: Plus or minus 1/4 inch (6 mm) where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch (13 mm).
 5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch (13 mm) of plan dimensions.
 6. Tendons: Plus or minus 1/4 inch (6 mm), vertical; plus or minus 1 inch (25 mm), horizontal.
 7. Location of Rustication Joints: Plus or minus 1/8 inch (3 mm).

8. Location of Opening within Panel: Plus or minus **1/4 inch (6 mm)**.
9. Location of Flashing Reglets: Plus or minus **1/4 inch (6 mm)**.
10. Location of Flashing Reglets at Edge of Panel: Plus or minus **1/8 inch (3 mm)**.
11. Reglets for Glazing Gaskets: Plus or minus **1/8 inch (3 mm)**.
12. Electrical Outlets, Hose Bibs: Plus or minus **1/2 inch (13 mm)**.
13. Location of Bearing Surface from End of Member: Plus or minus **1/4 inch (6 mm)**.
14. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or **1/4 inch (6 mm)** maximum over the full dimension of unit.
15. Position of Sleeve: Plus or minus **1/2 inch (13 mm)**.
16. Location of Window Washer Track or Buttons: Plus or minus **1/8 inch (3 mm)**.

2.17 FINISHES

- A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample and as follows:
 1. PCI's "Architectural Precast Concrete - Color and Texture Selection Guide," of plate numbers indicated.
 - a. As-Cast Surface Finish: Provide surfaces to match approved sample for acceptable surface, air voids, sand streaks, and honeycomb.
 - b. Burnished finish to match sample
 - c. Light Acid Wash: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attack.
 - d. Medium Retarded finish to expose aggregate at recessed panel
 2. Provide finishes as detailed below, in colors as indicated.
 - a. Mix/Finish #1 – D1 (Dark Gray, architect's sample); Acid Washed finish with form liner (Form liner #1 BOD = Architectural Polymers - #305 3/8" Smooth Flute 1" O.C.)
 - b. Mix/Finish #2 – C1 (Light Gray, architect's sample); As-cast finish.
 - c. Mix/Finish #3 (for mockup) – D1 (Dark Gray, architect's sample); Acid Washed finish with form liner (Form liner #2 BOD = Fitzgerald VinyLok #14662).
 - d. Mix/Finish #4 (for mockup) – D1 (Dark Gray, architect's sample); Acid Washed finish with form liner (Form liner #3 BOD = Sika No. 334).
- B. Finish exposed top back surfaces of architectural precast concrete units with smooth, steel-trowel finish.
- C. Finish unexposed surfaces of architectural precast concrete units with as cast finish.

2.18 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712.
- B. Strength of precast concrete units is considered deficient if units fail to comply with **ACI 318 (ACI 318M)** requirements for concrete strength.
- C. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with **ACI 318 (ACI 318M)** requirements, precaster will employ an independent testing

agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M and **ACI 318 (ACI 318M)**.

1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
 2. Test cores in an air-dry condition.
 3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- D. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- E. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 4. Unless otherwise indicated, maintain uniform joint widths of **3/4 inch (19 mm)**.
- C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
1. Do not permit connections to disrupt continuity of roof flashing.
- D. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
 3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum **4.0-mil- (0.1-mm-)** thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
 4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.
- E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
 - a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - c. Twist-off Tension Control Bolt: ASTM F 1852.
 - d. Direct-Tension Control Bolt: ASTM F 1852.
 3. For slip-critical connections, use method and inspection procedure approved by Architect and coordinated with inspection agency.
- F. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.
- B. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:
 - 1. Plan Location from Building Grid Datum: Plus or minus **1/2 inch (13 mm)**.
 - 2. Plan Location from Centerline of Steel: Plus or minus **1/2 inch (13 mm)**.
 - 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus **1/4 inch (6 mm)**.
 - b. Non-Exposed Individual Panel: Plus or minus **1/2 inch (13 mm)**.
 - c. Exposed Panel Relative to Adjacent Panel: **1/4 inch (6 mm)**.
 - d. Non-Exposed Panel Relative to Adjacent Panel: **1/2 inch (13 mm)**.
 - 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: **1/2 inch (13 mm)**.
 - b. Maximum High: **1/4 inch (6 mm)**.
 - 5. Maximum Plumb Variation over the Lesser of Height of Structure or **100 Feet (30 m)**: **1 inch (25 mm)**.
 - 6. Plumb in Any **10 Feet (3 m)** of Element Height: **1/4 inch (6 mm)**.
 - 7. Maximum Jog in Alignment of Matching Edges: **1/4 inch (6 mm)**.
 - 8. Joint Width (Governs over Joint Taper): Plus or minus **1/4 inch (6 mm)**.
 - 9. Maximum Joint Taper: **3/8 inch (10 mm)**.
 - 10. Joint Taper in **10 Feet (3 m)**: **1/4 inch (6 mm)**.
 - 11. Maximum Jog in Alignment of Matching Faces: **1/4 inch (6 mm)**.
 - 12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: **1/4 inch (6 mm)**.
 - 13. Opening Height between Spandrels: Plus or minus **1/4 inch (6 mm)**.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections and prepare reports:
 - 1. Erection of loadbearing precast concrete members.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of **20 feet (6 m)**.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.6 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 04 2000

UNIT MASONRY

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. Concrete masonry units.
 - 2. Concrete building brick.
 - 3. Mortar and grout.
 - 4. Steel reinforcing bars.
 - 5. Masonry joint reinforcement.
 - 6. Ties and anchors.
 - 7. Embedded flashing.
 - 8. Miscellaneous masonry accessories.
- B. Related Sections:
 - 1. Section 033000 "Cast-in-Place Concrete" for installing dovetail slots for masonry anchors.
 - 2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
 - 3. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
 - 4. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
1. Prism Test: For each type of construction required, according to ASTM C 1314.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
 4. Include LEED documentation at time of shop drawing submittal.
- C. Samples for Verification: For each type and color of the following:
1. Accessories embedded in masonry.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
1. Masonry units.
 - a. Include data on material properties and material test reports substantiating compliance with requirements.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of **24 inches (600 mm)** down both sides of walls and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of **24 inches (600 mm)** down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F (4 deg C)** and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs shall be manufactured within **500 miles (800 km)** of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.

- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.

- C. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **2150 psi (14.8 MPa)**.

2. Density Classification: Normal weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

- D. Concrete Building Brick: ASTM C 55.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **2800 psi (19.31 MPa)**.
 2. Density Classification: Normal weight.
 3. Size (Actual Dimensions): **3-5/8 inches (92 mm)** wide by **2-1/4 inches (57 mm)** high by **7-5/8 inches (194 mm)** long.

2.3 CONCRETE AND MASONRY LINTELS

- A. General: Provide one of the following:
- B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.
- C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 033000 "Cast-in-Place Concrete," and with reinforcing bars indicated.
- D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Mortar Cement: ASTM C 1329.
1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **Lafarge North America Inc.;** Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.
 - b. Manufacturers not listed but who do offer products that comply with the requirements of this Section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section Product Substitution Procedures.

- F. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than **1/4 inch (6 mm)** thick, use aggregate graded with 100 percent passing the **No. 16 (1.18-mm)** sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **Euclid Chemical Company (The);** Accelguard 80.
 - b. **Grace Construction Products, W. R. Grace & Co. - Conn.;** Morset.
 - c. **Sonneborn Products, BASF Aktiengesellschaft;** Trimix-NCA.
- I. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, **Grade 60 (Grade 420)**.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: **[0.148-inch (3.77-mm)] [0.187-inch (4.76-mm)]** diameter.
 - 4. Wire Size for Cross Rods: **[0.148-inch (3.77-mm)] [0.187-inch (4.76-mm)]** diameter.
 - 5. Wire Size for Veneer Ties: **0.187-inch (4.76-mm)** diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than **16 inches (407 mm)** o.c.
 - 7. Provide in lengths of not less than **10 feet (3 m)**, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
 - 1. Ladder type with 1 side rod at each face shell of hollow masonry units more than **4 inches (100 mm)** wide, plus 2 side rods at each wythe of masonry **4 inches (100 mm)** wide or less.
 - 2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least **5/8-inch (16-mm)** cover on outside face.
 - 3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of **1-1/4 inches (32 mm)**. Size ties to extend at least halfway through facing wythe but with at least **5/8-inch (16-mm)** cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
 3. Stainless-Steel Sheet: ASTM A 666, Type 304.
 4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 5. Stainless-Steel Bars: ASTM A 276 or ASTM a 666, Type 304.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least **5/8-inch (16-mm)** cover on outside face. Outer ends of wires are bent 90 degrees and extend **2 inches (50 mm)** parallel to face of veneer.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than **4 inches (100 mm)** wide.
1. Where wythes do not align and are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of **1-1/4 inches (32 mm)**.
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped **1/4-inch- (6.35-mm-)** diameter, stainless-steel wire.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within **1 inch (25 mm)** of masonry face, made from **0.25-inch- (6.35-mm-)** diameter, stainless-steel wire.
 3. Provide additional sealant around dovetail slots to assure waterproofing is consistent across wall.
- E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from **0.109-inch- (2.78-mm-)** thick, stainless-steel sheet.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within **1 inch (25 mm)** of masonry face, made from **0.187-inch- (4.76-mm-)** diameter, stainless-steel wire.
- F. Partition Top anchors: **0.105-inch- (2.66-mm-)** thick metal plate with **3/8-inch- (9.5-mm-)** diameter metal rod **6 inches (152 mm)** long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- G. Rigid Anchors: Fabricate from steel bars **1-1/2 inches (38 mm)** wide by **1/4 inch (6.35 mm)** thick by **24 inches (610 mm)** long, with ends turned up **2 inches (51 mm)** or with cross pins unless otherwise indicated bent to configuration indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.7 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

- B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch (0.86-mm), galvanized steel sheet.
- C. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.8 FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual", Section 076200 "Sheet Metal Flashing and Trim" and as follows:

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
 - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of ½-cup (0.14-L) dry measure tetrasodium polyphosphate and ½-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4-L) of water.

2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.

2. Use portland cement-lime mortar unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
1. For masonry below grade or in contact with earth, use Type S.
 2. For reinforced masonry, use Type S.
 3. For mortar parge coats, use Type S or Type N.
 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
 3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus **1/2 inch (12 mm)** or minus **1/4 inch (6 mm)**.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus **1/2 inch (12 mm)**.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus **1/4 inch (6 mm)** in a story height or **1/2 inch (12 mm)** total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than **1/4 inch in 10 feet (6 mm in 3 m)**, or **1/2 inch (12 mm)** maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than **1/8 inch in 10 feet (3 mm in 3 m)**, **1/4 inch in 20 feet (6 mm in 6 m)**, or **1/2 inch (12 mm)** maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than **1/4 inch in 10 feet (6 mm in 3 m)**, **3/8 inch in 20 feet (9 mm in 6 m)**, or **1/2 inch (12 mm)** maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/8 inch in 10 feet (3 mm in 3 m)**, **1/4 inch in 20 feet (6 mm in 6 m)**, or **1/2 inch (12 mm)** maximum.
 - 5. For lines and surfaces do not vary from straight by more than **1/4 inch in 10 feet (6 mm in 3 m)**, **3/8 inch in 20 feet (9 mm in 6 m)**, or **1/2 inch (12 mm)** maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than **1/4 inch in 10 feet (6 mm in 3 m)**, or **1/2 inch (12 mm)** maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than **1/16 inch (1.5 mm)** except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**, with a maximum thickness limited to **1/2 inch (12 mm)**.
 - 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than **1/8 inch (3 mm)**.
 - 3. For head and collar joints, do not vary from thickness indicated by more than plus **3/8 inch (9 mm)** or minus **1/4 inch (6 mm)**.

4. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**. Do not vary from adjacent bed-joint and head-joint thicknesses by more than **1/8 inch (3 mm)**.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than **1/16 inch (1.5 mm)** from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal **4-inch (100-mm)** horizontal face dimensions at corners or jambs.
 1. See drawings for location and type of special bond patterns.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than **4-inches (100-mm)**. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal **4-inch (100-mm)** horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout **24 inches (600 mm)** under bearing plates, beams, lintels, posts, at base of wall at foundation, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 1. Install compressible filler in joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.

4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for **2.67 sq. ft. (0.25 sq. m)** of wall area spaced not to exceed **24 inches (610 mm)** o.c. horizontally and **16 inches (406 mm)** o.c. vertically. Stagger ties in alternate courses. Provide additional ties within **12 inches (305 mm)** of openings and space not more than **36 inches (914 mm)** apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than **24 inches (610 mm)** o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 3. Header Bonding: Provide masonry unit headers extending not less than **3 inches (76 mm)** into each wythe. Space headers not over **[8 inches (203 mm)] [12 inches (305 mm)]** clear horizontally and **16 inches (406 mm)** clear vertically.
- B. Bond wythes of composite masonry together using bonding system indicated on Drawings.
- C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
- D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
 1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
 1. Provide individual metal ties not more than **16 inches (406 mm)** o.c.
 2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
 3. Provide rigid metal anchors not more than **48 inches (1220 mm)** o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch (16 mm)** on exterior side of walls, **1/2 inch (13 mm)** elsewhere. Lap reinforcement a minimum of **6 inches (150 mm)**.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than [**1/2 inch (13 mm)**] [**1 inch (25 mm)**] [**2 inches (50 mm)**] wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than **24 inches (610 mm)** o.c. vertically and **36 inches (915 mm)** o.c. horizontally.

3.9 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
 - 3. Embed connector sections and continuous wire in masonry joints. Provide not less than **2 inches (50 mm)** of air space between back of masonry veneer and face of sheathing.
 - 4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 5. Space anchors as indicated, but not more than **16 inches (406 mm)** o.c. vertically and **24 inches (610 mm)** o.c. horizontally with not less than 1 anchor for each **2.67 sq. ft. (0.25 sq. m)** of wall area. Install additional anchors within **12 inches (305 mm)** of openings and at intervals, not exceeding **36 inches (914 mm)**, around perimeter.

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 - 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than **3/8 inch (10 mm)**.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.
- D. Locations:
 - 1. As indicated, or if not indicated, provide vertical control joints spaced at maximum of 30'-0" on center and at points of natural weakness in masonry work.
 - 2. Above and below major openings in wall
 - 3. At vertical chase, recesses and other points of reduction in wall thickness.
 - 4. Where end of masonry wall butts against supporting structure.
 - 5. Where masonry partitions are installed across control joints in floor slabs, make nearest vertical wall joint on one side of floor control joint, a wall control joint.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete or masonry lintels where shown and where openings of more than **24 inches (610 mm)** for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of **8 inches (200 mm)** at each jamb unless otherwise indicated.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than **60 inches (1520 mm)**.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Coordinate with COTR special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 2 special inspections according to the "International Building Code."
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each **5000 sq. ft. (464 sq. m)** of wall area or portion thereof.
- E. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.14 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of **3/4 inch (19 mm)**. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of **1/8 inch per foot (3 mm per 300 mm)**. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.15 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Clean stone trim to comply with stone supplier's written instructions.

3.16 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than **4 inches (100 mm)** in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within **18 inches (450 mm)** of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Furnish and deliver for installation by others, anchor bolts, bearing plates and loose lintels with complete instructions and templates to facilitate installation.
2. Furnish and erect all struts, columns, bearing plates, beams, steel trusses, girders, bracing, hangers and all related connections (bolted and welded).
3. Openings (unreinforced and reinforced) in structural steel to accommodate mechanical and electrical work.
4. Shop painting and field touch-up painting.
5. Erection bracing and supports, including steel wedges, shims or nuts required for leveling base plates.
6. Lintels and angles attached to structural steel as shown on drawings.
7. Unless specifically excluded, furnish and install all other items for structural steel work indicated on the drawings, specified, or obviously needed to make the work of this Section complete.
8. Waste Management

- B. Related Requirements:

1. Division 01 Section "Construction Waste Management and Disposal"
2. Division 03 Section "Cast in Place Concrete"
3. Division 04 Section "Unit Masonry"
4. Division 05 Section "Metal Deck."
5. Division 05 Section "Metal Fabrications."
6. Division 06 Section "Miscellaneous Carpentry."
7. Division 07 Section "Waterproofing."
8. Division 07 Section "Joint Sealants."
9. Division 07 Section "Expansion Control"

- C. Related Work Specified Elsewhere

1. Installation of anchor bolts furnished under this section.
2. Grout under base and bearing plates.
3. Installation of loose lintels furnished under this section.
4. Miscellaneous metal work

5. Light gage metal roof trusses.
6. Stair framing and hangers.
7. Field painting of structural steel, except as specified herein.
8. Fireproofing systems.

1.3 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Contractor is to implement practices and procedures to meet the Project's Sustainable Design goals. The Contractor shall ensure that the requirements related to these goals, as defined in this Section and in Related Sections of the Contract Documents, are implemented. Substitutions, or other changes to the Work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the Project's Sustainable Design goals.
- B. The Contractor is to efficiently use resources and energy while executing the Work of this Section. Resource efficient aspects to be considered in completing this Project include the use of techniques that minimize waste generation, reuse of construction materials on site where possible, and recycling of waste generated during the construction process.
- C. Performance Requirements: The following criteria are required for the products included in this section
 1. Preference shall be given to materials within 500 miles of the project site, and those steel components originating from mills/fabricators located nearest to the building site.
 2. All steel shall contain a minimum of 50% (combined) pre-consumer/post-consumer recycled content.
 3. Adhesives, sealants, paints and coatings used for the work of this section shall meet the Volatile Organic Compound (VOC) limits specified in Section 018113 "Sustainable Design Requirements," and below where applicable.
 4. Require mills and fabricators have ISO14001 certification. Maximize the re-use of salvaged steel (as approved by the Engineer of Record) and, for work on existing buildings, alert the design team to any existing steel which could be re-used but has not been indicated on the drawings.
 5. Maximize the recycled content of all steel products.
 6. Design details penetrating the façade strictly in accordance with the architectural and structural directives.
 7. Where possible all connections should be made using bolted as opposed to welded details.
 8. Where welding is required use Submerged Arc Welding (SAW). The Gas Metal Arc Welding (GMAW) shall be used were SAW is not applicable (such as for angled connections and anything irregular or short). Field welding shall be allowed only in special circumstances; in such cases Flux Core Arc welding (FCAW) shall be specified with the use of portable fume exhaust system.
 9. Use surface preparation techniques that minimize the use of halogenated solvents and solvents classified as volatile organic compounds. Consider using 'weathering steel' (ASTM A 847) for exterior steel with the approval of the Architect and Engineer of Record.

1.4 LEED SUBMITTALS

A. Submit LEED Certification as follows:

1. LEED Materials Certification Form: For all installed products and materials of this Section, complete the "Environmental Materials Reporting Form" (attached to end of Section 018113 "Sustainable Design Requirements"). Information to be supplied for this Form shall include:

- a. Cost breakdowns for materials included in the Contractor or sub-contractor's Work. Material cost does not include costs associated with labor and equipment.
- b. The percentages (by weight) of pre-consumer and/or post-consumer recycled content in the supplied product(s).
- c. Indication of whether the raw materials have been extracted, harvested or recovered, as well as the final product has been manufactured (location of final assembly), within 500 miles of the project site.

B. VOC Reporting Form: For all installed products and materials of this Section, complete the "VOC Reporting Form" (attached to end of Section 018113 "Sustainable Design Requirements"). Information to be supplied for this Form shall include:

1. Provide generic name by means of product type or application of all field-applied interior adhesives, sealants, paints, and coatings in this Section.
2. Provide corresponding referenced standard limits.
3. Provide full name of supplied product(s) and vendor or manufacturer for each product in this Section.
4. For all field-applied interior adhesives, sealants, paints, and coatings in this Section, provide Volatile Organic Compound (VOC) content in grams/liter or lbs./gallon.

C. Letters of Certification: Provided by the manufacturer on the manufacturer's letterhead, verifying the amount of recycled content.

D. Product Cut Sheets: For all materials that meet the sustainable design performance criteria as per the LEED Performance Requirements of this section.

E. Material Safety Data Sheets (MSDS): For all applicable products. Applicable products include, but are not limited to, adhesives, sealants, paints, and coatings applied to the interior of the building. MSDS shall indicate the Volatile Organic Compound (VOC) content of products submitted. If an MSDS does not indicate VOC content, then product data sheets, manufacturer's literature, or certification letter indicating a product's VOC content can be submitted with the MSDS.

F. Assemble required LEED Submittal information into one (1) package for each Specification Section or sub-contractor. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submittal products or assemblies.

1.5 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches .
 - 2. Welded built-up members with plates thicker than 2 inches .
 - 3. Column base plates thicker than 2 inches .
- D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.6 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of all connections required by the drawings to be completed by structural steel fabricator (including comprehensive engineering analysis by a qualified professional engineer) to withstand loads indicated and comply with other information and restrictions indicated, unless noted otherwise.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Use design method indicated on structural drawings.
 - 3. Moment Connections: Fully restrained unless otherwise noted on drawings.
- B. Lateral Framing Resisting System: Type used is indicated on structural drawings.

1.7 SUBMITTALS

- A. Product Data: Submit data for each type of product indicated in the contract documents.
- B. Shop Drawings: Submit shop drawings in accordance with the specifications as follows:
 - 1. Show clearly all work, including relationship of structural steel to the adjacent work of other trades and to significant lines of finishes of other trades.
 - 2. Do not fabricate or deliver work to the site before drawings reviewed by the Architect and Engineer of Record have been returned.
 - 3. Before preparing steel shop drawings, submit proposed submittal schedule for review by Architect and Engineer of Record.
 - 4. Before preparing steel shop drawings, submit for review a set of job standards showing all necessary joint details with full particulars of connection pieces, shop and field welds, and holes for erection bolts and permanent bolts. These shall include any moment and shear connections. Appropriate marks for designating all types and sizes of joint details shall be included. After approval of these job standards, the erection plans are to be submitted and shall be marked to indicate unmistakably the type and size of joint to be

- used for every beam connection. Do not order steel in advance of approval of the job standards and the erection plans with joint marks, except at own risk
5. Submit calculations for design of connections on job standards and all other connections such as moment and brace frames. Calculations shall be signed and sealed by a Professional Engineer licensed in the state in which the project is located.
 6. Prepare remainder of steel shop drawings after approval of job standards and erection plans. Drawings submitted prior to approval of job standards will be returned without review.
 7. Prepare shop drawings in conformance with the applicable procedures shown in "*Detailing for Steel Construction*," latest edition, published by AISC. Prepare shop drawings under the supervision of competent engineering personnel, licensed by the state in which the construction is to take place. During the preparation of shop drawings, and prior to submittal, coordinate and cross check all shop drawings, including those prepared by subcontractors, for compliance with the Contract Documents.
 8. Indicate clearly the size and grade of steel for each component. Identify rolled shapes, tubes and plates by using the standard designations used in "*Steel Construction Manual*" Latest Edition, by AISC.
 9. Indicate welds and nondestructive tests by using the symbols conforming to AWS A2.4 "*Symbols for Welding and Nondestructive Testing*." Where necessary for clarity, indicate welding procedure designations or other data in the tail of the welding symbol.
 10. Show explicitly the type of connection used in each location, the grade, size, and number of bolts; the type, number, position, designation and orientation of each washer; and the size of each hole, whether slotted or round. Ensure that adequate wrench clearance for correct bolt tightening is provided and note special bolt tightening sequences where applicable and necessary.
 11. Show all camber dimensions in the shop drawings. Where specific camber is not shown in the drawings, note on each affected shop drawing that such members are to be fabricated with the natural camber up.
 12. Show holes required for securing work specified in other sections to structural steelwork, as well as all holes required for passage through structural steelwork of work of other trades. Provide field work drawings for all such holes not shown in shop or erection drawings. Addition of, or change in size or location of openings will not be permitted without prior approval.
 13. Use bolted connections wherever possible; avoid field welding unless otherwise noted on drawings.
 14. Make details in such a way as to avoid having steel, connections, bracing, bolts, etc., interfere with architectural details or in any way reduce the areas of shafts, openings, clearances, etc.
 15. Detail and schedule cleaning and painting data and requirements, including specific indication of "no-paint" areas.
 16. The use of the Architect's or Engineer of Record's electronic drawing files as a base for the erection shop drawings will be permitted at the request of the structural steel detailer upon completion and return of the waiver form. The use of the Architect's or Engineer of Record's electronic drawing files as a base for shop drawing details will not be permitted. The structural steel detailer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design team makes no representation regarding the accuracy or completeness of the electronic files given to the structural steel detailer and their use will be at the structural steel detailer's sole risk and without liability to the design team. The structural steel detailer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing sections and details. The structural steel detailer shall also remove all reference to work not included in

- the steel contract.
17. Scaling of the Architect's or Engineer of Record's drawings is not permitted. This applies to hard paper, electronic, and all other versions.
 18. Show clearly the size and location of each member and the erection mark assigned to each member. Show each field connection with all data and details necessary for assembling the structure. Direct special attention to the possible need for special guying, bracing, or shoring to prevent deformation of existing or new structure due to stresses caused by erection procedures and equipment, by construction loadings, and by forces of natural phenomena.
 19. Prepare, keep up-to-date, and submit a complete drawing index cross-referencing each assigned piece mark with the drawing number in which the piece is detailed. Detail drawings submitted without an up-to-date index and the applicable erection drawing(s) showing the location of each piece will be deemed an incomplete submission and will not be accepted as subject to any agreed shop drawing review schedule.
 20. Prepare anchor bolt and base plate erection drawings containing complete location and placing details, including details of all templates. Provide anchor bolt erection drawings to the concrete trade in advance of applicable concrete work and in coordination with concrete construction sequence.
 21. Submit, in writing, any proposed deviations from the Contract Documents, prior to the submission of shop drawings showing the proposed deviation. Submit requests for deviations on the steelwork subcontractor's letterhead. Deviations not identified, or identified only in letters of transmittal or in shop drawings or both, without the required written request, may not be accepted, and shall be sufficient cause for the architect to return each shop drawing containing such deviations without further action. Acceptance of shop drawings containing deviations not detected by the architect during shop drawing review shall not relieve the steelwork subcontractor from responsibility to conform strictly to the Contract Documents.
 22. Prior to resubmission of shop drawings with additions or corrections, circle or bubble and identify all changes. Drawings submitted without each change being clearly identified are subject to return for resubmission.
 23. Prior to making shop drawings for any portion of the work involving alterations to an existing structure, make all necessary field observations, measurements and surveys of existing conditions. If probes are required to accomplish such measurements, give timely notice where probes will be required.
- C. Submit certified copies of each survey conducted by a surveyor licensed by the state in which the construction is to take place and employed by the structural steel subcontractor. Survey shall show elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and Contract Documents.
- D. Reports:
1. Submit certified copies of mill test reports for all steel furnished. Perform mechanical and chemical tests for all material regardless of thickness or use.
 2. Submit certification of recycled steel content. Certification shall clearly indicate post-consumer AND post-industrial recycled steel content for the particular member or members used.
 3. Submit mill and fabricator certification of compliance with ISO14001.
 4. Submit anchor bolt checking certification as required.
 5. Submit qualification certificates of all welders who will perform work on the project.
 6. Submit survey of erected steelwork as required.

- E. Submit verification of bio-degradable or low VOC, and low Hazardous Air Pollutants (HAPS) cleaning solutions. Provide a cut sheet for all cleaning solutions used in the surface preparation of steel components. Highlight VOC limits and chemical component limits.

1.8 QUALITY ASSURANCE

- A. Except as modified by this specification, comply with the applicable provisions and recommendations of the following codes and standards:

1. International Building Code, 2015
2. AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".
3. AISC "Code of Standard Practice for Steel Buildings and Bridges" latest edition.
4. AISC "Seismic Provisions for Structural Steel Buildings", latest edition.
5. Industrial Fasteners Institute "Handbook of Bolt and Bolted Joints" latest edition.
6. RCSC "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts."
7. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
8. AWS D1.1, "Structural Welding Code."
9. AWS A5.18 & A5.28, Structural Welding Code for GMAW
10. SSPC "Painting Manual, Volume 2, Systems and Specifications.", Latest edition.

- B. Qualifications for welding work shall be as follows:

1. Qualify welding procedures and welding operators in accordance with the AWS "Standard Qualification Procedure."
 - a. Include amended requirements of the building code as noted above.
2. Submit certification that all welders to be employed in work are AWS qualified. If re-certification of welders is required, retesting will be responsibility of structural steel subcontractor.
 - a. Include licensing requirements as per the building code noted above and local jurisdiction.

1.9 TESTING AND INSPECTION

- A. Special Inspection as required by the applicable Building Code of all structural steelwork in the shop and field will be performed by an inspection agency retained by the Contractor (and approved by the Owner, Architect and Engineer of Record) at no expense to the Owner. The inspection agency shall work under the direction of the Contractor. Contractor shall provide the inspection agency with the following:

1. Schedule of all work in both shop and field with at least ten days' written notice before commencement of either activity.
2. A complete set of approved shop and erection drawings.
3. Cutting lists, order sheets, material bills, shipping bills and mill test reports.
4. Information as to time and place of all rollings and shipment of material to shops.
5. Representative sample pieces as requested by the testing agency.

6. Full and ample means and assistance for testing all material.
 7. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.
- B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person making the connection.
- C. The following minimum criteria shall be adhered to in testing of welds and bolts:
1. All welds and bolts shall be examined by visual means.
 2. 25% of all welds, selected randomly, shall be measured.
 3. 25% of all bolts, selected randomly, shall be checked with calibrated torque wrench.
 4. In addition, all welds subject to tensile stress shall be examined by the Ultrasonic Method for 100% of their length.
 5. 10% of all manual fillet welds shall be tested by the magnetic particle method.
 6. 1'-0" at each end of automatic fillet welds shall be tested by the magnetic particle method.
 7. 100% of groove welds shall be tested by the ultrasonic method.
- D. Shop inspection will include examination of steel for straightness and alignment, fissures, mill scale, and other defects and deformities, as described in ASTM A6, examination of fabricated pieces for conforming to approved shop drawings, testing of bolts and welds, and inspection of shop painting. All shop welds shall be visually inspected and spot tested using Ultrasonic Method ASTM E 114 and AWS, Chapter 6, Part C. All inspected welds shall be identified by the inspector.
- E. Field inspection will include examination of erected steel for welding, proper fitting and tensioning of bolts, alignment, trueness and plumbness, touching-up of shop coat, level of billets and base plates.
- F. Inspection of welding will be such as to assure that the work is within the quality requirements specified below and elsewhere in this section of the specifications and will include:
1. Ascertainment that the electrodes and flux used for the SAW, GMAW and FCAW welding processes conform to the requirements of this section of the specifications.
 2. Ascertainment that the approved welding procedures and sequence are followed without deviation, unless specific approval for change is obtained from the Engineer of Record.
 3. The testing agency shall be prepared to utilize the following approved methods of testing:
 - a. Liquid penetrant inspection: ASTM E 165.
 - b. Magnetic particle: ASTM E 1444.
 - c. Radiographic inspection: ASTM E 94 and E 1032.
 - d. Ultrasonic inspection: ASTM E 114 and AWS, Chapter 6, Section C.
- G. When defects are revealed, additional inspection by whatever method is deemed necessary by the inspector, shall be performed to the extent necessary to assure that the full amount of defect has been located. No further work shall be done on the assembly or sub-assembly in question until all the necessary corrections have been made. Defects shall be repaired, using the same welding procedure that was used initially in making the weld, unless otherwise approved by the Engineer of Record. Inspection of the repaired weld shall be by the same method that was used to reveal the defect. A second repair of a defective area shall not be made without approval of the Engineer of Record.

- H. Apparatus and procedure for measuring torque and tension in high strength bolts and for calibrating wrenches shall be furnished and maintained by steel contractor, and shall be approved by the inspection agency. Wrenches shall be calibrated each day at the beginning of the work, each time the bolt size or length of pressure hose is changed, and at such other times as the inspection agency may direct. Periodic checks of high strength steel bolt connections will be made in the field by the inspection agency. The steel contractor shall maintain at all times during erection a manual torque wrench, and shall provide a laborer and scaffolding as required for the testing of connections by the inspection agency, and shall at his own expense, furnish such facilities and provide such assistance as may be required for proper inspection.
- I. A distinguishing mark will be placed on all work that has been inspected and approved. Material or work that is not acceptable will be designated by words such as "REJECT" or "REPAIR" marked directly on the material or work.
- J. Inspection of Shop Painting:
 - 1. Visually evaluate surface preparation by comparison with pictorial standards in accordance with SSPC-Vis 1.
 - 2. Measure dry film thickness of each coat with a magnetic film thickness gauge in accordance with SSPC-PA 2.
 - 3. Visually inspect dried film for runs, sags, dry spray, overspray and missed areas.
 - 4. Repair defective or damaged areas in accordance with painting requirements specified. Architecturally exposed structural steel shall be free of runs and holidays. Make repairs to shop or field coat as directed.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work. Minimize the disturbances to site and soil conditions.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members in a safe, dry, off ground location, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration, discoloration or staining.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structures as directed.

1.11 PROJECT CONDITIONS

- A. The structural steel contractor shall coordinate the structural steel work with the work of other Contracts. Verify all dimensions and details of this Contract and those of other Contracts that affect the work before proceeding. Any discrepancies shall be immediately reported to the architect.
- B. Be fully responsible for the accurate installation of the work. Any discrepancy which arises from his failure to execute the work in conformity to the drawings and specifications shall be

properly remedied at the contractor's own expense and in a manner acceptable to the architect.

- C. Locate dimensionally on setting plans all anchor bolts, inserts, bearing and base plates, etc., and prepare and deliver all required templates and fully dimensioned setting plans in time for the proper execution of the work. Anchor bolts shall be set by another subcontractor. The structural steel contractor shall check all such settings for correctness after they have been cast in place, and before proceeding with erection work.
- D. Report to the architect and certify compliance with the above checking requirements in writing and indicate any inaccuracies found in the location of anchor bolts or inserts, and corrections which must be made to their installation. Any inaccuracies not included in the report and found during or after steel erection shall be the responsibility of the structural steel contractor and the cost of corrective measures shall be borne by the structural steel contractor.
- E. Use base lines, bench marks, or other standards for survey work that have been provided or verified by others. If permanent building bench marks have been established, these will be used for field checking.
- F. Coordinate with all other trades to insure that work of this section does not cause undue conflict. Insure that location of erection devices such as cranes, derricks, booms or hoists, does not cause over-stresses to steel frame to work previously placed by other trades or to existing structures. When required, retain the services of a licensed professional engineer to ascertain that erection devices do not create unsafe conditions or cause overstresses.
- G. Ensure full co-ordination with other related trades and professions.

1.12 SUBSTITUTION

- A. Architect reserves the right to require substitute shapes of other sizes than those indicated on the drawings when it is apparent that the shapes specified cannot be furnished within the time required for the progress of construction. Make said substitutions without additional cost to the owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel shapes, including structural steel wide flange and structural tee rolled shapes, channels, angles, plates, pipe, and hollow structural sections: As noted on structural drawings.
- B. High Strength Bolts:
 - 1. Slip-critical bolts as noted on structural drawings, with hardened washers. Faying surfaces shall be Class A unless otherwise noted.
- C. Anchor Bolts: As noted on structural drawings
- D. Filler metal for welding electrodes. As noted on structural drawings.

- E. Structural steel primer paint (to be used on all non-fireproofed steel): rust inhibitive primer conforms to the following criteria
1. Coordinate all paint requirements with specification sections 099113 and 099123.
 2. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A
 3. Demonstrate a minimum opacity as determined by ASTM D 2805
 4. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
 5. "Slip Critical" compatible rating where applicable
 6. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in Master Painters Institute (MPI) *Green Performance Standard*, GPS-1-08.
 7. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 340 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.
 8. The product shall meet all the requirements of MPI Standards: 23, 26, 76, 79, 95, 107, 135, 173, 275. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category.
 - a. Exterior exposed steel, normal conditions: Use alkyd or polyamide solvent based paints (MPI #'s 76, 79 & 101)
 - b. Interior exposed steel: Use water based paint (MPI # 107)
 - c. Special Applications, highly corrosive environments: Use zinc rich paints (MPI #'s 20 & 200)
- F. Structural steel field paint for exposed members: rust inhibitive primer conforms to the following criteria
1. Coordinate all paint requirements with specification sections 099113 and 099123.
 2. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A
 3. Demonstrate a minimum opacity as determined by ASTM D 2805
 4. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
 5. "Slip Critical" compatible rating where applicable.
 6. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in the Master Painters Institute *Green Performance Standard*, GPS-1-08.
 7. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 400 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.
 8. The product shall meet all the requirements of MPI Standards: 23, 26, 76, 79, 95, 107, 135, 173, 275. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category.
 - a. Exterior exposed steel, normal conditions: Use alkyd or polyamide solvent based paints (MPI #'s 23, 79)
 - b. Interior exposed steel: Use water based paint (MPI # 107)

PART 3 - EXECUTION

STRUCTURAL STEEL

3.1 FABRICATION

- A. All shop connections shall be high strength bolted unless specifically shown otherwise. Fabricate work in shop in as large assemblies as practicable. Use welded connections ONLY where shown on drawings. If a bolted connection is not possible obtain written approval from the Engineer of Record for the welded connection.
- B. Camber: As indicated on drawings.
- C. Mill column ends and bearing stiffeners to give full bearing over the cross section. Plane contact surfaces of bearing plates when required by the AISC Specifications. It is not necessary to plane bottom surfaces of plates on grout beds.
- D. Drill or punch holes at right angles to the surface of the metal, not more than 1/16" larger than the connector diameter. Do not make or enlarge holes by burning. Drill material having a thickness in excess of the connector diameter and material thicker than 7/8". Holes shall be clean-cut without torn or ragged edges. Remove outside burrs resulting from drilling operations.
- E. Provide holes in members to permit connection of the work of other trades. Use suitable templates for proper location of these holes. Steel requiring adjustment or accurate alignment shall be provided with slotted holes or full bearing shims as shown.
- F. Provide holes, slots and openings required by other trades together with necessary reinforcing required. Use suitable templates for proper location of these openings. All such openings shall be shown on the shop drawings. No change in size or location will be permitted without prior approval.
- G. Manual flame cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is within 1/8" of the required line.

3.2 SHOP CONNECTIONS

- A. Provide connections as shown on the drawing exactly as detailed. Where connections are not detailed, the minimum connections shall comply with appropriate tables headed, "Framed Beam Connections" shown in the AISC "Manual of Steel Construction" unless otherwise noted on the drawings. Use high strength bolts unless otherwise shown.
- B. Do not use welded connections unless shown on details. Field welding is not allowed without written instruction from the Engineer of Record.
- C. Proportion and detail all connections on shop drawings to resist forces shown on design drawings. If no reactions are indicated on design drawings, design connections for non-composite beams to resist the end reaction shown in the AISC tables for Uniform Load Constants for Beams. Connections for composite beams shall be proportioned to resist 150% of the above mentioned tabulated load.
- D. Bolting
 - 1. Bolts shall be of a length that will extend not less than 1/4" beyond the nuts. Enter bolts

into holes without damaging the thread.

2. Use high-strength bolts in friction as shown. Make high-strength bolted joints without the use of erection bolts. Bolt heads and nuts shall rest squarely against the metal. Where structural members have sloping surface, bolted connections shall be provided with beveled washers to afford square seating or framing for bolt heads or nuts. Bring members tightly together with sufficient high-strength "fitting-up" bolts which shall be retightened as all the bolts are finally tightened. Manual torque wrenches will not be accepted for final tightening. Protect bolt heads from damage during placing. Final tightening of high-strength bolts shall be by properly calibrated power torque wrenches. Bolts that have been completely tightened shall be marked for identification.

E. Welding

1. The following environmentally preferable welding processes shall be used as described for the related application without exception:
 - a. Submerged Arc Welding (SAW): Plate girders, fillet and butt joints in pipes, cylinders, columns and beams, and welds where 'downhand' or horizontal positions are possible.
 - b. Gas Metal Arc Welding (GMAW) shall be used where SAW is not applicable (such as for angled connections and anything irregular or short).
 - c. Field welding shall be allowed only in special circumstances; in such cases Flux Core Arc welding (FCAW) shall be specified
2. Do not begin structural welding until joint elements are inspected for surface preparation, fit-up, and cleanliness of surface to be welded and are then bolted or tacked in intimate contact and adjusted to dimensions shown on drawings, or both, with allowance for any weld shrinkage that is expected. No members are to be spliced without prior approval by the Engineer of Record.
 - a. Containment surface preparation debris must meet SSPC-Guide 6 guidelines.
3. Pre-heat and interpass temperature shall be in accordance with Table 4.2 (including footnotes) of the AWS Code for Welding in Building Construction. The temperature shall be measured from the side opposite to that which the pre-heat is applied, where possible.
4. All groove welds shall be continuous and full penetration welds unless otherwise shown on the design drawings. Welds made without the aid of a back-up bar shall have their roots chipped, ground or roughened out to sound metal from the second side, before welding is done from the second side.
5. All welds shall be sound throughout. There shall be no crack in any weld or weld pass. Weld may be considered sound if it contains only slight porosity or fusion defects which are well dispersed.
6. The heat, input, length of weld and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.

3.3 SHOP PAINTING AND CLEANING

A. Finishing, coating, plating

1. Shop painting and factory finishing shall be preferred to field painting whenever possible.

Where applicable, finishes and surface preparations based on a physical process such as abrasive blasting, grinding, buffing and polishing are preferred to coatings and solvent based cleaning. Where coatings are necessary powder-coated fabrication is preferred to painting and plating. Avoid plated metals especially those using cadmium and chromium as plate material or cyanide or copper/formaldehyde based electroless copper as the plating solution.

- B. Remove all rust, scale, grease and other detrimental foreign matter in accordance with SSPC-SP 3, Power Tool Cleaning, unless conditions/opportunities listed below apply.
 - 1. Use surface preparation classification recommended by paint manufacturer, SSPC or Master Painters Institute (MPI) for paint product used.
 - a. SSPC-Guide 6, Guide for Containing Debris Generated During Paint Removal Operations, must be followed for all applicable surface preparation techniques.
- C. Immediately after surface preparation, apply structural steel primer paint where specified, in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 2.0 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces. Use type of primer paint as specified in "Materials" article above. Apply two coats to surfaces that will be inaccessible after erection
- D. Paint all structural steel in accordance with the foregoing specification, except as follows:
 - 1. Steel which is to receive spray-on fireproofing.
 - 2. Within 2" of field welds or welds made after paint is applied.
 - 3. Within 3" of high strength friction bolts.
 - 4. Machined surfaces and threaded parts required for adjustment of the structure. Protect these with suitable rust inhibiting coating which may be removed after final installation of the work so that proper finished coatings may be applied.

3.4 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

3.5 SOURCE QUALITY CONTROL

- A. Refer to testing and inspection requirements specified above.

3.6 EXAMINATION

- A. Verify field measurements prior to start of erection. Check the alignment and elevation of all column supports and location of all anchor bolts with transit and level instruments before starting erection. Notify architect of any errors. Obtain Architect's approval of methods

proposed for correcting errors prior to proceeding with corrections and erection.

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

3.7 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.8 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- C. Column billets and bearing plates shall be supported and aligned on steel wedges, shims, or leveling nuts. After the supported members have been plumbed and properly positioned by instrument and anchor nuts tightened, the entire bearing area under the plate shall be packed solidly with grout specified in another Section. Wedges and shims shall be set back a minimum of 3/4" from the edges of plates and shall be left in place. Leveling plates are not permitted.
- D. Plumbing, Leveling and Bracing
 - 1. Structural steel shall be erected true and level, and temporary bracing shall be introduced wherever necessary to provide for all loads to which the structure may be subjected, including equipment and the operation thereof. Such bracing shall be left in place as long as may be required for safety. No welding shall be done or bolts drawn up tight until structural steel has been properly aligned. Obtain approval for guy locations to assure lack of interference with operations of other trades.
- E. Drifting
 - 1. Light drifting necessary to draw holes together will be permitted, but drifting of unfair holes will not be permitted. Twist drills shall be used to enlarge holes as necessary to the next larger size; use next larger size bolts as required. Reaming that weakens the members, or make it impossible to fill the holes properly or to adjust accurately after reaming, will not be allowed.

3.9 FIELD CONNECTIONS

- A. In addition to the requirements for shop connections comply with the following:
 - 1. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint

- specified.
 - 2. Joint Type: As noted on structural drawings.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
- 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

3.10 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 3, Power Tool Cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9."
- D. After erection, all damaged areas in shop coat, exposed surfaces of bolt heads, nuts and washers, and all field welds and unpainted areas adjacent to field welds and high strength bolts shall be painted with a "touch-up" application of same paint used in the shop coat and then painted with same paint used for shop coat tinted another color. Retouch in field, any scraped, abraded, and unpainted surfaces. Painting shall be as specified for shop coats.
- E. Structural steel which is to support mechanical equipment and will be left exposed to the weather in the finished project shall be field painted with one coat of anti-corrosive paint as described in Part 2 for Paint Materials.

3.11 WASTE MANAGEMENT

- A. Separate and recycle waste materials in accordance with the Section 017419 Construction Waste Management and Disposal and to the maximum extent feasible.
- B. Separate for recycling and place in designated containers the following metal waste in accordance with the Waste Management Plans and local recycler standards: Steel, iron, galvanized steel, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass and bronze.
- C. Collect all metal cut-offs and scraps and recycle as above.
- D. Fold up metal banding, flatten and place in designated area.
- E. Close and seal tightly all partly used paint and finish containers and store protected in a well-

ventilated, fire-safe area at moderate temperature.

F. Designated un-used paint for:

1. Immediate re-use
2. Long term maintenance needs
3. Recycling by an appropriate facility.
4. Donation

G. Place empty containers of solvent-based paints in areas designated for hazardous materials.

H. Do not dispose of paints or solvents by pouring on the ground. Place amounts too small to re-use in designated containers for proper disposal

I. Place materials defined as hazardous or toxic waste in designated containers.

END OF SECTION

SECTION 05 2100

STEEL JOISTS

PART 1 - GENERAL

1.1 SCOPE

- A. The work under this section consists of furnishing and installing the following items required to complete the work of this section, as shown on the drawings and specified herein:
1. Open web steel joists designed, fabricated and erected in conformance with SJI (The Steel Joist Institute), AISC, and OSHA
 2. All bridging, bracing and accessories
 3. Bottom chord extensions and connections
 4. Painting of all steel members (including field touchup.)

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Particular attention is directed to Contract Drawings and other Sections of Contract Specifications for information pertaining to required items of work which are related to and usually associated with work of this section, but which are to be provided as part of work of other sections. This includes but is not limited to the following:
1. Division 05 Section "Structural Steel Framing"
 2. Division 05 Section "Steel Decking"
 3. Division 04 Section "Unit Masonry"

1.3 SUBMITTALS

- A. Submit complete shop drawings in accordance with the provisions of "Submittals" Section.
- B. Shop drawings shall include information necessary for complete fabrication and erection of component parts of structure.
1. Shop drawings shall show: Identification mark of members; dimensions; size, arrangement, and weight of members; bridging; requirements, such as punched or drilled holes, for attachment of other materials or parts of construction; type, size and location of shop and field connections; type, size and extent of welds, joint welding procedures; welding sequences; type and dry thickness of paint. (Use welding symbols adopted by American Welding Society.)
- C. Approval of shop drawings will be for size and arrangement of principal and auxiliary components and strength of connections. Dimensional errors on shop drawings are the responsibility of the Contractor.
- D. Submit calculations, as required, under the seal of a professional engineer.

1.4 INSPECTION, TESTING AND CONTROL

- A. An independent testing agency, under the supervision of the architect, will be paid by the Owner.

- B. The materials and workmanship to be furnished under this section shall be subject to inspection in the shop and field by the architect or the owner. Such inspection shall not relieve the contractor of his requirements to furnish materials and workmanship in accordance with requirements of the Contract Documents.
- C. Access shall be provided for inspection of all facilities by the architect and the fabricator shall, when requested, aid the inspectors in carrying out their duties.

PART 2 - PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel for steel joists shall conform to ASTM Specification A36 or A242 for chord and web sections.
 - 1. Selection of steel type shall conform to the standard specifications for steel joists of the type(s) being used of the American Institute of Steel Construction and the Steel Joist Institute.
- B. Filler Metal for Welding: As noted on structural drawings.
- C. Conform to one of the following: Steel Structures Painting Council Specification 12-68T, Type 1 (Red Oxidized), or Federal Specification TT-P-636 (Red Oxide).

PART 3 - PART 3 EXECUTION

3.1 DESIGN AND FABRICATION

- A. All open web steel joists shall be designed and fabricated in accordance with the Standard Specifications for Open Web Steel Joists and Joist Girders as adopted by the Steel Joist Institute (SJI) and the AISC and as specified herein.
- B. Top and bottom chord members shall be limited in shape to angles or structural tees.
- C. Substitutions: Substitutions of sections or modifications of details or both shall be made only with the prior written approval of the architect.
- D. Certification: The contractor shall furnish the following:
 - 1. Certified mill test reports covering chemical and physical properties of steel used in joists.

3.2 ACCESSORIES

- A. Bridging for joists shall be in conformance with recommended practices of the SJI specifications.
- B. All bridging rows shall be spaced as shown on the drawings, but in no case further than is standard with SJI specifications. Provide anchors for all ends of bridging lines terminating at walls or beams. Positive anchorage shall be provided at the ends of each bridging line at both top and bottom chords. Where joists are too close to parallel walls for bridging, provide side wall anchors.
- C. Ceiling extensions shall be either an extended bottom chord or a separate unit as standard with the manufacturer and approved by the architect. Provide ceiling extensions where hung

ceilings are indicated on the drawings. Provide hangers for the ceiling extension to limit the deflection of the free end as required.

- D. Headers, trimmers and bearing plates shall be manufacturer's standard items as approved by the architect.
- E. Provide extended ends for top and/or bottom chords of steel joists where indicated on the drawings.
- F. Provide sloping top chord where indicated on the drawings.

3.3 HANDLING, SHIPPING, AND STORAGE

- A. Care shall be exercised at all times to avoid damage through careless handling. Materials shall be unloaded and placed on skids; dumping onto the ground will not be permitted.
- B. All materials shall be stored off the ground in a well drained location and protected from the weather. No damaged or bent members may be used or installed.

3.4 ERECTION

- A. All steel joists shall be erected in accordance with the procedures and details shown on the approved shop drawings, as shown on the Contract Drawings and in strict conformance with the Standard Specifications for Open Web Steel Joists.
- B. K Series Joists shall bear a minimum of three inches on structural steel, or a minimum of 4 inches on masonry or concrete walls. The end of bearing shall extend one inch beyond the centerline of the beam except where joists abut each other. Each joist shall be anchored to the steel supports with a 1/8 inch fillet weld 2 inches long, each side. LH Series shall bear a minimum of 4 in. on structural steel, or a minimum of 6 inches on masonry or concrete walls. The end of bearing shall extend one inch beyond the centerline of the beam web except where joists abut each other. Each joist shall be anchored to the steel supports with a 1/4 in. fillet weld 2 inches long, each side (minimum).
- C. All anchorage shall be designed to resist a minimum net uplift of 30 pounds per square foot.
- D. The member shall be permanently fastened to supports and all bridging and anchors completely installed before any construction loads (other than workmen) are placed on the joists.
- E. Field welding shall be executed in accordance with the "Code of Arc and Gas Welding in Building Construction" of the AWS, and only by welding operators who have been previously qualified to perform the type of work involved.
- F. Maintain temporary bracing, as required, in place until end moment connections are complete (after slabs are cast).

END OF SECTION

SECTION 05 31 00

STEEL DECKING

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 the work of this Section.

1.2 SUMMARY

- A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Roof deck
2. Headed shear studs
3. All necessary deck supports and reinforcing other than principal framing members including diagonals at columns, angles, plates, and etc.
4. Flashing, cell closures, closure plates and sheet metal work required to contain concrete.
5. Ceiling hanger tabs at new decking composite with concrete where new suspended ceilings are required.
6. Waste Management.

- B. Related Requirements:

1. Concrete and reinforcement over decking
2. Structural steel
3. Shoring of metal deck where unsupported span exceeds the allowable
4. Ceiling systems
5. Mechanical and electrical where supported from deck
6. Fireproofing systems
7. Sheet metal work
8. Waste Management/Recycling Strategies

1.3 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Contractor is to implement practices and procedures to meet the Project's Sustainable Design goals. The Contractor shall ensure that the requirements related to these goals, as defined in this Section and in Related Sections of the Contract Documents, are implemented. Substitutions, or other changes to the Work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the Project's Sustainable Design goals.
- B. The Contractor is to efficiently use resources and energy while executing the Work of this Section. Resource efficient aspects to be considered in completing this Project include the use of techniques that minimize waste generation, reuse of construction materials on site where possible, and recycling of waste generated during the construction process.

- C. Performance Requirements: The following criteria are required for the products included in this section
1. Preference shall be given to decking containing raw materials harvested or extracted, and processed within 500 miles of the project site.
 2. All steel decking, and other steel products including but not limited to studs, reinforcement bar, fasteners, and clips required by the work of this section shall contain a minimum of 50% (combined) pre-consumer/post-consumer recycled content.
 3. Adhesives, sealants, paints and coatings used for the work of this section shall meet the Volatile Organic Compound (VOC) limits specified in [Section 018113 "Sustainable Design Requirements,"](#) where applicable.
 4. Where welding is required use Submerged Arc Welding (SAW). The Gas Metal Arc Welding (GMAW) shall be used were SAW is not applicable (such as for angled connections and anything irregular or short). Field welding shall be allowed only in special circumstances; in such cases Flux Core Arc welding (FCAW) shall be specified with the use of portable fume exhaust system.
 5. Use surface preparation techniques that minimize the use of halogenated solvents and solvents classified as volatile organic compounds.
- D. LEED Performance Requirements:
1. Certification of recycled content, sourcing of materials, and VOC content shall be in accordance with the LEED Submittals requirements of this section.

1.4 LEED SUBMITTALS

- A. Submit LEED Certification items as follows:
1. LEED Materials Certification Form: For all installed products and materials of this Section, complete the "Environmental Materials Reporting Form" (attached to end of [Section 018113 "Sustainable Design Requirements"](#)). Information to be supplied for this Form shall include:
 - a. Cost breakdowns for materials included in the Contractor or sub-contractor's Work. Material cost does not include costs associated with labor and equipment.
 - b. The percentages (by weight) of pre-consumer and/or post-consumer recycled content in the supplied product(s).
 - c. Indication of whether the raw materials have been extracted, harvested or recovered, as well as the final product has been manufactured (location of final assembly), within 500 miles of the project site.
- B. VOC Reporting Form: For all installed products and materials of this Section, complete the "VOC Reporting Form" (attached to end of [Section 018113 "Sustainable Design Requirements"](#)). Information to be supplied for this Form shall include:
1. Provide generic name by means of product type or application of all field-applied interior adhesives, sealants, paints, and coatings in this Section.
 2. Provide corresponding referenced standard limits.
 3. Provide full name of supplied product(s) and vendor or manufacturer for each product in this Section.
 4. For all field-applied interior adhesives, sealants, paints, and coatings in this Section, provide Volatile Organic Compound (VOC) content in grams/liter or lbs./gallon.

- C. Letters of Certification: Provided by the manufacturer on the manufacturer's letterhead, verifying the amount of recycled content.
- D. Product Cut Sheets: For all materials that meet the sustainable design performance criteria as per the LEED Performance Requirements of this section.
- E. Material Safety Data Sheets (MSDS): For all applicable products. Applicable products include, but are not limited to, adhesives, sealants, paints, and coatings applied to the interior of the building. MSDS shall indicate the Volatile Organic Compound (VOC) content of products submitted. If an MSDS does not indicate VOC content, then product data sheets, manufacturer's literature, or certification letter indicating a product's VOC content can be submitted with the MSDS.
- F. Assemble required LEED Submittal information into one (1) package for each Specification Section or sub-contractor. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submittal products or assemblies.

1.5 PERFORMANCE REQUIREMENTS

- A. Metal deck unit sizes and gages are indicated on the drawings. Gages indicated on the drawings are a minimum. Thickness of deck may be required to be increased by deck manufacturer for loadings indicated on drawings.
- B. Unit shall span over three or more supports except where steel layout does not permit.
- C. Maximum allowable deflection under live load plus super imposed dead load shall not exceed (1/360) of the span or (1/4) inch whichever is less.
- D. Deck shall be sized as unshored. Shoring of deck is not permitted unless specifically shown in areas on the drawings.
- E. Use of piercing, non-piercing, and integral hanger tabs is not permitted at roof deck.
- F. Units included in a fire rated assembly must be classified in appropriate UL design.

1.6 SUBMITTALS

- A. Product Data: Product data, including manufacturer's specifications, load tables, section properties and installation instructions for each type of decking and accessories.
- B. Shop Drawings: Shop drawings for all installations showing gauges, deck layout, type of deck, any shoring required, where located, welding details necessary for fabrication to fit in place, and all accessories. Do not use reproductions of the Design Drawings. In addition include the following:
 - 1. Ceiling tab, fillers, closures and similar items.
 - 2. Show placement of headed shear studs connectors with respect to the flutes of the metal deck. Variation from the specified deck configuration may result in a decrease of the capacity of the studs, requiring more studs.
- C. Product Certificates: Certification of specification compliance for each item specified.

- D. Shop drawings showing exact placement of all headed shear studs connectors with respect to the flutes of the metal deck. Variation from the specified deck configuration may result in a decrease of the capacity of the studs, requiring more studs.
- E. Reports
 - 1. Submit certification of recycled steel content. Certification shall clearly indicate post-consumer AND post-industrial recycled steel content for the particular member or members used.
 - 2. Submit mill and fabricator certification if in compliance with ISO14001.
 - 3. Submit verification of finishing process:
 - a. Provide a cut sheet and a Material Safety Data Sheet (MSDS) for all shop and field paints used highlighting VOC limits and chemical and mineral component limits.
 - b. For heavy metals in used plating processes: Provide a cut sheet and a Material Safety Data Sheet (MSDS) for each plating material and related compounds highlighting chemical component limits.
 - c. Certification of recycled zinc content for galvanized products: Provide cut sheets clearly indicating whether the galvanized products used meet the minimums for post-consumer OR post-industrial recycled contents. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and if the recycled content is post-consumer or post-industrial.
 - 4. Submit verification of biodegradable or low VOC, and low Hazardous Air Pollutants (HAPS) cleaning solutions. Provide a cut sheet and a Material Safety Data Sheet (MSDS) for all cleaning solutions used in the surface preparation of steel components. Highlight VOC limits and chemical component limits.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
 - 2. Acoustical roof deck.
- G. Evaluation Reports: For steel deck.

1.7 QUALITY ASSURANCE

- A. Except as modified by governing codes and by this specification, comply with the applicable provisions and recommendations of the following codes and standards:
 - 1. International Building Code, 2015
 - 2. American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members".
 - 3. American Welding Society (AWS), D1.1 "Structural Welding Code" and D1.3 "Structural Welding Code-Sheet Steel".
 - 4. Steel Deck Institute (SDI) "Design Manual for Composite Decks, Form Decks, and Roof Decks".
 - 5. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
- B. Fabricator Qualifications: The work under this section shall be performed by a fabricator and erector submitting conclusive evidence of having satisfactorily completed work of similar scope

and of having the necessary skill, equipment, facilities and capacities to fabricate and perform the erection in accordance with the construction schedules and in full compliance with all requirements of the Contract Documents.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work. However, efforts should be made to minimize the disturbance to site and soil conditions for example, by not requiring excessive areas to be put aside for on-site storage.
- B. Store materials to permit easy access for inspection and identification. Keep all materials in a safe, dry, off ground location, using pallets, platforms, or other supports. Protect all materials from corrosion and deterioration, discoloration or staining. Make efforts to minimize any waste and ensure that as much waste as possible is recycled.
- C. Do not store materials on structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structures as directed.

1.9 PROJECT CONDITIONS

- A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.
- B. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of the steel decking units, the steel decking contractor shall bring the matter to the attention of the contractor for corrective action. The steel decking units are not to be placed until the necessary correlations are made.
- C. Installation of the deck and shear studs will be inspected by the Architect and/or Contractor's inspection agent.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 MANUFACTURERS

- A. Supply manufactured deck units in accordance with the applicable requirements of the Steel Deck Institute's "Design Manual for Floor Decks and Roof Decks".
- B. Deck shall be manufactured by one of the following (or other equivalent as approved by the architect and engineer of record):
 - 1. United Steel Deck (manufactured by Canam)
 - 2. Wheeling Corrugating Co.

3. Vulcraft

2.3 DECK MATERIALS

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, with the minimum section properties indicated on the drawings. Contractor shall provide heavier gauge if minimum gauge indicated is not adequate to support total loads as shown on the drawings.
- B. Non-composite Form Deck: Fabricate ribbed-steel sheet non-composite form-deck panels to comply with "SDI Specifications and Commentary for Non-composite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated on the drawings. Contractor shall provide heavier gauge if minimum gauge indicated is not adequate to support total loads as shown on the drawings.

2.4 ACCESSORIES

- A. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- C. Anchor clips, vent clips, welding washers, flashing, saddle plates, sump pans, other accessories shall be those types, sizes, and configurations recommended by the decking manufacturer, and shall be of the same material and finish as the deck units. All accessories shall conform to ASTM A653/A63M.
- D. Cell closure flexible strips, and fillers shall be of material in compliance with applicable building code governing class of construction.
- E. Provide metal closure strips at edges of all slabs and openings that serve as pour stops for concrete. Gauge shall be sufficient to span or cantilever from steel beams.
- F. Roof sump pans: Fabricate from a single piece of galvanized sheet steel of the same quality as the deck units; not less than nominal 0.0747" (14 gauge) thick before galvanizing; with bottoms level after erection and sloping sides to direct water flow to the drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess pans not less than 1-1/2" below the roof deck surface, unless otherwise shown or required by deck configuration. Weld to deck at maximum 12" o.c.
- G. Headed studs for shear connectors shall be per drawings manufactured from cold drawn wire and conforming to ASTM A 108, Grades 1010 thru 1020.
 - 1. Subject to compliance with requirements, studs shall be manufactured by one of the following:
 - a. Nelson
 - b. KSM
- H. Paint: Where indicated on drawings, must be compatible with galvanized surfaces such that minimal preparation is required.

1. For decks exposed to exterior conditions or high humidity paint must
 - a. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
2. For all decks paint must
 - a. Demonstrate a minimum opacity as determined by ASTM D 2805
 - b. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A
3. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in Master Painters Institute (MPI) *Green Performance Standard*, GPS-1-08.
4. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 340 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.

2.5 FABRICATION

- A. Fabricate deck units in accordance with the AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and accepted shop drawings. Fabricate deck units to the sizes and configurations indicated and cut to lengths which will span not fewer than three supporting members; use only full length units at overhang where indicated in a manner that laps fit tightly. Locate openings for penetrations where indicated and provide support framing and edge reinforcement for all openings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSPECTION

- A. Inspection of the metal deck and shear stud installation will be performed by an inspection agency retained by the Contractor at no expense to the Owner. The inspection agency shall work under the direction of the Contractor. The inspection agency is to be approved by the Owner, Architect and Engineer of Record. Contractor shall provide the inspection agency with the following:
 1. Schedule of all work in both shop and field with at least ten days written notice before commencement of either activity.
 2. A complete set of approved shop and erection drawings.

3.3 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section. Erection shall closely follow the erection of structural steel.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members as per load schedule provided on contract documents.
- D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work, per drawings and manufacturer's specifications.
- F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- G. Headed shear studs shall be installed by welding through metal deck onto beam below. Automatic welding machinery of approved design, amperage, duration of current, etc., shall be used. Studs shall be tested by testing laboratory in accordance with AWS Procedures for Bend Test; replace all studs which do not pass test.
- H. All welding shall be performed by competent experienced welding mechanics. All welds shall be given a protective coat of paint as specified in painting article of section 051200.
- I. All abraded or damaged protective surfaces of steel decking work shall be touched up with a protective coat of paint by this contractor as erected.

3.4 ROOF DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members per drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports per drawings.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing per manufacturer's specification but not less than 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.
- D. All unframed openings in roof deck shall be reinforced per the drawings.
- E. Roof sump pans: Fabricate from a single piece of galvanized sheet steel of the same quality as the deck units; not less than nominal 0.0747" (14 gauge) thick before galvanizing; with bottoms level after erection and sloping sides to direct water flow to the drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess pans not less than 1-1/2" below the roof deck surface, unless otherwise shown or required by deck configuration. Weld to deck at maximum 12" o.c.
- F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end clo-

tures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

- A. Special Inspection as required by the applicable Building Code of all metal decking will be performed by an inspection agency retained by the Owner at no expense to the Contractor. The inspection agency shall work under the direction of the Contractor. Contractor shall provide the inspection agency with the following:
1. Schedule of all work in field with at least ten days' written notice before commencement of either activity.
 2. A complete set of approved shop and erection drawings.
 3. Order sheets, material bills, shipping bills and mill test reports.
 4. Representative sample pieces as requested by the testing agency.
 5. Full and ample means and assistance for testing all material.
 6. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.
- B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person making the connection.
- C. The following minimum criteria shall be adhered to in testing of welds:
1. All welds shall be examined by visual means.
 2. 25% of all welds, selected randomly, shall be measured.
 3. In addition, all welds subject to tensile stress shall be examined by the Ultrasonic Method for 100% of their length.
 4. 10% of all manual fillet welds shall be tested by the magnetic particle method.
 5. 1'-0" at each end of automatic fillet welds shall be tested by the magnetic particle method.
 6. 100% of groove welds shall be tested by the ultrasonic method.
- D. Field inspection will include examination of decking for welding and touching-up of shop coat.
- E. Inspection of welding will be such as to assure that the work is within the quality requirements specified below and elsewhere in this section of the specifications and will include:
1. Ascertainment that the electrodes and flux used for the SAW, GMAW and FCAW welding processes conform to the requirements of this section of the specifications.
 2. Ascertainment that the approved welding procedures and sequence are followed without deviation, unless specific approval for change is obtained from the architect.
 3. The testing agency shall be prepared to utilize the following approved methods of testing:
 - a. Liquid penetrant inspection: ASTM E 165.
 - b. Magnetic particle: ASTM A 709.
 - c. Radiographic inspection: ASTM E 94 and E 1032.
 - d. Ultrasonic inspection: ASTM E 114 and AWS, Chapter 6, Section C.
- F. When defects are revealed, additional inspection by whatever method is deemed necessary by the inspector, shall be performed to the extent necessary to assure that the full amount of defect

has been located. No further work shall be done on the assembly or sub-assembly in question until all the necessary corrections have been made. Defects shall be repaired, using the same welding procedure that was used initially in making the weld, unless otherwise approved by the architect. Inspection of the repaired weld shall be by the same method that was used to reveal the defect. A second repair of a defective area shall not be made without approval of the Architect.

- G. A distinguishing mark will be placed on all work that has been inspected and approved. Material or work that is not acceptable will be designated by words such as "REJECT" or "REPAIR" marked directly on the material or work.
- H. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- I. Remove and replace work that does not comply with specified requirements.
- J. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 CLEANING UP

- A. Remove all equipment, unused materials and debris from the site immediately upon the completion of this work.

3.7 WASTE MANAGEMENT

- A. Separate and recycle waste materials in accordance with the [Section 017419 Construction Waste Management and Disposal](#) and to the maximum extent feasible.
- B. Separate for recycling and place in designated containers the following metal waste in accordance with the Waste Management Plans and local recycler standards: Steel, iron, galvanized steel, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass and bronze.
- C. Collect all metal cut-offs and scraps and recycle as above.
- D. Fold up metal banding, flatten and place in designated area.
- E. Close and seal tightly all partly used paint and finish containers and store protected in a well-ventilated, fire-safe area at moderate temperature.
- F. Designated un-used paint for:
 - 1. Immediate re-use
 - 2. Long term maintenance needs
 - 3. Recycling by an appropriate facility.
 - 4. Donation
- G. Place empty containers of solvent-based paints in areas designated for hazardous materials.
- H. Do not dispose of paints or solvents by pouring on the ground. Place amounts too small to re-use in designated containers for proper disposal
- I. Place materials defined as hazardous or toxic waste in designated containers.

END OF SECTION

SECTION 05 4000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior non-load-bearing wall framing.
- B. Related Requirements:
 - 1. Section 05 5000 "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Section 09 2116 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
 - 3. Section 09 2216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed steel framing.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.

5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Mockups: Furnish cold-formed metal framing for installation in integrated exterior mockups specified in Section 04 2000 "Unit Masonry."
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- 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."
- E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 1. [Dietrich Metal Framing; a Worthington Industries Company.](#)
 2. [MarinoWARE.](#)
 3. [SCAFCO Corporation.](#)
 4. [Steel Network, Inc. \(The\).](#)
- B. Regional Materials: Provide steel manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site

2.2 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.

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/360 for non-masonry cladding of the wall height. Horizontal deflection of 1/600 for masonry cladding of the wall height.
 - b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
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 (67 deg C).
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 (13 mm).
5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards:

1. Wall Studs: AISI S211.
2. Headers: AISI S212.
3. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

E. Fire-Resistance Ratings: Comply with ASTM E 119; 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.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

A. Recycled Content: Provide steel framing with minimum 30 percent total recycled content including at least 25 percent post-consumer recycled content.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180).

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

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

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
2. Flange Width: 1-5/8 inches (41 mm).

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: 1-1/4 inches (32 mm).

- C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. **Dietrich Metal Framing;** a Worthington Industries company.
 - b. **MarinoWARE.**
 - c. **SCAFCO Corporation.**
 - d. **Steel Network, Inc. (The).**

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight 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. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Hole reinforcing plates.
 - 10. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- B. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- C. Sealer Gaskets: Closed-cell neoprene foam, **1/4 inch (6.4 mm)** thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw 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 to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of **1/8 inch in 10 feet (1:960)** and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus **1/8 inch (3 mm)** from plan location. Cumulative error shall not 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 (3 mm)**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than **1/4 inch (6 mm)** to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to 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 (1.6 mm)**.
- 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 and install according to Shop Drawings, and complying 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 comparable in intensity 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 built-up exterior framing members, such as headers, sills, 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.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of **1/8 inch in 10 feet (1:960)** and as follows:
 - 1. Space individual framing members no more than plus or minus **1/8 inch (3 mm)** from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: **16 inches (406 mm)**.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Connect vertical deflection clips to bypassing and infill studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than **48 inches (1220 mm)** apart. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

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. Steel framing and supports for countertops.
 2. Steel framing and supports for mechanical and electrical equipment.
 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 4. Elevator machine beams.
 5. Steel shapes for supporting elevator door sills.
 6. Shelf angles.
 7. Metal Bollards
 8. Alternating tread devices.
 9. Metal ladders.
 10. Metal Floor Grating
 11. Cast Iron Lamb Tongue.
 12. Miscellaneous steel trim including steel edgings and decorative metal plates at copings
 13. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section:
1. Loose steel lintels.
 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Sections:
1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 3. Section 051200 "Structural Steel Framing."
 4. Section 055100 "Metal Stairs."
 5. Section 057300 "Decorative Metal Railings."

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Structural Performance of Gratings and Floor Plate: Provide gratings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Floors: Uniform load of 125 lbf/sq. ft. (6.00 kN/sq. m) or concentrated load of 2000 lbf (8.90 kN), whichever produces the greater stress.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Paint products.
 - 2. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 2. Include LEED documentation at time of shop drawing submittal.
- C. Delegated-Design Submittal: For installed products 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. Qualification Data: For qualified professional engineer.
- B. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- B. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual" and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders and alternating tread devices.
- B. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D.

2.3 FERROUS METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: As indicated.
 - 2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0677-inch (1.7-mm) minimum thickness; unfinished.
- I. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- E. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
- F. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.5 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.

3. Provide stainless-steel fasteners for fastening nickel silver.
 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, [ASTM A 307, Grade A \(ASTM F 568M, Property Class 4.6\)](#); with hex nuts, [ASTM A 563 \(ASTM A 563M\)](#); and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, [ASTM F 593 \(ASTM F 738M\)](#); with hex nuts, [ASTM F 594 \(ASTM F 836M\)](#); and, where indicated, flat washers; Alloy Group [1 \(A1\)](#).
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: [ASME B18.6.3 \(ASME B18.6.7M\)](#).
- G. Lag Screws: [ASME B18.2.1 \(ASME B18.2.3.8M\)](#).
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, [ASME B18.22.1 \(ASME B18.22M\)](#).
- J. Lock Washers: Helical, spring type, [ASME B18.21.1 \(ASME B18.21.2M\)](#).
- K. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- L. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- M. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or [ASTM F 1941 \(ASTM F 1941M\)](#), Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group [1 \(A1\)](#) stainless-steel bolts, [ASTM F 593 \(ASTM F 738M\)](#), and nuts, [ASTM F 594 \(ASTM F 836M\)](#).
- N. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, [1-5/8 by 7/8 inches \(41 by 22 mm\)](#) by length indicated with anchor straps or studs not less than [3 inches \(75 mm\)](#) long at not more than [8 inches \(200 mm\)](#) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting." And Section 099123 Interior Painting."
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of **3000 psi (20 MPa)**.

2.7 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, **1/8 by 1-1/2 inches (3.2 by 38 mm)**, with a minimum **6-inch (150-mm)** embedment and **2-inch (50-mm)** hook, not less than **8 inches (200 mm)** from ends and corners of units and **24 inches (600 mm)** o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports at exterior locations, and where indicated

2.9 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive **3/4-inch (19-mm)** bolts, spaced not more than **6 inches (150 mm)** from ends and **24 inches (600 mm)** o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately **2 inches (50 mm)** larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.10 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3 unless otherwise indicated.
 - 2. For elevator pit ladders, comply with ASME A17.1.

- B. Steel Ladders:
1. Space siderails **18 inches (457 mm)** apart unless otherwise indicated.
 2. Space siderails of elevator pit ladders **12 inches (300 mm)** apart.
 3. Siderails: Continuous, **3/8-by-2-1/2-inch (9.5-by-64-mm)** steel flat bars, with eased edges.
 4. Rungs: **3/4-inch- (19-mm-)** diameter steel bars.
 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 6. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 7. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than **1/2 inch (12 mm)** in least dimension.
 8. Support each ladder at top and bottom and not more than **60 inches (1500 mm)** o.c. with welded or bolted steel brackets.
 9. Galvanize exterior ladders, including brackets and fasteners.

2.11 ALTERNATING TREAD DEVICES

- A. Alternating Tread Devices: Fabricate alternating tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [Lapeyre Stair Inc.](#)
 - b. [Schmidt Structural Products, Inc.](#)
 2. Tread depth shall be not less than **5 inches (127 mm)** exclusive of nosing or less than **8-1/2 inches (216 mm)** including the nosing, tread width shall be not less than **7 inches (178 mm)**, and riser height shall be not more than **9-1/2 inches (241 mm)**.
 3. Tread depth shall be not less than **8-1/2 inches (216 mm)** exclusive of nosing or less than **10-1/2 inches (267 mm)** including the nosing, tread width shall be not less than **7 inches (178 mm)**, and riser height shall be not more than **8 inches (203 mm)**.
 4. Fabricate from steel and assemble by welding or with stainless-steel fasteners.
- B. Galvanize and prime steel alternating tread devices, including treads, railings, brackets, and fasteners.

2.12 METAL BAR GRATINGS

- A. Rectangular Bar Grating:
1. Traffic Surface: As indicated.
 2. Finish: Galvanized.
 3. Basis of Design: McNichols GW, Welded Rectangular Bar Grating.
- B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
1. Provide not less than 4 saddle clips for each grating section composed of rectangular bearing bars **3/16 inch (4.8 mm)** or less in thickness and spaced **15/16 inch (24 mm)** or more o.c., with each clip designed and fabricated to fit over 2 bearing bars.

2. Furnish threaded bolts with nuts and washers for securing grating to supports.

C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

D. Do not notch bearing bars at supports to maintain elevation.

2.13 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Provide decorative Aluminum plate at coping. Plate to be prefinished extruded aluminum plate at top of parapet.

1. Finish: High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Color and Gloss: Three-coat Metallic – Valspar; Medium Gray (Metallic); 439RZ1824M

D. Provide decorative Aluminum plate door surrounds. Plate to be prefinished extruded aluminum plate.

1. Finish: High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Color and Gloss: Three-coat Metallic – Valspar; Medium Gray (Metallic); 439RZ1824M

E. Galvanize exterior miscellaneous steel trim.

2.14 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Cap bollards with **1/4-inch- (6.4-mm-)** thick steel plate.

2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.

3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.

B. Fabricate sleeves for bollard anchorage from steel pipe or tubing with **1/4-inch- (6.4-mm-)** thick steel plate welded to bottom of sleeve. Make sleeves not less than **8 inches (200 mm)** deep and **3/4 inch (19 mm)** larger than OD of bollard.

- C. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch (6.4-mm) wall-thickness steel tubing with an OD approximately 1/16 inch (1.5 mm) less than ID of bollards. Match drill sleeve and bollard for 3/4-inch (19-mm) steel machine bolt.
- D. Prime bollards with zinc-rich primer.
- E. Provide plastic covers where indicated.

2.15 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.

2.16 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm) unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.17 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.18 LAMBS TONGUE DRAINAGE NOZZLE

- A. Basis of Design: Watts Drainage Products RD-940 cast nickel bronze downspout nozzle with anchor flange, countersunk mounting holes, and IPS threaded (standard), no hub, or push-on connection

2.19 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.20 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Section 099113 "Exterior Painting" and primers specified in Section 099123 "Interior Painting" unless indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.5 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - 1. Do not fill removable bollards with concrete.
- B. Anchor bollards in concrete in formed or core-drilled holes not less than **8 inches (200 mm)** deep and **3/4 inch (19 mm)** larger than OD of bollard. Fill annular space around bollard solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately **1/8 inch (3 mm)** toward bollard.
- C. Anchor internal sleeves for removable bollards in formed or core-drilled holes not less than **8 inches (200 mm)** deep and **3/4 inch (19 mm)** larger than OD of sleeve. Fill annular space around internal sleeves solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately **1/8 inch (3 mm)** toward internal sleeve.
- D. Place removable bollards over internal sleeves and secure with **3/4-inch (19-mm)** machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner furnishes padlocks.
- E. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.
- F. Provide plastic covers where indicated.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 5100

METAL STAIRS

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. Preassembled steel stairs with concrete-filled treads.
- B. Related Sections:
 - 1. Section 033000 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
 - 2. Section 057300 "Decorative Metal Railings" for ornamental metal railings.
 - 3. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking for anchoring railings.
 - 4. Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Abrasive nosings.
 - 2. Paint products.
 - 3. Grout.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include LEED documentation at time of shop drawing submittal.

C. Delegated-Design Submittal: For installed products 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. Qualification Data: For qualified professional engineer and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial class.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- F. Wire Rod for Grating Crossbars: [ASTM A 510](#) ([ASTM A 510M](#)).
- G. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- H. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, [Grade 25](#) ([Grade 170](#)), unless another grade is required by design loads; exposed.
- I. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, [Grade 30](#) ([Grade 205](#)), unless another grade is required by design loads.
- J. Galvanized-Steel Sheet: ASTM A 653/A 653M, [G90](#) ([Z275](#)) coating, either commercial steel, Type B, or structural steel, [Grade 33](#) ([Grade 230](#)), unless another grade is required by design loads.

2.3 ABRASIVE NOSINGS

- A. Cast-Metal Units: Cast iron, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - 1. [Manufacturers](#): Subject to compliance with requirements, provide products by one of the following:
 - a. [American Safety Tread Co., Inc.](#)
 - b. [Balco Inc.](#)
 - c. [Wooster Products Inc.](#)

2. Configuration: Cross-hatched angle-shaped units, same depth as bar-grating treads and 1 to 1-1/2 inches (25 to 38 mm) wide.

- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.
- G. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 STEEL-FRAMED STAIRS

- 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. **Alfab, Inc.**
 - 2. **American Stair, Inc.**
 - 3. **Sharon Companies Ltd. (The).**
- B. Stair Framing:
 - 1. Fabricate stringers of steel plates or channels at industrial and service stairs. Fabricate stringers of steel tubes at ornamental or student-use stairs
 - a. Provide closures for exposed ends of channel and tube stringers.
 - 2. Construct platforms of steel plate, channel or tube headers and miscellaneous framing members as needed to comply with performance requirements indicated.
 - 3. Weld stringers to headers; weld framing members to stringers and headers.
 - 4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
 - 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

- C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than **0.067 inch (1.7 mm)**.
1. Steel Sheet: Uncoated cold-rolled steel sheet unless otherwise indicated.
 2. Steel Sheet: Galvanized-steel sheet, where indicated.
 3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 4. Shape metal pans to include nosing integral with riser.
 5. Attach abrasive nosings to risers
 6. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
 7. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.8 STAIR RAILINGS

- A. Comply with applicable requirements in Section 057300 "Decorative Metal Railings."

2.9 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 2. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
1. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."
- E. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.2 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 7300

DECORATIVE METAL RAILINGS

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. Steel and iron decorative railings.
- B. Related Sections:
 - 1. Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.

- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of railings assembled from standard components.
 - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- 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.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Fittings and brackets.
 - 3. Welded connections.
 - 4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
- E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Welding certificates.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- D. Preconstruction test reports.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

- B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than **24 inches (600 mm)** in length.
 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.
 - 1. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.

2.2 STEEL AND IRON

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- C. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- F. Woven-Wire Mesh: Intermediate-crimp, square pattern, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter wire complying with ASTM A 510 (ASTM A 510M).

2.3 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
 - 2. Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
 - 3. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.
 - 1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group **1 (A1)** stainless-steel bolts, **ASTM F 593 (ASTM F 738M)**, and nuts, **ASTM F 594 (ASTM F 836M)**.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- D. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.5 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the 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. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- I. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. By flush bends or by inserting prefabricated flush-elbow fittings.
- K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of hollow railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is **1/4 inch (6 mm)** or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide stainless-steel sleeves not less than **6 inches (150 mm)** long with inside dimensions not less than **1/2 inch (13 mm)** greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to

not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

R. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) metal channel frames.

1. Make wire mesh and frames from steel unless otherwise indicated.
2. Orient wire mesh with wires perpendicular and parallel to top rail.

S. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.6 GENERAL FINISH REQUIREMENTS

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 shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

- E. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
- G. Shop-Painted Finish: Comply with Section 099113 "Exterior Painting."
 - 1. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet (5 mm in 3 m)**.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending **2 inches (50 mm)** beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within **6 inches (150 mm)** of post.

3.4 ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Leave anchorage joint exposed with **1/8-inch (3-mm)** buildup, sloped away from post.
- C. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
- D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Attach handrails to walls with wall brackets. Provide brackets with **1-1/2-inch (38-mm)** clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- B. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.6 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. 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.

END OF SECTION

SECTION 06 1053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Rooftop equipment bases and support curbs.
 2. Wood blocking, cants, and nailers.
 3. Wood furring and grounds.
 4. Wood sleepers.
 5. Plywood backing panels.
- B. Related Requirements:
1. Section 061600 "Sheathing."
 2. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of **2 inches nominal (38 mm actual)** or greater but less than **5 inches nominal (114 mm actual)** in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NHLA: National Hardwood Lumber Association.
 3. NLGA: National Lumber Grades Authority.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. 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.

3. 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 according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. LEED Submittals:

1. Certificates for Credit MR 7: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification and chain-of-custody requirements. Include statement indicating cost for each certified wood product.
2. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that products contain no urea formaldehyde.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Expansion anchors.
5. Metal framing anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 3. 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 lumber.
 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.
- C. Certified Wood: Plastic-laminate cabinets shall be made from wood products certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying 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 according to ASTM E 84, 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 (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
1. Concealed blocking.
 2. Roof framing and blocking.
 3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 4. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
 3. Rooftop equipment bases and support curbs.
 4. Cants.
 5. Furring.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine, No. 2 grade; SPIB.
 2. Hem-fir or hem-fir (north), Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
 3. Eastern softwoods, No. 3 Common grade; NELMA.
 4. Northern species, No. 3 Common grade; NLGA.

5. Western woods, Standard or No. 3 Common grade; 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 blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than **3/4-inch (19-mm)** nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: **ASME B18.2.1 (ASME B18.2.3.8M)**.
- G. Bolts: Steel bolts complying with **ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6)**; with **ASTM A 563 (ASTM A 563M)** hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with **ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4)**.

2.7 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.025 inch (0.6 mm)**.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than **16 inches (406 mm)** o.c.
- H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than **96 inches (2438 mm)** o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- I. Sort and select lumber so that natural characteristics will 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.

- J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- L. 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 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

- 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 or Hardboard Paneling: Install **1-by-3-inch nominal-size (19-by-63-mm actual-size)** furring horizontally and vertically at **24 inches (610 mm)** o.c.
- C. Furring to Receive Gypsum Board: Install **1-by-2-inch nominal-size (19-by-38-mm actual-size)** furring vertically at **16 inches (406 mm)** o.c.

3.4 PROTECTION

- A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 1600

SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Sheathing joint and penetration treatment.
- B. Related Requirements:
 - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for plywood backing panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. LEED Submittals:
 - 1. Certificates for Credit MR 7: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification and chain-of-custody requirements. Include statement indicating cost for each certified wood product.
 - 2. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that products contain no urea formaldehyde.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory".
- B. Certified Wood: Plastic-laminate cabinets shall be made from wood products certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

2.2 WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [CertainTeed Corporation; GlasRoc.](#)
 - b. [G-P Gypsum Corporation; Dens-Glass Gold.](#)
 - c. [National Gypsum Company; Gold Bond e\(2\)XP.](#)
 - d. [United States Gypsum Co.; Securock.](#)
 - 2. Type and Thickness: Type X, **5/8 inch (15.9 mm)** thick, as indicated.
 - 3. Size: **48 by 96 inches (1219 by 2438 mm)** for vertical installation.

2.3 ROOF SHEATHING

- A. Glass-Mat Gypsum Roof Sheathing: ASTM C 1177/1177M.
 - 1. **Products:** Subject to compliance with requirements, provide the following:
 - a. Georgia-Pacific Corporation; Dens Deck.
 - 2. Type and Thickness: Type X, 5/8 inch (16 mm) thick.
 - 3. Size: 48 by 96 inches (1219 by 2438 mm) for vertical installation.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.

- C. Power-Driven Fasteners: NES NER-272.
- D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

2.6 MISCELLANEOUS MATERIALS

- A. Felts: ASTM D 226, Type I, recycled synthetic rubber-saturated organic felts, nonperforated.
- B. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 2. Install boards with a **3/8-inch (9.5-mm)** gap where non-load-bearing construction abuts structural elements.
 3. Install boards with a **1/4-inch (6.4-mm)** gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 1. Space fasteners approximately **8 inches (200 mm)** o.c. and set back a minimum of **3/8 inch (9.5 mm)** from edges and ends of boards.
 2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Seal sheathing joints according to sheathing manufacturer's written instructions.
 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION

SECTION 06 4116

PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
- B. Related Requirements:
 - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate and cabinet hardware and accessories.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. LEED Submittals:
 - 1. Certificates for Credit MR 7: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification and chain-of-custody requirements. Include statement indicating cost for each certified wood product.
 - 2. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that products contain no urea formaldehyde.
- C. Samples for Initial Selection:
 - 1. Plastic laminates.
 - 2. PVC edge material.
 - 3. Thermoset decorative panels.
- D. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each color, pattern, and surface finish.

2. Thermoset decorative panels, 8 by 10 inches (200 by 250 mm), for each color, pattern, and surface finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of product.
 1. Composite wood and agrifiber products.
 2. Thermoset decorative panels.
 3. High-pressure decorative laminate.
 4. Adhesives.
- B. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that 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. Shop is a certified participant in AWI's Quality Certification Program.
- B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

- D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Custom.
- C. Regional Materials: Plastic-laminate cabinets shall be manufactured within **500 miles (800 km)** of Project site.
- D. Certified Wood: Plastic-laminate cabinets shall be made from wood products certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- E. Type of Construction: Frameless.
- F. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- G. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [Abet Laminati, Inc.](#)
 - b. [Formica Corporation.](#)
 - c. [Lamin-Art, Inc.](#)
 - d. [Panolam Industries International, Inc.](#)
 - e. [Wilsonart International](#); Div. of Premark International, Inc.
- H. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: Grade HGS.

- I. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS Thermoset decorative panels.
 - a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch (0.460-mm) minimum thickness, matching laminate in color, pattern, and finish.
 - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
- J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from laminate manufacturer's full range in the following categories:
 - a. Solid colors, matte finish.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 8 to 13 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
 - 2. Thermoset Decorative Panels: Medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 7000 "Door Hardware."
- B. Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
 - 1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Catches: Push-in magnetic catches, BHMA A156.9, B03131.
- E. Shelf Rests: BHMA A156.9, B04013; metal.
- F. Door and Drawer Silencers: BHMA A156.16, L03011.

- G. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
- H. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Adhesive for Bonding Plastic Laminate: Contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of **1/8 inch in 96 inches (3 mm in 2400 mm)**.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than **1/8 inch in 96-inch (3 mm in 2400-mm)** sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than **16 inches (400 mm)** o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

SECTION 07 1326

SELF-ADHERING SHEET WATERPROOFING

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. Modified bituminous sheet waterproofing.
 - 2. Modified bituminous deck-paving sheet waterproofing.
 - 3. Bonded HDPE or polyethylene sheet waterproofing.
- B. Related Requirements:
 - 1. Section 079500 "Expansion Control" for plaza- or foundation-wall expansion-joint assemblies that interface with waterproofing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. LEED Submittals:
 - 1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

- C. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
 - 1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
- D. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1. 8-by-8-inch (200-by-200-mm) square of waterproofing and flashing sheet.
 - 2. 8-by-8-inch (200-by-200-mm) square of insulation.
 - 3. 4-by-4-inch (100-by-100-mm) square of drainage panel.
 - 4. Plaza-deck paver, full sized, in each color and texture required.
 - 5. Paver pedestal assembly.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
 - 1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.
 - a. Size: 100 sq. ft. (9.3 sq. m) in area.
 - b. Description: Each type of wall installation.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.
 - 1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.
- B. Source Limitations for Plaza-Deck Paving: Obtain plaza-deck pavers from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum **60-mil (1.5-mm)** nominal thickness, self-adhering sheet consisting of **56 mils (1.4 mm)** of rubberized asphalt laminated on one side to a **4-mil- (0.10-mm-)** thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [American Hydrotech, Inc.; VM75.](#)
 - b. [Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.](#)
 - c. [CETCO Building Materials Group, a subsidiary of AMCOL International Corp.; Envirosheet.](#)
 - d. [Grace, W. R., & Co. - Conn.;](#) Bituthene 3000/Low Temperature or Bituthene 4000.
 - e. [Henry Company; Blueskin WP 100/200.](#)
 - f. [Meadows, W. R., Inc.; SealTight Mel-Rol.](#)
 - 2. Physical Properties:
 - a. Tensile Strength, Membrane: **250 psi (1.7 MPa)** minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at **minus 20 deg F (minus 29 deg C)**; ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of **1/8-inch (3-mm)** movement; ASTM C 836.
 - e. Puncture Resistance: **40 lbf (180 N)** minimum; ASTM E 154.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at **70 deg F (21 deg C)**; ASTM D 570.

- g. Water Vapor Permeance: **0.05 perms** (2.9 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
 - h. Hydrostatic-Head Resistance: **200 feet (60 m)** minimum; ASTM D 5385.
3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 BONDED HDPE OR POLYETHYLENE SHEET WATERPROOFING

- A. Products: Subject to compliance with requirements, provide one of the following:
 1. Vertical Applications:
 - a. Grace, W. R., & Co. - Conn.; Preprufe 160R.
 - b. Polyguard Products, Inc.; Underseal Blindside Membrane.
 2. Horizontal Applications:
 - a. Grace, W. R., & Co. - Conn.; Preprufe 300R.
 - b. Polyguard Products, Inc.; Underseal Underslab Membrane.
- B. Bonded HDPE Sheet for Vertical Applications: Uniform, flexible, multilayered-composite sheet membrane consisting of either a HDPE film coated with a pressure-sensitive adhesive and protective release liner, total **32-mil (0.8-mm)** thickness, or an HDPE film coated with a modified asphalt layer and a nonwoven geotextile-fabric final layer, total **73-mil (1.9-mm)** thickness; with the following physical properties:
 1. Tensile Strength, Film: **4000 psi (27.6 MPa)** minimum; ASTM D 412.
 2. Low-Temperature Flexibility: Pass at **minus 10 deg F (minus 23 deg C)**; ASTM D 1970.
 3. Peel Adhesion to Concrete: **5 lbf/in. (875 N/m)** minimum; ASTM D 903, modified.
 4. Lap Adhesion: **2.5 lbf/in. (440 N/m)** minimum; ASTM D 1876, modified.
 5. Hydrostatic-Head Resistance: **231 feet (70 m)**; ASTM D 5385, modified.
 6. Puncture Resistance: **100 lbf (445 N)** minimum; ASTM E 154.
 7. Water Vapor Permeance: **0.01 perms** (0.6 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
 8. Water Absorption: 0.5 percent maximum; ASTM D 570.
- C. Bonded HDPE or Polyethylene Sheet for Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane consisting of either an HDPE film coated with pressure-sensitive adhesive and protective release liner, total **46-mil (1.2-mm)** thickness, or a cross-laminated film of low- and medium-density polyethylene, coated with a modified asphalt layer and a nonwoven geotextile-fabric final layer, total **95-mil (2.4-mm)** thickness; with the following physical properties:
 1. Tensile Strength, Film: **2000 psi (13.8 MPa)** minimum; ASTM D 412.
 2. Low-Temperature Flexibility: Pass at **minus 10 deg F (minus 23 deg C)**; ASTM D 1970.
 3. Peel Adhesion to Concrete: **5 lbf/in. (875 N/m)** minimum; ASTM D 903, modified.
 4. Lap Adhesion: **2.5 lbf/in. (440 N/m)** minimum; ASTM D 1876, modified.
 5. Hydrostatic-Head Resistance: **231 feet (70 m)**; ASTM D 5385, modified.
 6. Puncture Resistance: **200 lbf (890 N)** minimum; ASTM E 154.
 7. Water Vapor Permeance: **0.01 perms** (0.6 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
 8. Water Absorption: 0.5 percent maximum; ASTM D 570.
- D. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.4 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.
- G. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch (13 mm) thick.

2.5 MOLDED-SHEET DRAINAGE PANELS

- A. Molded-Sheet Drainage Panel: Comply with Section 334600 "Subdrainage."
- B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Hydrotech, Inc.; Hydrodrain 400 or Hydrodrain 420.
 - b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRAIN 6000 CCW MiraDRAIN 6000XL CCW MiraDRAIN 6200 or CCW MiraDRAIN 6200XL.
 - c. Grace, W. R., & Co. - Conn.; Hydroduct 220 or Hydroduct 660.
 - d. Protecto Wrap Company; Protecto Drain 2000-V.

2.6 INSULATION

- A. Insulation, General: Comply with Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of **1/16 inch (1.6 mm)**.
- F. Bridge and cover isolation joints expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install **3/4-inch (19-mm)** fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
 - b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform **2-1/2-inch- (64-mm-)** minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between **25 and 40 deg F (minus 4 and plus 5 deg C)**, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than **60 deg F (16 deg C)**.
- D. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.
- E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- F. Seal edges of sheet-waterproofing terminations with mastic.
- G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending **6 inches (150 mm)** beyond repaired areas in all directions.
- I. Immediately install protection course with butted joints over waterproofing membrane.
 - 1. Board insulation may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.4 BONDED HDPE OR POLYETHYLENE SHEET-WATERPROOFING APPLICATION

- A. Install bonded HDPE or polyethylene sheets according to manufacturer's written instructions.
- B. Place and secure molded-sheet drainage panels over substrate. Lap edges and ends of geotextile to maintain continuity.
- C. Vertical Applications: Install sheet with HDPE face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.

1. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detailing tape.
- D. Horizontal Applications: Install sheet with HDPE or polyethylene face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.
- E. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.
- F. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.
- G. Install sheet-waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending **6 inches (150 mm)** beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.5 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 1. For vertical applications, install board insulation before installing drainage panels.

3.6 INSULATION INSTALLATION

- A. Install one or more layers of board insulation to achieve required thickness over waterproofed surfaces. Cut and fit to within **3/4 inch (19 mm)** of projections and penetrations.
- B. On vertical surfaces, set insulation units in adhesive or tape applied according to manufacturer's written instructions.
- C. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.7 INSULATION DRAINAGE-PANEL INSTALLATION

- A. Install insulation drainage panels over waterproofed surfaces; cut and fit to within **3/4 inch (19 mm)** of projections and penetrations.
- B. Ensure that drainage channels are aligned and free of obstructions.

- C. On vertical surfaces, set insulation drainage panels in adhesive or tape applied according to manufacturer's written instructions.
- D. On horizontal surfaces, loosely lay insulation drainage panels according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.8 FIELD QUALITY CONTROL

- A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.
- B. Prepare test and inspection reports.

3.9 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed board insulation and insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 1416

COLD FLUID-APPLIED WATERPROOFING

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. Polyurethane waterproofing.
- B. Related Requirements:
 - 1. Section 093000 "Tiling" for fluid-applied waterproof membranes beneath ceramic tiles.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including, but not limited to, the following:
 - a. Surface preparation specified in other Sections.
 - b. Minimum curing period.
 - c. Forecasted weather conditions.
 - d. Special details and sheet flashings.
 - e. Repairs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Certificates for Credit MR 5: For products required to comply with requirements for regional materials, certificates indicating location of manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

- C. Shop Drawings:
 - 1. Show locations and extent of waterproofing.
 - 2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
 - 3. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
- D. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
 - 1. Build mockup for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.
 - a. Size: 100 sq. ft. (9.3 sq. m) in area.
 - b. Description: Each type of wall installation.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
 - 1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.
 - 2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.8 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.
 - 1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.2 SINGLE-COMPONENT POLYURETHANE WATERPROOFING

- A. Single-Component, Modified Polyurethane Waterproofing: ASTM C 836/C 836M and coal-tar free.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Carlisle Coatings & Waterproofing Inc](#); CCW-525.
 - b. Manufacturers not listed but who do offer products that comply with the requirements of this section will be considered as substitute manufacturers, subject to the conditions specified in Division 1 Section *Product Substitution Procedures*.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated acrylic latex, polyurethane, or epoxy.
- C. Sheet Flashing: **50-mil- (1.3-mm-)** minimum, nonstaining, uncured sheet neoprene.
 - 1. Adhesive: Manufacturer's recommended contact adhesive.
- D. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric, manufacturer's standard weight.
- E. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.

- F. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; as specified in Section 079200 "Joint Sealants"; and as recommended by manufacturer for substrate and joint conditions.
 - 1. Backer Rod: Closed-cell polyethylene foam.

2.4 INSULATION

- A. Insulation, General: Comply with Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471.

- B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Comply with ASTM C 1193 for joint-sealant installation.
 - 2. Apply bond breaker on sealant surface, beneath preparation strip.
 - 3. Prime substrate along each side of joint and apply a single thickness of preparation strip at least **6 inches (150 mm)** wide along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.

3.5 WATERPROOFING APPLICATION

- A. Apply waterproofing according to manufacturer's written instructions and to recommendations in ASTM C 898/C 898M and ASTM C 1471.
- B. Start installing waterproofing in presence of manufacturer's technical representative.
- C. Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.
- D. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
 - 1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of **[60 mils (1.5 mm)] [90 mils (2.25 mm)] [120 mils (3 mm)]**.
 - 2. Apply waterproofing to prepared wall terminations and vertical surfaces.
 - 3. Verify manufacturer's recommended wet film thickness of waterproofing every **100 sq. ft. (9.3 sq. m)**.
- E. Reinforced Waterproofing Applications: Mix materials and apply waterproofing by roller, notched squeegee, trowel, or other suitable application method.
 - 1. Apply first coat of waterproofing, embed membrane-reinforcing fabric, and apply second coat of waterproofing to completely saturate reinforcing fabric and to obtain a seamless reinforced membrane free of entrapped gases and pinholes, with an average dry film total thickness of **[70 mils (1.8 mm)] [80 mils (2 mm)] [120 mils (3 mm)]**.
 - 2. Apply reinforced waterproofing to prepared wall terminations and vertical surfaces.
 - 3. Verify manufacturer's recommended wet film thickness of waterproofing every **100 sq. ft. (9.3 sq. m)**.
- F. Cure waterproofing, taking care to prevent contamination and damage during application and curing.

3.6 INSULATION INSTALLATION

- A. Install one or more layers of board insulation to achieve required thickness over waterproofed surfaces. Cut and fit to within **3/4 inch (19 mm)** of projections and penetrations.
- B. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions.
- C. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections:
 - 1. Testing agency shall verify thickness of waterproofing during application for each **600 sq. ft. (56 sq. m)** of installed waterproofing or part thereof.
- B. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components and to furnish daily reports to Architect.
- C. If test results or inspections show waterproofing does not comply with requirements, remove and replace or repair the waterproofing as recommended in writing by manufacturer, and make further repairs after retesting and inspecting until waterproofing installation passes.
- D. Prepare test and inspection reports.

3.8 PROTECTION

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

SECTION 07 2100

THERMAL INSULATION

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. Foam-plastic board insulation.
 - 2. Mineral-wool board insulation.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. **DiversiFoam Products.**
 - b. **Dow Chemical Company (The).**
 - c. **Owens Corning.**
 - d. **Pactiv Building Products.**
 2. Type V, **100 psi (690 kPa).**
 - a. Location:
 - 1) below grade and perimeter insulation
 - 2) between topping slab and deck
 3. Use minimum 2 inch thickness material to achieve required R value.
 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- B. Polyisocyanurate Board, Glass-Fiber-Mat Faced: ASTM C 1289, glass-fiber-mat faced, Type II, Class 2.
1. Use minimum 2 inch thickness material to achieve required R value.
 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 MINERAL-WOOL BOARD INSULATION

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. **Fibrex Insulations Inc.**
 2. **Owens Corning.**
 3. **Roxul Inc.** – Basis of Design Rockboard 40
 4. **Thermafiber.**
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- C. Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Nominal density of **4 lb/cu. ft. (64 kg/cu. m)**, Types IA and IB, thermal resistivity of **4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).**

2. Fiber Color: Darkened, where indicated.

D. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.3 MINERAL-WOOL BLANKET INSULATION

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

1. **Fibrex Insulations Inc.**
2. **Owens Corning.**
3. **Roxul Inc.**
4. **Thermafiber.**

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

C. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

D. Reinforced-Foil-Faced, Mineral-Wool Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.4 MINERAL-WOOL FLUTE FILLER

A. Basis-of-Design Product: Subject to compliance with requirements, provide Protec Metal roof/metal deck flute filler or comparable product by one of the following:

1. **Johns Manville; a Berkshire Hathaway company.**
2. **Roxul Inc.**
3. **Thermafiber, an Owens Corning Company**

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

C. Custom cut rigid mineral wool fiber metal deck flute filler.

2.5 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Plate: Perforated, galvanized carbon-steel sheet, **0.030 inch (0.762 mm)** thick by **2 inches (50 mm)** square.
2. Spindle: Copper-coated, low-carbon steel; fully annealed; **0.105 inch (2.67 mm)** in diameter; length to suit depth of insulation indicated.

- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
- C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive or loosely laid according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 48 inches (1220 mm) below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 48 inches (1220 mm) in from exterior walls.

3.4 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

- A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to

insulation manufacturer's written instructions for insulation type, thickness, and application indicated.

2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 2713

SELF ADHERING SHEET AIR BARRIERS

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 self-adhering, vapor-permeable modified bituminous sheet air barriers.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
2. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 1. Protect substrates from environmental conditions that affect air-barrier performance.
 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum **0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa)**, when tested according to ASTM E 283 ASTM E 783 or ASTM E 2357.

2.3 VAPOR-PERMEABLE SELF-ADHERING SHEET AIR BARRIER

- A. a self-adhering air barrier membrane with an engineered film specifically designed to be water resistant and vapor permeable. Membrane shall have the following physical properties:
1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **Grace, W. R. & Co. - Conn.**; Perm-A-Barrier VPS.
 - b. **Henry Company**; Blueskin VP 160.
 - c. **Meadows, W. R., Inc**; Air-Shield.
 - d. VaproShield LLC: WrapShield SA
 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum **0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa)** pressure difference; ASTM E 2178.
 - b. Tensile Strength: Minimum **250 psi (1.7 MPa)**; ASTM D 412, Die C.
 - c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
 - d. Puncture Resistance: Minimum **40 lbf (180 N)**; ASTM E 154.
 - e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at **70 deg F (21 deg C)**; ASTM D 570.
 - f. Vapor Permeance: Minimum **10 perms (580 ng/Pa x s x sq. m)**; ASTM E 96/E 96M.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Counterflashing Strip: Modified bituminous **40-mil- (1.0-mm-)** thick, self-adhering sheet consisting of **32 mils (0.8 mm)** of rubberized asphalt laminated to an **8-mil- (0.2-mm-)** thick, cross-laminated polyethylene film with release liner backing.
- D. Butyl Strip: Vapor retarding, **30 to 40 mils (0.76 to 1.0 mm)** thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.

- E. Modified Bituminous Strip: Vapor retarding, 40 mils (1.0 mm) thick, smooth surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick, cross-laminated polyethylene film with release liner backing.
- F. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.
- G. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- H. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- I. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0250 inch (0.64 mm) thick, and Series 300 stainless-steel fasteners.
- J. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft. (24- to 32-kg/cu. m) density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- K. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **Dow Corning Corporation;** 123 Silicone Seal.
 - b. **Momentive Performance Materials Inc.;** US11000 UltraSpan.
 - c. **Pecora Corporation;** Sil-Span.
 - d. **Tremco Incorporated, an RPM company;** Spectrem Simple Seal.
- L. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of **1/16 inch (1.6 mm)**.
- G. Bridge and cover isolation joints expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with overlapping modified bituminous strips.
- H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 INSTALLATION

- A. General: Install modified bituminous sheets and accessory materials according to air-barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.
 - 1. When ambient and substrate temperatures range between **25 and 40 deg F (minus 4 and plus 5 deg C)**, install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than **60 deg F (16 deg C)**.
- B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install modified bituminous strips centered over vertical inside corners. Install **3/4-inch (19-mm)** fillets of termination mastic on horizontal inside corners.
- C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.
- D. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

- E. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform **2-1/2-inch- (64-mm-)** minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
 - 1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
 - 2. Roll sheets firmly to enhance adhesion to substrate.
- F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.
- G. CMU: Install air-barrier sheet horizontally against the CMU beginning at base of wall. Align top edge of air-barrier sheet immediately below protruding masonry ties or joint reinforcement or ties, and firmly adhere in place.
 - 1. Overlap horizontally adjacent sheets a minimum of **2 inches (50 mm)** and roll seams.
 - 2. Apply overlapping sheets with bottom edge slit to fit around masonry reinforcing or ties. Roll firmly into place.
 - 3. Seal around masonry reinforcing or ties and penetrations with termination mastic.
 - 4. Continue the membrane into all openings in the wall, such as doors and windows, and terminate at points to maintain an airtight barrier that is not visible from interior.
- H. Seal top of through-wall flashings to air-barrier sheet with an additional **6-inch- (150-mm-)** wide, modified bituminous counterflashing strip.
- I. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
 - 1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install butyl or modified bituminous strip on roofing membrane or base flashing so that a minimum of **3 inches (75 mm)** of coverage is achieved over each substrate.
- K. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- L. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone-sealant extrusion so that a minimum of **3 inches (75 mm)** of coverage is achieved over each substrate. Maintain **3 inches (75 mm)** of full contact over firm bearing to perimeter frames with not less than **1 inch (25 mm)** of full contact.
 - 1. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.
- M. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier membrane with foam sealant.
- N. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.

- O. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- P. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending **6 inches (150 mm)** beyond repaired areas in all directions.
- Q. Do not cover air barrier until it has been tested and inspected by testing agency.
- R. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Continuous structural support of air-barrier system has been provided.
 - 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 4. Site conditions for application temperature and dryness of substrates have been maintained.
 - 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 6. Surfaces have been primed.
 - 7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
 - 8. Termination mastic has been applied on cut edges.
 - 9. Air barrier has been firmly adhered to substrate.
 - 10. Compatible materials have been used.
 - 11. Transitions at changes in direction and structural support at gaps have been provided.
 - 12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 13. All penetrations have been sealed.
- C. Tests: As determined by Owner's testing agency from among the following tests:
 - 1. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of **16 lbf/sq. in. (110 kPa)** according to ASTM D 4541 for each **600 sq. ft. (56 sq. m)** of installed air barrier or part thereof.
- D. Air barriers will be considered defective if they do not pass tests and inspections.
 - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 - 2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 4216

FORMED METAL WALL PANELS

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. Concealed-fastener, lap-seam metal wall panels

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel assembly during and after installation.
 - 8. Review of procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than **1-1/2 inches per 12 inches (1:10)**.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
1. Include Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
1. Metal Panels: **12 inches (305 mm)** long by actual panel width. Include fasteners, closures, and other metal panel accessories.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
 - B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
 - C. Field quality-control reports.
 - D. Sample Warranties: For special warranties.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For metal panels to include in maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
 - B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
 - C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
 - D. Retain strippable protective covering on metal panels during installation.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content: Provide steel and aluminum with minimum 30 percent total recycled content, including at least 25 percent post-consumer recycled content.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- F. Fire-Resistance Ratings: Comply with ASTM E 119; 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.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Corrugated-Profile, Exposed-Fastener Non-Perforated Metal Wall Panels (MWP-1): Formed with alternating curved ribs spaced at 3 inches o.c. across width of panel with 1 inch reveal.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Morin MX1.0 or comparable product by one of the following:
 - a. Alcoa Inc.
 - b. ATAS International, Inc.
 - c. Berridge Manufacturing Company.
 - d. Eco Screen CENTRIA Architectural Systems
 - e. Firestone Metal Products, LLC.
 - 2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: 0.040 inch (1.02 mm).
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Three-coat fluoropolymer.
 - d. Color: Color:
 - 1) Solid – Valspar; Dove Gray; 432R1021 and fashion gray (9919)
 - 2) Three-coat Metallic – Valspar; Medium Gray (Metallic); 439RZ1824M
 - 3. Panel Coverage: 12 inches.
 - 4. Panel Depth: 1 ½ inches
- C. Flat screen, perforated 40% free area wall panel type MWP-2
 - 1. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: 0.040 inch (1.02 mm).
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Three-coat fluoropolymer.
 - d. Color: Color:

- 1) Solid – Valspar; Dove Gray; 432R1021 and fashion gray (9919)
- 2) Three-coat Metallic – Valspar; Medium Gray (Metallic); 439RZ1824M

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, **G90 (Z275 hot-dip galvanized)** coating designation or ASTM A 792/A 792M, **Class AZ50 (Class AZM150)** aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch- (25-mm-)** thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch (13 mm)** wide and **1/8 inch (3 mm)** thick.
 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. 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 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.
- C. Aluminum Panels and Accessories:
 - 1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color:
 - a. Solid – Valspar; Dove Gray; 432R1021 and fashion gray (9919)
 - b. Three-coat Metallic – Valspar; Medium Gray (Metallic); 439RZ1824M

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - 3. Flash and seal panels with weather closures at perimeter of all openings.
- E. Watertight Installation:
 - 1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
 - 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - 3. At panel splices, nest panels with minimum **6-inch (152-mm)** end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (610 mm)** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

- C. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- E. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 5216

SBS MODIFIED BITUMINOUS MEMBRANE ROOFING

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. 2-Ply Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.
 - 2. Roof Walkway Pads
 - 3. Vapor retarder.
 - 4. Roof insulation.
- B. Related Requirements:
 - 1. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof flashings and counter-flashings.
 - 2. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Crickets, saddles, and tapered edge strips, including slopes.
 - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- C. Samples for Verification: For the following products:
 - 1. Cap sheet, of color required.
 - 2. Flashing sheet, of color required.
 - 3. Aggregate surfacing material in gradation and color required.
 - 4. Walkway pads, of color required.
- D. If requested by Owner, the Contractor shall furnish samples of the completed membrane or the entire system for analysis by the Engineer. The Contractor shall take samples where and when directed by the Engineer. The Engineer's analysis of samples shall be the official record for the project. Additional testing (such as by the system manufacturer) will not be used for determining compliance with the project specifications. The Contractor is responsible for repairing all sample areas in a manner required so as to maintain all warranties and guarantees.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Qualifications: A qualified manufacturer that is FM Global approved for roofing system identical to that used for this Project.
- C. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of complying with performance requirements.
- D. Product Test Reports: For components of membrane roofing system, for tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Research/Evaluation Reports: For components of membrane roofing system, from ICC-ES.
- F. Field quality-control reports.
- G. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is FM Global approved for membrane roofing system identical to that used for this Project.

- B. The manufacturer shall certify that all materials were provided from a single source manufacturer and intended to be used in the system are acceptable and compatible for the intended end use of the system. The manufacturer shall have been successfully producing the specified types of primary products for not less than 10 years.
- C. Installer Qualifications: The system shall be installed only by a qualified contracting firm, which has been installing the specified system for not less than 5 years and is approved (licensed, where applicable) by the materials manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

- A. The roof deck shall be verified in the field by the Contractor for flatness, slope and camber. Variations in the roof deck shall be taken into account during the design and installation of the tapered insulation system to provide for specified slope and water drainage as indicated in the approved shop drawings.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Guarantee shall be sole source, full systems including lightweight concrete, modified bitumen, and pre manufactured metal. Contractor's shop made metal components are not acceptable for this project.
- B. Upon successful completion of the project, and after all post installation procedures have been completed, furnish the Owner with the roof system manufacturer's 20 year labor and materials roof system guarantee. The roof system guarantee shall include the roofing and flashing membranes, manufacturer's metal edge system, and lightweight insulating concrete system. All repair or replacement costs covered under the guarantee shall be borne by the roofing membrane manufacturer. The guarantee shall be a term type, without deductibles or limitations on coverage amount (NDL- no dollar limit), and be issued at no additional cost to the Owner.

- C. Perimeter Edge Metal/Coping/Expansion Joint System: In addition to the specified Twenty-Year NDL Roof System Guarantee, furnish the Owner with the manufacturer's guarantee offering coverage of the prefabricated edge metal coping, fascia, and roof expansion joint system. Perimeter Edge Metal shall be a factory-prefabricated type as specified in Division 07 Section "Sheet Metal Flashing and Trim." Perimeter Edge Metal systems made by the Contractor are not acceptable. This shall be included in the roofing manufacturer's guarantee.
- D. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion, No Dollar Limit
 - 2. Submit executed copy of roofing manufacturer's full systems Guarantee, including all addenda and coverage indicated below, signed by an authorized representative of modified bitumen roofing system manufacturer, on form that was published with product literature as of date of Contract Documents.
- E. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, as well as lightweight insulating concrete as specified in 03 5216 "Lightweight Insulating Concrete," for the following warranty period:
 - 1. Warranty Period: Five years from date of Substantial Completion.
 - 2. The contractor shall provide the University with a written standard roofer's guarantee, applicable to any leaks or failures due to defective materials or workmanship, occurring in the roof system or flashing within two years from date of completion of the roof work. This does not include any limiting penal sum.
- F. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide products by one of the following:
 - 1. Firestone Building Products
 - 2. Johns Manville, Inc
 - 3. Henry Company
 - 4. Siplast, Inc.
 - 5. Soprema, Inc.
- B. Manufacturers must be able to comply with FM Global requirements.
- C. Source Limitations: Obtain components including roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to

defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
3. The roof system shall pass 500 cycles of ASTM D 5849 Resistance to Cyclic Joint Displacement (fatigue) at 14 degrees F. Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles.
4. The roof system shall pass 200 cycles of ASTM D 5849 after heat conditioning performed in accordance with ASTM D 5147.
5. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system.

- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: Class 1A-90.
- D. Roof Edge Securement: Roof edge systems shall comply with ANSI/SPRI ES-1 standards for edge securement for low-slope roof construction.
- E. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- F. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 ROOFING SHEET MATERIALS

- A. Sheathing Paper: Red-rosin type, minimum **3 lb/100 sq. ft.**
- B. Base Sheet: ASTM D 4601, Type II, SBS-modified asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.
1. Weight: **50 lb/100 sq. ft.**, minimum.
- C. Roofing Membrane Sheet: ASTM D 6164/D 6164M, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); smooth surfaced; suitable for application method specified.

- D. Granule-Surfaced Roofing Cap Sheet: ASTM D 6164/D 6164M, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); granule surfaced; suitable for application method specified, and as follows:
 - 1. Granule Color: White.

2.4 BASE FLASHING SHEET MATERIALS

- A. Backer Sheet: ASTM D 6164/D 6164M, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); smooth surfaced; suitable for application method specified.
- B. Granule-Surfaced Flashing Sheet: ASTM D 6164/D 6164M, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); granule surfaced; suitable for application method specified, and as follows:
 - 1. Granule Color: White.

2.5 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Cold-Applied Adhesive: Roofing system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.
- C. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.
- D. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.6 SUBSTRATE BOARDS

- A. Fire-Rated Glass-Mat Gypsum Roof Substrate Board: ASTM C 1177/1177M.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Georgia-Pacific Corporation; Dens Deck Prime.
 - 2. Type and Thickness: Type X, 5/8 inch (16 mm) thick for horizontal locations
 - 3. Type and Thickness: Type X, 1/2 inch (12.7 mm) thick for vertical locations
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck., and base sheet to lightweight insulating concrete.

2.7 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: ASTM D 1970, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil- (1.0-mm-) total thickness; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.8 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Carlisle SynTec Incorporated.
 - c. CertainTeed Corporation.
 - d. Firestone Building Products.
 - e. GAF Materials Corporation.
 - f. Hunter Panels.
 - g. Johns Manville; a Berkshire Hathaway company.
 - h. Rmax, Inc.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of **1/4 inch per 12 inches (1:48)** unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.9 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Single component, moisture cured polyurethane foam adhesive, dispensed from a portable, pre-pressurized container used to adhere cant strips to the nailed base sheet.
 - 1. Modified asphaltic, asbestos-free, cold-applied adhesive.
- D. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
- E. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, **5/8 inch (16 mm)** thick.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; GlasRoc Sheathing Type X.
 - b. Georgia Pacific Building Products; Dens Deck Prime.
 - c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
 - d. United States Gypsum Company; Securock Glass Mat Roof Board.

2.10 WALKWAYS FOR TYPICAL ROOF AREA

- A. Walkway Pads: Reinforced asphaltic composition pads in dimensions indicated with slip-resisting mineral-granule surface, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, 1/2 inch minimum thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations.
 3. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 4. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 5. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 6. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 7. Verify that concrete-curing compounds that impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 SUBSTRATE BOARD INSTALLATION

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 1. Fasten substrate board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

3.4 VAPOR-RETARDER INSTALLATION

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each

sheet a minimum of 3-1/2 inches (90 mm) and 6 inches (150 mm), respectively. Seal laps by rolling.

- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSULATION INSTALLATION

- A. Install one lapped base-sheet course and mechanically fasten to substrate according to roofing system manufacturer's written instructions.
- B. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing system with vertical surfaces or angle changes greater than 45 degrees.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation with long joints of insulation in a continuous straight line, with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - 1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- E. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- H. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten first layer of insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 - 2. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - 3. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing system manufacturer.
 - 1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 - 2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
- J. Apply roofing asphalt to underside, and immediately bond cover board to substrate.

3.6 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:
 - 1. Fiberglass Base Sheet - Fasten with FM approved fasteners at the appropriate frequency to obtain the specified uplift rating. Base sheet to lay flat and free of wrinkles.
 - 2. SBS Base Ply installed in Cold Adhesive
 - 3. SBS Cap Ply installed in Cold Adhesive
- B. Start installation of roofing in presence of manufacturer's technical personnel.
- C. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
 - 2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.7 SBS MODIFIED BITUMEN BASE-PLY INSTALLATION

- A. Install specified sheet according to roofing system manufacturer's written instructions starting at low point of roofing system. Align base-ply sheets without stretching. Extend sheets over and terminate beyond cants.
 - 1. Mechanically fasten to substrate at steel deck.
 - 2. Embed base-ply sheet in specified cold adhesive according to the manufacturer's requirements. Sheets are to be straight, flat and wrinkle free.
 - 3. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer

3.8 SBS-MODIFIED BITUMEN CAP-PLY INSTALLATION

- A. Install specified sheet according to roofing system manufacturer's written instructions starting at low point of roofing system. Align cap-ply sheets with the selvedge edge. Extend sheets over and terminate beyond cants.
 - 1. Embed each cap-ply sheet in specified cold adhesive according to the manufacturer's requirements. Sheets are to be straight, flat and wrinkle free.
- B. Unroll roofing sheets and allow them to relax for minimum time period required by manufacturer.
- C. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
 - 1. Repair tears and voids in laps and lapped seams not completely sealed.
- D. Install roofing sheets so side and end laps shed water.

3.9 FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
 - 1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 - 2. Backer Sheet Application: Adhere backer sheet to substrate as required by CERTA Recommendations and recommendations of the roofing system manufacturer.
 - 3. Flashing Sheet Application: Torch adhere flashing sheet to substrate as required by CERTA and the roofing system manufacturer.
- B. Extend base flashing up walls or parapets a minimum of **8 inches (200 mm)** above roofing membrane and **4 inches (100 mm)** onto field of roofing membrane.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
- D. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.
- E. Roof Drains: Set **30-by-30-inch- (760-by-760-mm-)** metal flashing in bed of asphaltic adhesive on completed roofing membrane. Cover metal flashing with roofing cap-sheet stripping, and extend a minimum of **4 inches (100 mm)** beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - 1. Install stripping according to roofing system manufacturer's written instructions.

3.10 WALKWAY INSTALLATION FOR TYPICAL ROOF

- A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size, according to walkway pad manufacturer's written instructions.
 - 1. Set walkway pads in cold-applied adhesive.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. At the completion of all roof work, Contractor shall perform a flood test in the presence of Owner. Areas of the roof that exceed manufacturer's tolerances for standing water shall be removed and corrected.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- D. Roofing system will be considered defective if it does not pass tests and inspections.
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.12 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

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. Manufactured reglets with counterflashing.
 - 2. Formed low-slope roof sheet metal fabrications.
 - 3. Formed wall sheet metal fabrications.
 - 4. Formed equipment support flashing.
 - 5. Formed overhead-piping safety pans.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 07 4213 "Metal Wall Panels" for sheet metal flashing and trim integral with metal wall panels.
 - 3. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include identification of material, thickness, weight, and finish for each item and location in Project.
 - 3. Include details for forming, including profiles, shapes, seams, and dimensions.
 - 4. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 5. Include details of termination points and assemblies.
 - 6. Include details of roof-penetration flashing.
 - 7. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 - 8. Include details of special conditions.
 - 9. Include details of connections to adjoining work.
 - 10. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Verification: For each type of exposed finish.
 - 1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is FM Approvals approved.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: 2D (dull, cold rolled).

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum **30 mils (0.76 mm)** thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
- Products:** Subject to compliance with requirements, provide one of the following:
 - Carlisle Residential, a division of Carlisle Construction Materials;** WIP 300HT.
 - Grace Construction Products, a unit of W. R. Grace & Co.-Conn.;** Ultra.
 - Henry Company;** Blueskin PE200 HT.
 - Metal-Fab Manufacturing, LLC;** MetShield.
 - Owens Corning;** WeatherLock Specialty Tile & Metal Underlayment.
 - Thermal Stability: ASTM D 1970; stable after testing at **240 deg F (116 deg C)** or higher.
 - Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus **20 deg F (29 deg C)** or lower.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
- General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
- For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch (13 mm)** wide and **1/8 inch (3 mm)** thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on slope and location lines indicated on Drawings and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates. Shop fabricate interior and exterior corners.
1. Joint Style: Butted with expansion space and 6-inch- (150-mm-) wide, exposed cover plate.
 2. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch (1.27 mm) thick
- B. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous formed- or extruded-aluminum anchor bar with integral drip-edge cleat to engage fascia cover. Provide matching corner units.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Metal-Fab Snap On Fascia SF50 or comparable product by one of the following:
 - a. Hickman Company, W. P.
 - b. Johns Manville.
 2. Fascia Cover: Fabricated from the following exposed metal:
 - a. Formed Aluminum: 0.050 inch (1.27 mm) thick.
 3. Corners: Factory mitered and continuously welded.
 4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 5. Special Fabrications: Cornice fascia cover and Cove fascia cover.
 6. Fascia Accessories: Fascia extenders with continuous hold-down cleats, Wall cap and Soffit trim.
- C. Roof and Roof-to-Wall Transition Expansion-Joint Cover: Fabricate from the following materials:
1. Stainless Steel: 0.025 inch (0.64 mm) thick.
- D. Base Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- E. Counterflashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- F. Flashing Receivers: Fabricate from the following materials:
1. Stainless Steel: 0.016 inch (0.40 mm) thick.
- G. Roof-Penetration Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- H. Roof-Drain Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.016 inch (0.40 mm) thick.

2.7 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond

each side of wall openings; and form with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

C. Wall Expansion-Joint Cover: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch (0.48 mm) thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch (0.48 mm) thick.

B. Overhead-Piping Safety Pans: Fabricate from the following materials:

1. Stainless Steel: 0.025 inch (0.64 mm) thick.

2. Depth: 2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.2 UNDERLAYMENT INSTALLATION

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

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than **12 inches (300 mm)** apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of **10 feet (3 m)** with no joints within **24 inches (600 mm)** of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than **1 inch (25 mm)** into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between **40 and 70 deg F (4 and 21 deg C)**, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below **40 deg F (4 deg C)**.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of **1-1/2 inches (38 mm)**; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel and aluminum sheet.
 2. Do not pre-tin zinc-tin alloy-coated stainless steel and zinc-tin alloy-coated copper.
 3. Do not use torches for soldering.
 4. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 5. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- H. Rivets: Rivet joints in zinc where necessary for strength.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered **3-inch (75-mm)** centers.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of **4 inches (100 mm)** over base flashing. Install stainless-steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing **4 inches (100 mm)** over base flashing. Lap counterflashing joints minimum of **4 inches (100 mm)**. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry."
- C. Reglets: Installation of reglets is specified in Section 042000 "Unit Masonry."

- D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.6 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 7100

ROOF SPECIALTIES

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. Copings.
- B. Related Sections:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
 - 3. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 4. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
 - 1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 3. Details of termination points and assemblies, including fixed points.
 - 4. Details of special conditions.
- C. Samples for Verification: For copings made from 12-inch (300-mm) lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
 - 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.9 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Materials that interact with roofing systems shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by testing and field experience.

2.2 EXPOSED METALS

- A. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 - 1. Surface: Smooth, flat finish.
 - 2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Three-Coat Fluoropolymer: AAMA 620. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.
 - b. Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.
- B. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
 - 1. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- a. Three-Coat Fluoropolymer: AAMA 2605. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.

2.3 CONCEALED METALS

- A. Aluminum Sheet: [ASTM B 209](#) ([ASTM B 209M](#)), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- B. Aluminum Extrusions: [ASTM B 221](#) ([ASTM B 221M](#)), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, [G90](#) ([Z275](#)) coating designation.

2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum [30 to 40 mils](#) ([0.76 to 1.0 mm](#)) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: ASTM D 1970; stable after testing at [240 deg F](#) ([116 deg C](#)).
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus [20 deg F](#) ([29 deg C](#)).
 3. [Products](#): Subject to compliance with requirements, provide one of the following:
 - a. [Carlisle Coatings & Waterproofing](#); CCW WIP 300HT.
 - b. [Grace Construction Products, a unit of W. R. Grace & Co.](#); Ultra.
 - c. [Henry Company](#); Blueskin PE200 HT.
 - d. [Metal-Fab Manufacturing, LLC](#); MetShield.
 - e. [Owens Corning](#); WeatherLock Metal High Temperature Underlayment.
- B. Polyethylene Sheet: [6-mil-](#) ([0.15-mm-](#)) thick polyethylene sheet complying with ASTM D 4397.

2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

- D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.6 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding **12 feet (3.6 m)**, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [ATAS International, Inc.](#)
 - b. [Cheney Flashing Company.](#)
 - c. [Hickman Company, W. P.](#)
 - d. [Johns Manville.](#)
 - e. [Merchant & Evans, Inc.](#)
 - f. Metal-Fab Manufacturing, Inc
 - g. [MM Systems Corporation.](#)
 - 2. Coping-Cap Material: Extruded aluminum, aluminum, **0.125 inch (3.18 mm)** thick.
 - a. Finish: Three-coat fluoropolymer.
 - b. Color:
 - 1) Solid – Valspar; Dove Gray; 432R1021 and fashion gray (9919)
 - 2) Three-coat Metallic – Valspar; Medium Gray (Metallic); 439RZ1824M
 - 3. Corners: Factory mitered and continuously welded.
 - 4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
 - 5. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, **12 inches (300 mm)** wide, with integral cleats.
 - 6. Face Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- B. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
- C. Polyethylene Sheet: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).
- D. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.3 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.

- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or self-adhering, high-temperature sheet underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of **12 feet (3.6 m)** with no joints within **18 inches (450 mm)** of corners or intersections unless otherwise shown on Drawings.
 - 2. When ambient temperature at time of installation is between **40 and 70 deg F (4 and 21 deg C)**, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

- E. Seal joints with elastomeric or butyl sealant as required by roofing-specialty manufacturer.

- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below **40 deg F (4 deg C)**.

3.4 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

- B. Anchor copings to meet performance requirements.
 - 1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

- B. Clean and neutralize flux materials. Clean off excess solder and sealants.

- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 7200

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof curbs.
 - 2. Roof hatches.
 - 3. Gravity ventilators.
 - 4. Pipe supports.
 - 5. Preformed flashing sleeves.
 - 6. Fall arrest Protection Systems
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, and miscellaneous sheet metal trim and accessories.
 - 3. Section 077100 "Roof Specialties" for manufactured, copings, reglets and counterflashing.
 - 4. Section 099113 "Exterior Painting"

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings:
 - 1. For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Fall arrest system to comply with the following Regulatory Requirements.
 - 1. Comply with OSHA regulations as follows:
 - a. 1910, Subpart D, Walking and Working Surfaces.
 - b. Appendix C to 1910 Subpart F, Personal Fall Arrest Systems.
 - c. OSHA Ruling on Window Cleaning by Bosun's Chair.
 - d. 1910.66, Subpart F, Powered Platforms

1.8 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
- C. Storage and Protection:
 - 1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, **G90 (Z275)** coating designation and mill phosphatized for field painting where indicated.
 - 1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
 - 2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of **0.2 mil (0.005 mm)**.
 - 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.
- B. Aluminum Sheet: **ASTM B 209**, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Mill Finish: As manufactured.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of **0.5 mil**.
- C. Aluminum Extrusions and Tubes: **ASTM B 221**, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.
- D. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.
- E. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- F. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Certified Wood: Plastic-laminate cabinets shall be made from wood products certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- C. Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.
- D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than **1-1/2 inches (38 mm)** thick.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Underlayment:

1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 2. Polyethylene Sheet: **6-mil-** (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
 3. Slip Sheet: Building paper, **3-lb/100 sq. ft.** (0.16-kg/sq. m) minimum, rosin sized.
- G. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- I. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- J. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- K. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [AES Industries, Inc.](#)
 - b. [Curbs Plus, Inc.](#)
 - c. [Custom Solution Roof and Metal Products.](#)
 - d. [Greenheck Fan Corporation.](#)
 - e. [LM Curbs.](#)
 - f. [Metallic Products Corp.](#)
 - g. [Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.](#)
 - h. [Roof Products, Inc.](#)
 - i. [Safe Air of Illinois.](#)
 - j. [Thybar Corporation.](#)
 - k. [Vent Products Co., Inc.](#)
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Zinc-coated (galvanized) steel sheet, **0.079 inch** (2.01 mm) thick.
1. Finish: Baked enamel or powder coat.
 2. Color: As selected by Architect from manufacturer's full range.

- D. Construction:
1. Insulation: Factory insulated with **1-1/2-inch- (38-mm-)** thick cellulosic-fiber board insulation.
 2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
 4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 5. Fabricate curbs to minimum height of **12 inches (300 mm)** unless otherwise indicated.
 6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.

2.4 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated single-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Bilco Company (The); Type L roof hatch or comparable product by one of the following:
 - a. Babcock-Davis.
 - b. O'Keefe's Inc.
- B. Type and Size: Single-leaf lid, 2'6" x 6'0".
- C. Loads: Minimum **40-lbf/sq. ft.** external live load and **20-lbf/sq. ft.** internal uplift load.
- D. Hatch Material: Aluminum sheet, **0.090 inch** (11 gage) thick.
1. Finish: Mill.
- E. Construction:
1. Insulation: Polyisocyanurate board.
 2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 5. Fabricate curbs to minimum height of **12 inches** unless otherwise indicated.
- F. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 2. Height: **42 inches** above finished roof deck.
 3. Material: Aluminum.
 4. Post: **1-5/8-inch-** diameter pipe.
- H. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation;

attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: **42 inches (1060 mm)** above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, **1-1/4 inches (31 mm)** in diameter or galvanized-steel tube, **1-5/8 inches (41 mm)** in diameter.
3. Flat Bar: Galvanized steel, **2 inches (50 mm)** high by **3/8 inch (9 mm)** thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere **21 inches (533 mm)** in diameter.
5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
6. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
9. Fabricate joints exposed to weather to be watertight.
10. Fasteners: Manufacturer's standard, finished to match railing system.
11. Finish: Manufacturer's standard.
 - a. Color: As selected by Architect from manufacturer's full range.

2.5 GRAVITY VENTILATORS

- A. Louvered Penthouse-Style Gravity Ventilators: Manufacturer's standard, fabricated as indicated, with manufacturer's standard welded or sealed mechanical joints.
1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Greenheck Fan Corporation or comparable product by one of the following:
 - a. [Loren Cook Company](#).
 - b. [PennBarry](#).
 - c. [Vent Products Co., Inc.](#)
 2. Construction: Louver frames shall be 4 in. deep channel style with 0.081 in. minimum extruded aluminum wall thickness. Louver blades shall be 4 in. deep drainable style and shall be located on approximately 3.25 in. centers and 37.5 degree angles with 0.081 in. minimum extruded aluminum wall thickness. Where maximum louver section sizes are exceeded visible butt style vertical mullion joints shall be incorporated. Louvered penthouse shall be provided with formed 0.100 in. thick aluminum box corners, formed 0.100 in. thick aluminum hood members, hood reinforcing rafters and purlins and vertical rear louver blade and corner reinforcing angles (where required) which shall extend 3 in. down beyond the louver sill for attachment to roof curb. All materials shall be provided mill finish. Louvered penthouse shall ship knocked down in maximum allowable assembled sections for field erection.
 3. Dimensions:
 - a. Inside Throat Dimension: 95 in. wide x 240 in.
 - b. Outside Dimension: 103 in. wide x 248 in.
 - c. Louver Height: 30 in.
 4. Configuration: As indicated on Drawings.
 5. Bird Screens: Louvers shall be provided with internally mounted flattened expanded aluminum bird screen.
 6. Security Grille: Provide where indicated on Drawings.
 7. Frame, Base Flange, Cap, and Louver Material: Aluminum sheet, of manufacturer's standard thickness.
 8. Finish: as indicated on drawings

2.6 PIPE SUPPORTS

- A. Pipe Supports: Adjustable-height, extruded-aluminum tube, filled with urethane insulation; **2 inches (50 mm)** in diameter; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, and extruded-aluminum carrier assemblies; suitable for quantity of pipe runs and sizes.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Thaler Metal USA Inc.](#)
 2. Pipe Support Height: As indicated on Drawings.
 3. Roller Assembly: With stainless-steel roller, sized for supported pipes.
 4. Pipe Support Flashing: Manufacturer's standard insulated sleeve flashing with integral base flange; aluminum sheet, **0.063 inch (1.60 mm)** thick.
 5. Finish: Manufacturer's standard.

2.7 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, **12 inches (300 mm)** high, with removable metal hood and metal collar.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Custom Solution Roof and Metal Products.](#)
 - b. [Thaler Metal USA Inc.](#)
 2. Metal: Aluminum sheet, **0.063 inch (1.60 mm)** thick.
 3. Diameter: As indicated.
 4. Finish: Manufacturer's standard.

2.8 FALL ARREST PROTECTION SYSTEMS

- A. Basis of Design Manufacturer: Pro-Bel Group of Companies, Phone: (905) 427-0616, USA Toll Free: (800) 461-0575, Fax: (905) 427-2545, E-mail: info@pro-belgroup.com, Internet URL: <http://www.pro-belgroup.com>
- B. Design Performance Requirements
1. Design window cleaning and suspended maintenance system to suit project requirements to AISC S342L and as indicated.
 2. Locate anchorages to suit suspension equipment specified.
 3. Design anchor components for cleaning and suspended maintenance equipment to ASME A120.1.
 - a. Ensure compatibility with industry standard equipment.
 - b. Anchorage and anchor components: Designed by Engineer qualified in design of window cleaning and suspended maintenance equipment and licensed in State of Virginia.
 4. Design system fall arrest safety anchors and equipment supports to AISC S342L (including supplement No.1) and ANSI/IWCA I-14.1, and as follows:
 - a. Comply with OSHA 1910, Subpart F, Appendix C.
 - b. Fall Arrest Safety Anchors:
 - 1) Fall arresting force safety factor of 2 to 1 without permanent deformation: 1800 lbs (8.0 kN) minimum.

- 2) Fall arrest force against fracture or detachment: 5,000 lbs (22.4 kN) minimum.

C. Equipment

1. Anchors.
2. Double Lanyard Horizontal Lifeline Systems.

D. Anchors

1. Safety U-bars: Stainless steel to ASTM A276, Type 304 with 35 Ksi (240 MPa) minimum yield strength.
 - a. U-bar: 0.75 inches (19 mm) minimum diameter material with 1.5 inches (38 mm) eye opening.
2. Hollow Steel Section (HSS) Piers: Mild steel, Type 300W with 50 Ksi (350 MPa) minimum yield strength, hot dipped galvanized to ASTM A123/A123M
 - a. Wall thickness to suit application.
3. Plate and other sections: Mild steel, Type 300W with 44 Ksi (300 MPa) minimum yield strength, hot dipped galvanized to ASTM A123/A123M
 - a. Wall thickness to suit application
4. Flashing
 - a. Deck flange flashing: To NRCA Roofing and Waterproofing Manual recommendations In accordance with Section 07 62 00 Sheet Metal Flashing and Trim, detachable watertight stainless steel cap.
5. Miscellaneous Bolts, Nuts and Washers: Stainless steel to ASTM A276, Type 304 with 35 Ksi (240 MPa) minimum yield strength.

E. Double Lanyard Horizontal Lifeline System

1. Galvanized steel, 5/16" inches (8mm) minimum diameter cable, 9127 lbs (40 kN) minimum breaking strength with permanently or mechanically swaged cable ends.
2. Data plate: Ensure non-corrosive data plate stating Maximum Service Capacity of cable, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed at cable system entry points.
3. Tensioner: Stainless steel turnbuckle to ASTM A167, Type 316.
4. Harness: Manufacturer's standard full body harness with double shock absorber lanyard.
5. Acceptable Material: Pro-Bel Group, Double Lanyard Horizontal Lifeline System.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Gravity Ventilator Installation: Verify that gravity ventilators operate properly and have unrestricted airflow. Clean, lubricate, and adjust operating mechanisms.
- E. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.
- F. Roof-Hatch Installation:
 - 1. Install roof hatch so top surface of hatch curb is level.
 - 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 3. Attach safety railing system to roof-hatch curb.
 - 4. Attach ladder-assist post according to manufacturer's written instructions.

- G. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.

- H. Fall Arrest Protection System installation
 - 1. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions and Pro-Bel Group technical data sheets.
 - 2. Ensure structure or substrate is adequate to support complete system.
 - 3. Ensure structural steel to receive safety anchors [has adequate bearing surface as indicated on shop drawings] [and] [has 100% welds between anchors and structural steel].
 - 4. Install fall protection equipment plumb and level in accordance with manufacturer's written instructions.
 - 5. [Mechanically fasten anchors in accordance with manufacturer's recommendations] [Install anchors in concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete and with manufacturer's recommendations.
 - 6. Accurately fit and align, securely fasten and install free from distortion or defects.
 - 7. Deform threads of tail end of anchor studs after nuts have been tightened to prevent accidental removal and vandalism

- I. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 ADJUSTMENT

- A. Lubricate moving parts to operate smoothly and fit accurately.

- B. Complete "Initial Inspection - Certification for Use" form included in Equipment Manual and Inspection Log Book provided by manufacturer.

3.4 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

- C. Clean exposed surfaces according to manufacturer's written instructions.

- D. Clean off excess sealants.

- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 8100

APPLIED FIREPROOFING

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 sprayed fire-resistive materials (SFRM).

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
- C. Shop Drawings: Framing plans, schedules, or both, indicating the following:
 - 1. Extent of fireproofing for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 4. Treatment of fireproofing after application.
- D. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Preconstruction Test Reports: For fireproofing.
- E. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. Mockups: Build mockups [to verify selections made under Sample submittals and to demonstrate aesthetic effects] [to set quality standards for materials and execution] [and] [for preconstruction testing].
 - 1. Build mockup of each type of fireproofing and different substrate and each required finish.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on fireproofing.
 - 1. Provide test specimens and assemblies representative of proposed materials and construction.
- B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
 - 1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 - 2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 - 3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
 - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F (7 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Primers, Sealers, and Undercoaters: 200 g/L.
 - 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
- E. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS - CONCEALED

- A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Carboline Company; RPM International](#); Pyrolite 15.
 - b. [Grace Construction Products; W.R. Grace & Co. -- Conn](#); Grace Construction Products; Monokote MK-6 Series, Grace Construction Products; Monokote Z106/HY.
 - c. [Isolatek International, Inc](#); Cafco 300.
 - d. [Southwest Fireproofing Products Co](#); Type 5EF Type 5GP Type 5MD.
 - 2. Bond Strength: Minimum **200-lbf/sq. ft. (9.6-kPa)** cohesive and adhesive strength based on field testing according to ASTM E 736.
 - 3. Density: Not less than **15 lb/cu. ft. (240 kg/cu. m)** and as specified in the approved fire-resistance design, according to ASTM E 605.
 - 4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than **0.375 inch (9 mm)**.
 - 5. Combustion Characteristics: ASTM E 136.
 - 6. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 10 or less.
 - b. Smoke-Developed Index: 10 or less.
 - 7. Compressive Strength: Minimum **10 lbf/sq. in. (68.9 kPa)** according to ASTM E 761.
 - 8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
 - 9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.

10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
11. Air Erosion: Maximum weight loss of **0.025 g/sq. ft. (0.270 g/sq. m)** in 24 hours according to ASTM E 859.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.
13. Sound Absorption: NRC of not less than 0.60 according to ASTM C 423 for Type A mounting according to ASTM E 795.
14. Finish: As selected by Architect from manufacturer's standard finishes.
 - a. Color: As selected by Architect from manufacturer's full range.

2.3 SPRAYED FIRE-RESISTIVE MATERIALS - EXPOSED

- A. SFRM: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.
1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **Carbolite Company; RPM International;** Pyrocrete 239 or Pyrocrete 40.
 - b. **Grace Construction Products; W.R. Grace & Co. -- Conn;** Grace Construction Products; Monokote Z106/HY or Grace Construction Products; Monokote Z146T.
 - c. **Isolatek International, Inc;** Cafco 400 or Fendolite M-II.
 - d. **Southwest Fireproofing Products Co;** Type 7GP.
 2. Bond Strength: Minimum **430-lbf/sq. ft. (20.59-kPa)** cohesive and adhesive strength based on field testing according to ASTM E 736.
 3. Density: Not less than **22 lb/cu. ft. (350 kg/cu. m)** and as specified in the approved fire-resistance design, according to ASTM E 605.
 4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than **0.375 inch (9 mm)**.
 5. Combustion Characteristics: ASTM E 136.
 6. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 10 or less.
 - b. Smoke-Developed Index: 10 or less.
 7. Compressive Strength: Minimum **100 lbf/sq. in. (689 kPa)** according to ASTM E 761.
 8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
 9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
 10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
 11. Air Erosion: Maximum weight loss of **0.025 g/sq. ft. (0.270 g/sq. m)** in 24 hours according to ASTM E 859.
 12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.
 13. Sound Absorption: NRC of not less than 0.60 according to ASTM C 423 for Type A mounting according to ASTM E 795.
 14. Finish: As selected by Architect from manufacturer's standard finishes.
 - a. Color: As selected by Architect from manufacturer's full range.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
 - 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.
- G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by fireproofing manufacturer for each fire-resistance design.
- H. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
 - 1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
 - 2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

- B. Verify that concrete work on steel deck has been completed before beginning fireproofing work.
- C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.
- D. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
 - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Metal Decks:
 - 1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
 - 2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

- E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- G. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- I. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.
- J. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- K. Cure fireproofing according to fireproofing manufacturer's written recommendations.
- L. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- M. Finishes: Where indicated, apply fireproofing to produce the following finishes:
 - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, 1704.10.
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

SECTION 07 8413

PENETRATION FIRESTOPPING

PART 1 B GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section describes firestopping materials and procedures:
1. Penetrations through fire-resistance-rated construction, including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 2. Expansion and control joints in fire-rated walls, floors, floor-ceiling, and roof-ceiling assemblies.
 3. Voids at the intersections of fire-rated walls, floors, floor-ceiling, and roof-ceiling assemblies.
 4. Intersections and penetrations of floors, ceilings, walls, and columns.
- B. Related Sections:
1. Division 4 Section *Concrete Unit Masonry* for coordination of penetrations and joints.
 2. Division 7 Section *Building Insulation* for other types of building insulation and fire safing at curtain wall..
 3. Division 9 Section *Gypsum Board Assemblies* for penetrations and joints.
 4. Sections of Division 15 *Mechanical* for coordination of penetrations.
 5. Sections of Division 16 *Electrical* for coordination of penetrations.

1.3 REFERENCES

- A. The following publications govern the work of this Section and are hereby incorporated in the Contract Documents as if bound herein. The standards described apply generally unless specifically indicated otherwise in the text. They are identified below by their publishers and are referred to in the text by basic designation only.

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84-91a	<i>Surface Burning Characteristics of Building Materials</i>
ASTM E 814-88	<i>Fire Tests of Through-Penetration Fire Stops</i>
ASTM C 1193-91	<i>Guide for Use of Joint Sealants</i>

2. UNDERWRITERS LABORATORIES (UL)

UL-05-92	<i>Fire Resistance Directory</i>
UL 723-93	<i>Test for Surface Burning Characteristics of</i>

UL 1479-83
UL 2079

Building Materials
Fire Tests of Through-Penetration Firestops
Tests for Fire Resistance of Building Joint
Systems

1.4 SUBMITTALS

- A. Comply with the requirements of Division 1 Section *Submittal Procedures*.
- B. For Approval:
1. Shop Drawings: Detail drawings including manufacturer's descriptive data, typical details, installation instructions and the fire-test data and/or report as appropriate for the fire resistance rated construction and location. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations are to receive firestopping, drawings shall indicate location and type of application.
- C. For Information:
1. Certificates: Certificates attesting that firestopping material complies with the specified requirements. The label or listing of the Underwriters Laboratories will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing agency equipped to perform such services, stating that the items have been tested and conform to the specified requirements and testing
 2. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Individuals installing firestop materials should have documented proof of training directly from the firestop manufacturer. Training by third party resellers is not sufficient. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction
 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:

- i UL in its "Fire Resistance Directory."
- ii Intertek ETL SEMKO in its "Directory of Listed Building Products."
- iii FM Global in its "Building Materials Approval Guide."

1.6 SYSTEM DESCRIPTION

- A. Firestopping shall consist of furnishing and installing a material or a combination of materials 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. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.
- B. The design of all firestop assemblies and systems and manufacturer's products must be approved by Factory Mutual Insurance Company, or written approval must be obtained from the University project manager to be in non-compliance with Factory Mutual's recommendations.

1.7 STORAGE AND DELIVERY

- A. Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

PART 2 B PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application.
 - 1. Hilti, Inc.
 - 2. 3M; Fire Protection Products Division.
 - 3. Tremco; Sealant/Weatherproofing Division.
 - 4.

2.2 FIRESTOPPING MATERIALS

- A. Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:
 - 1. Fire Hazard Classification: Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL-05.
 - 2. Toxicity: Material shall be nontoxic to humans at all stages of application.
 - 3. Fire Resistance Rating: Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed. Fire resistance ratings of construction joints, as described in Part 1 Article *System*

Description, and gaps such as those between floor slabs or roof decks walls shall be the same as the construction in which they occur.

PART 3 B EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
 - 1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 - 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove latence and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Firestopping shall be provided in the following locations:
 - 1. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
 - 2. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
 - 3. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
 - 4. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
 - 5. Construction joints in floors and fire rated walls and partitions.

6. Other locations where required to maintain fire resistance rating of the construction.

3.4 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instruction for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by joints
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.6 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or

deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION

SECTION 07 8446

FIRE-RESISTIVE JOINT 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. Joints in or between fire-resistance-rated constructions.
 - 2. Joints at exterior curtain-wall/floor intersections.
 - 3. Joints in smoke barriers.
- B. Related Sections:
 - 1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
 - 2. Section 079500 "Expansion Control" for fire-resistive architectural joint systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For fire-resistive joint system sealants, documentation including printed statement of VOC content.
- C. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
 - 1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."
- B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- C. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
 - 1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
- D. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
 3. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Grace Construction Products.
 - b. Hilti, Inc.
 - c. Johns Manville.
 - d. 3M Fire Protection Products.
 - e. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - f. USG Corporation.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of **0.01-inch wg (2.49 Pa)** or ASTM E 2307.
1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
 2. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Grace Construction Products.
 - b. Hilti, Inc.
 - c. Johns Manville.
 - d. 3M Fire Protection Products.
 - e. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - f. USG Corporation.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
1. L-Rating: Not exceeding **5.0 cfm/ft (0.00775 cu. m/s x m)** of joint at **0.30 inch wg (74.7 Pa)** at both ambient and elevated temperatures.
 2. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Grace Construction Products.
 - b. Hilti, Inc.
 - c. Johns Manville.
 - d. 3M Fire Protection Products.
 - e. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - f. USG Corporation.

- E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
 - 4. The VOC content of all products in this section shall not exceed the VOC limits established in Section 01 81 16, VOC LIMITS FOR ADHESIVES, SEALANTS, PAINTS, AND COATINGS.
- G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within **6 inches (150 mm)** of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG].
- B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under product category Firestop Systems.
- C. Vertical, Fire-Resistive Joint Systems:
 - 1. Assembly Rating: as indicated.
 - 2. Nominal Joint Width: As indicated.
- D. Horizontal, Fire-Resistive Joint Systems:
 - 1. Assembly Rating: 2 hours.
 - 2. Nominal Joint Width: As indicated.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 1. Silicone joint sealants.
 2. Urethane joint sealants.
 3. Latex joint sealants.
 4. Preformed joint sealants.
 5. Acoustical joint sealants.
- B. Related Sections:
 1. Section 042000 "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
 2. Section 079500 "Expansion Control" for building expansion joints.
 3. Section 078446 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
 4. Section 084423 "Structural-Sealant-Glazed Curtain Walls" for structural and other glazing sealants.
 5. Section 088000 "Glazing" for glazing sealants.
 6. Section 092900 "Gypsum Board" for sealing perimeter joints.
 7. Section 093000 "Tiling" for sealing tile joints.
 8. Section 095113 "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.
 9. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each application indicated below:
 - a. Each kind of sealant and joint substrate indicated.
 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
 3. Product Data for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

- D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in **1/2-inch- (13-mm-)** wide joints formed between two **6-inch- (150-mm-)** long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and testing agency.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- G. Field-Adhesion Test Reports: For each sealant application tested.
- H. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project, and are qualified by virtue of having performed work of similar nature and scope for at least 5-years.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Provide exterior wall mock-up panel as indicated on drawings and as detailed in 04 2000 – "Unit Masonry". Panels to include all components necessary for a completed exterior wall assembly.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- E. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: 20 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
 - 4. The VOC content of all products in this section shall not exceed the VOC limits established in Section 01 81 16, VOC LIMITS FOR ADHESIVES, SEALANTS, PAINTS, AND COATINGS.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- F. Dimensions of all joints as indicated on drawings.
- G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
 - 1. Assume multiple colors based on proximity to variety of building systems and materials.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Dow Corning Corporation](#); 795.
 - b. [GE Advanced Materials](#) - Silicones; SilPruf SCS2000 .
 - c. [Pecora Corporation](#); 864.
 - d. [Tremco Incorporated](#); Spectrem 3.

- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Dow Corning Corporation](#); 786-M White.
 - b. [GE Construction Sealants](#); SCS1700 Sanitary.
 - c. 898 Silicone Sanitary Sealant; Pecora Corp.
 - d. [Tremco Incorporated](#); Tremsil 200.

2.3 URETHANE JOINT SEALANTS

- A. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Pecora Corporation](#); Urexpan NR 200
 - b. SL 2 Sealant; Sonneborn Building Products Div., ChemRex Inc.
 - c. [Tremco Incorporated](#); THC 900/901.

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Pecora Corporation](#); AC-20+.
 - b. Sonolac; Sonneborn Building Products Div, ChemRex, Inc.
 - c. [Tremco Incorporated](#); Tremflex 834.

2.5 PREFORMED JOINT SEALANTS

- A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of **10 lb/cu. ft. (160 kg/cu. m)** and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.
 - 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Dayton Superior Specialty Chemicals](#); Polytite Standard.
 - b. [EMSEAL Joint Systems, Ltd.](#); Emseal 25V.
 - c. [Sandell Manufacturing Co., Inc.](#); Polyseal.
 - d. [Schul International, Inc.](#); Sealtite or Sealtite 50N.
 - e. [Willseal USA, LLC](#); Willseal 150 or Willseal 250.
- B. Expanding Foam Sealant: Manufacturer's standard preformed, precompressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water-based polymer-modified acrylic emulsion; factoryproduced in precompressed sizes and in roll or stick form to fit joint widths indicated, depth as recommended by manufacturer for size of joint:
 - 1. **Properties:** Permanently elastic, mildew-resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants

2. Density: Manufacturer's standard
3. Acceptable Product and Manufacturer or equal:
 - a. Backerseal (Greyflex); Emseal Corp.
 - b. Polytite B; Dayton Superior Corp.
 - c. Willseal 600; Illbruck Sealant Systems

2.6 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Pecora Corporation](#); AC-20 FTR.
 - b. [USG Corporation](#); SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant for Concealed Joints
 1. Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
 2. Acceptable products and manufacturers or equal:
 - a. BA-98; Percora Corporation
 - b. Tremco Acoustical Sealant; Tremco
 3. Locations: Concealed interior acoustically sealed joints at metal stud tracks

2.7 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.
- H. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - b. Perform three tests for each 1000 feet (300 m) of joint length thereafter.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Tile control and expansion joints.
 - c. Joints between different materials listed above.
 - d. Other joints as indicated.
 2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 25.
 3. Joint-Sealant Color: Match Architect's sample.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precaster architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints between metal panels.
 - e. Joints between different materials listed above.
 - f. Perimeter joints between materials listed above and frames of doors windows and louvers.
 - g. Control and expansion joints in ceilings and other overhead surfaces.
 - h. Other joints as indicated.
 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 50.
 3. Joint-Sealant Color: Match Architect's sample.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - c. Other joints as indicated.
 2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 25.
 3. Joint-Sealant Color: Match Architect's sample.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical joints on exposed surfaces of interior unit masonry concrete walls and partitions.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
 - f. Other joints as indicated.
 2. Joint Sealant: Latex.
 3. Joint-Sealant Color: Match Architect's sample.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated.

2. Joint Sealant: Single component, nonsag, mildew resistant, acid curing.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Location:
 - a. Acoustical joints where indicated.
 - b. Other joints as indicated.
 2. Joint Sealant: Acoustical.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION

SECTION 07 9500

EXPANSION 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 SUMMARY

- A. Section Includes:
 - 1. Interior expansion control systems.
 - 2. Exterior wall expansion control systems.
- B. Related Requirements:
 - 1. Section 077129 "Manufactured Roof Expansion Joints" for factory-fabricated roof expansion control.
 - 2. Section 078446 "Fire-Resistive Joint Systems" for liquid-applied joint sealants in fire-resistive building joints.
 - 3. Section 079200 "Joint Sealants" for liquid-applied joint sealants and for elastomeric sealants without metal frames.

1.3 ACTION SUBMITTALS

- A. Product Data: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - 1. Manufacturer and model number for each expansion control system.
 - 2. Expansion control system location cross-referenced to Drawings.
 - 3. Nominal joint width.
 - 4. Movement capability.
 - 5. Classification as thermal or seismic.
 - 6. Materials, colors, and finishes.
 - 7. Product options.
 - 8. Fire-resistance ratings.
- B. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- C. Samples: For each exposed expansion control system and for each color and texture specified, full width by 6 inches (150 mm) long in size.

- D. Samples for Initial Selection: For each type of expansion control system indicated.
 - 1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.
- E. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches (150 mm) long in size.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
 - 1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
 - 2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.
- B. Coordination: Coordinate installation of exterior wall and soffit expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

2.3 INTERIOR EXPANSION CONTROL SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
 - 1. Balco, Inc.
 - 2. JointMaster/InPro Corporation.
 - 3. MM Systems Corporation.
 - 4. Nystrom, Inc.
 - 5. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.

- B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

- A. Loading Characteristics: Standard Floor Covers – shall be designed to withstand a minimum point load of 500 lbs. without damage or permanent deformation. Heavy-duty covers should withstand a point load of 2,000 lbs.

- B. Floor-to-Floor:
 - 1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 - 2. Type: Cover plate, Glide plate and Dual elastomeric seal.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.
 - c. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.

- C. Floor-to-Wall:
 - 1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 - 2. Type: Cover plate and Glide plate.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.
 - c. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.

- D. Wall-to-Wall:
 - 1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 - 2. Type: Glide Plate.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.
 - c. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.

- E. Wall Corner:

1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 2. Type: Glide Plate.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.
 - c. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
- F. Wall-to-Ceiling:
1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 2. Type: Glide Plate.
 - a. Cover-Plate Design: Recessed to accept field-applied finish materials.
 - 1) Cover-Plate Recess Depth: As required to accommodate adjacent flooring.
 - b. Metal: Aluminum.
 - 1) Finish: Mill.
 - c. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
- G. Ceiling-to-Ceiling:
1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 2. Type: Glide Plate.
 - a. Finish: Mill.
 - b. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
- 2.4 EXTERIOR WALL EXPANSION CONTROL SYSTEMS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
 1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
 2. Balco, Inc.
 3. D. S. Brown Company (The).

4. [EMSEAL Corporation.](#)
5. MM Systems Corporation
6. [Nystrom, Inc.](#)
7. [Watson Bowman Acme Corp.; a BASF Construction Chemicals business.](#)

- C. Source Limitations: Obtain expansion control systems from single source from single manufacturer.
- D. Wall-to-Wall, Wall to corner, and Soffit to Soffit:
1. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Movement Capability: -25 percent/+75 percent.
 - c. Type of Movement: Thermal.
 - d. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
 2. Type 1: Cover plate.
 - a. Metal: Aluminum.
 - 1) Finish: Mill.
 3. Type 2: Flat seal.
 - a. Metal: Aluminum.
 - b. Seal Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
 - c. Pantograph Mechanism: Manufacturer's standard pantographic wind-load support mechanism with stainless-steel fasteners.

2.5 PREFORMED JOINT SEAL TAPE

- A. Provide Pre-compressed Impregnated Foam Seal at expansion locations and as indicated.
1. Basis of Design: Tremco illmod 600 tape.

2.6 ROOF EXPANSION JOINTS

- A. Source Limitations: Obtain bellows-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.
- B. Flanged Bellows Roof Expansion Joint: Manufactured, continuous, waterproof, joint-cover assembly, consisting of exposed membrane bellows, laminated to flexible, closed-cell support foam, and secured along each edge to a 3- to 4-inch- (76- to 100-mm-) wide metal flange for nailing to substrate. Provide each size and type indicated, factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation. Fabricate each assembly specifically for installation configuration indicated on Drawings.
1. [Basis-of-Design Product](#): Subject to compliance with requirements, provide ERFL-200 by MM Systems Corporation or comparable product by one of the following: **SRJ 900 W/FB**
 2. Joint Movement Capability: Plus and minus 50 percent of joint size.
 - a. Color: Black.
 3. Flanges: Galvanized steel, 0.022 inch (0.56 mm) thick.
 - a. Form: Flat to fit cants as indicated on Drawings.

- b. Mortar Flanges: Where flanges will be embedded in concrete or mortar, provide perforated-metal mortar flanges.
- C. Roof Expansion Joint Assembly: Metal frames and covers for exterior joints on shingle roof.
 1. Basis-of-Design Product: MM Systems Corp Series ERF 200 or a comparable product of one of the following:
 - a. Construction Specialties
 - b. Balco
 - c. Nystrom, Inc.
 2. Base and Frame: Aluminum, ASTM B 221, alloy 6063 T5 for extrusions; ASTM B 209, alloy 6061 T6 for sheet and plate.
 3. Splice cap: Formed Aluminum.
 4. Provide custom transitions as necessary to provide a complete watertight system.
 5. Exposed Cover Material: Aluminum.
 6. Exposed Frame Material: Same material and finish as exposed cover material.
 - a. Moisture Barrier: Continuous elastomeric sheet.
 - b. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction
- D. Aluminum Roof Expansion Joint: Factory-fabricated, continuous, waterproof, joint cover; consisting of a formed or extruded metal cover secured to extruded aluminum frames, with water-resistant gasketing between cover and frames, and with provision for securing assembly to substrate and sealing assembly to roofing membrane or flashing.
 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
 - a. [Balco, Inc.](#)
 - b. [InPro Corporation.](#)
 - c. [Johns Manville; a Berkshire Hathaway company.](#)
 - d. MM Systems Corporation
 - e. [Watson Bowman Acme Corp.](#)
 2. Nominal Joint Width: As indicated.
 3. Type of Movement Capability: Expansion and contraction.
 4. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.
 5. Joint Movement Capability: Plus and minus 50 percent of joint size.
 6. Frame Members: Extruded aluminum configured for sloped cants as indicated; with exposed finish matching cover.
 7. Cover: Formed or extruded aluminum; thickness as recommended by manufacturer.
 8. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.
 9. Accessories: Provide splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation.
 10. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the cover.
 - a. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture to drain to exterior-wall expansion joint cover.
 - b. Thermal Insulation: Fill space above secondary seal with mineral-fiber blanket insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.
 11. Fire Barrier: Manufacturer's standard fire barrier for fire-resistance-rated expansion joint system.

E. Materials:

1. Aluminum: **ASTM B 209 (ASTM B 209M)** for sheet and plate, **ASTM B 221 (ASTM B 221M)** for extrusions; alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 - a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.
 - b. Mill Finish: As manufactured.

2.7 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary cover.
1. Drain-Tube Assemblies: Equip moisture barrier with drain tubes and seals to direct collected moisture to drain.

2.8 MATERIALS

- A. Aluminum: **ASTM B 221 (ASTM B 221M)**, Alloy 6063-T5 for extrusions; **ASTM B 209 (ASTM B 209M)**, Alloy 6061-T6 for sheet and plate.
1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.
- C. Compression Seals: ASTM E 1612; preformed elastomeric extrusions having an internal baffle system and designed to function under compression.
- D. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.
- E. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required fire-resistance rating.
- F. Moisture Barrier: Flexible elastomeric material, EPDM, minimum 45 mils thick.
- G. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- H. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.9 GENERAL FINISH REQUIREMENTS

- 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.

2.10 ALUMINUM FINISHES

- A. Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion control system manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.
- C. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.

3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
 5. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.
 6. Locate anchors at interval recommended by manufacturer, but not less than **3 inches (75 mm)** from each end and not more than **24 inches (600 mm)** o.c.
- C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
 2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer to both **[frame interfaces] [sides of slabs]** before installing compression seals.
- E. Foam Seals: Install with adhesive recommended by manufacturer.
- F. Epoxy-Bonded Seals: Pressurize seal for time period and to pressure recommended by manufacturer. Do not overpressurize.
- G. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.
- H. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion control system materials and associated work so complete assemblies comply with assembly performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- I. Moisture Barrier: Provide **[at all exterior joints and]**where indicated on Drawings. Provide drainage fittings **[at a maximum of 50 feet (15.2 m) or]** where indicated on Drawings.
- ### 3.4 PROTECTION
- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
 - B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 079500

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes hollow-metal doors and frames.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

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

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

2. Product Data for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 3. Product Data for LEED IEQ 4.1: For all adhesives and all sealants, provide printed statement of VOC content stated in grams per liter, less water.
 - a. All Products to meet or be below limits set by South Coast Air Quality District Rule #1168 effective July 1, 2005 and rule amended of January 7, 2005.
 - b. Aerosol adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.
- 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 anchorages, joints, field splices, and connections.
 7. Details of accessories.
 8. Details of moldings, removable stops, and glazing.
 9. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
1. For each type of exposed finish required, prepared on Samples of not less than **3 by 5 inches (75 by 127 mm)**.
- E. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.
- 1.7 INFORMATIONAL SUBMITTALS
- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver hollow-metal work 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 work vertically under cover at Project site with head up. Place on minimum **4-inch (102-mm)** high wood blocking. Provide minimum **1/4-inch (6-mm)** space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. **Ceco Door Products**; an Assa Abloy Group company.
 - 2. **Pioneer Industries, Inc.**
 - 3. **Steelcraft**; an Allegion company – Basis of Design.
- B. **Source Limitations:** Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. **Fire-Rated Assemblies:** Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. **Smoke- and Draft-Control Assemblies:** Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. **Fire-Rated, Borrowed-Light Assemblies:** Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. **Extra-Heavy-Duty Doors and Frames:** SDI A250.8, Level 3.
 - 1. **Physical Performance:** Level A according to SDI A250.4.
 - 2. **Doors:**
 - a. **Type:** As indicated in the Door and Frame Schedule.
 - b. **Thickness:** 1-3/4 inches (44.5 mm).
 - c. **Face:** Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - d. **Edge Construction:** Model 2, Seamless.
 - e. **Core:** Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 3. **Frames:**
 - a. **Materials:** Uncoated, steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - b. **Construction:** Face welded unless otherwise indicated.
 - 1) Slip on drywall at in place gypsum board partitions.
 - 4. **Exposed Finish:** Prime.

- C. Pocket Door Frames:
 - 1. Basis of Design: Hager 9630 – heavy duty pocket door kit.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm.)
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A40 (ZF120) coating.
 - b. Construction: Face welded.
 - 4. Exposed Finish: Prime.

2.5 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.7 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. 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.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, 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 E 136 for combustion characteristics.
- J. Glazing: Comply with requirements in Section 088000 "Glazing."
- K. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.8 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical,

fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness **0.026 inch (0.66 mm)**, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than **6 inches (152 mm)** apart. Spot weld to face sheets no more than **5 inches (127 mm)** o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
3. Vertical Edges for Single-Acting Doors: Provide square edges.
4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum **3/4 inch (19 mm)** beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than **16 inches (406 mm)** from top and bottom of frame. Space anchors not more than **32 inches (813 mm)** o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to **60 inches (1524 mm)** high.
 - 2) Three anchors per jamb from **60 to 90 inches (1524 to 2286 mm)** high.
 - 3) Four anchors per jamb from **90 to 120 inches (2286 to 3048 mm)** high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each **24 inches (610 mm)** or fraction thereof above **120 inches (3048 mm)** high.
 - b. Stud-Wall Type: Locate anchors not more than **18 inches (457 mm)** from top and bottom of frame. Space anchors not more than **32 inches (813 mm)** o.c. and as follows:
 - 1) Three anchors per jamb up to **60 inches (1524 mm)** high.
 - 2) Four anchors per jamb from **60 to 90 inches (1524 to 2286 mm)** high.
 - 3) Five anchors per jamb from **90 to 96 inches (2286 to 2438 mm)** high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each **24 inches (610 mm)** or fraction thereof above **96 inches (2438 mm)** high.

- c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
 - 6. 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.
 - 7. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
- 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
- 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
- G. At door frames that are modified to accommodate the personal lift systems, additional support and/or fasteners may be required

2.9 STEEL FINISHES

- A. Prime Finish at interior doors: Clean, pretreat, and apply manufacturer's standard primer.
- 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Factory Finish at exterior doors: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.
- 1. Color and Gloss: Three-coat Metallic – Valspar; Medium Gray (Metallic); 439RZ1824M.
 - 2. Exterior door frames to match doors in color and finish.

2.10 ACCESSORIES

- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

- c. Install frames with removable stops located on secure side of opening.
- d. Install door silencers in frames before grouting.
- e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
- f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
- g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and 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. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: **1/8 inch (3.2 mm)** plus or minus **1/32 inch (0.8 mm)**.
 - b. Between Edges of Pairs of Doors: **1/8 inch (3.2 mm)** to **1/4 inch (6.3 mm)** plus or minus **1/32 inch (0.8 mm)**.
 - c. At Bottom of Door with no Threshold: **5/8 inch (15.8 mm)** plus or minus **1/32 inch (0.8 mm)**.
 - d. At Bottom of Door with Threshold: **3/4 inch (19.1 mm)** plus or minus **1/32 inch (0.8 mm)**.
 - e. Between Door Face and Stop: **1/16 inch (1.6 mm)** to **1/8 inch (3.2 mm)** plus or minus **1/32 inch (0.8 mm)**.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than **9 inches (230 mm)** o.c. and not more than **2 inches (51 mm)** o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. 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.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 3113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.
- B. Related Requirements:
 - 1. Section 077200 "Roof Accessories" for roof hatches.
 - 2. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. LEED Submittals:
 - 1. Product Data for LEED MR 4: For products having recycled content, provide documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight for both postconsumer and pre-consumer products.
 - a. Include statement indicating costs for each product having recycled content. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
 - 2. Product Data for LEED MR 5: Provide certificate or letter from Manufacturer stating product was made within 500 miles of the Job Site. Provide certificate or letter from Manufacturer stating fraction, by weight, of product or material was extracted, harvested or recovered within 500 miles of the Project job site. Qualifying products must be made within 500 miles AND have some content that is also extracted, harvested or recovered in the same 500 miles.
 - a. Include statement indicating costs for each product having regional content. If regional content product is part of an assembly, indicate relative dollar value of regional content product to total dollar value of assembly.
 - b. Where product components are sourced or manufactured in separate locations, provide location information for each component.

- c. If only a portion of a product or material is extracted, harvested, or recovered and manufactured locally, then only that percentage by weight contributes to the regional value.
- 3. Product Data for LEED IEQ 4.1: For all adhesives and all sealants, provide printed statement of VOC content stated in grams per liter, less water.
 - a. All Products to meet or be below limits set by South Coast Air Quality District Rule #1168 effective July 1, 2005 and rule amended of January 7, 2005.
 - b. Aerosol adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation of access doors and frames for each type of substrate.
- D. Samples: For each door face material, at least **3 by 5 inches (75 by 125 mm)** in size, in specified finish.
- E. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 - 2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Babcock-Davis.
 - 2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 - 3. Larsen's Manufacturing Company.
 - 4. Nystrom, Inc.
- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Doors with Exposed Flanges:
 - 1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: As required.
 - 4. Uncoated Steel Sheet for Door: Nominal **0.060 inch (1.52 mm)**, 16 gage

- a. Finish: Factory prime.
 5. Frame Material: Same material, thickness, and finish as door.
 6. Hinges: Manufacturer's standard.
 7. Hardware: Latch
 8. Location: Where indicated.
- D. Recessed Access Doors:
1. Assembly Description: Fabricate door in the form of a pan recessed **5/8 inch (16 mm)** for gypsum board infill. Provide frame with gypsum board bead for concealed flange installation.
 - a. Basis of Design: Model KATR by KARP Associates Inc.
 2. Locations: Wall and ceiling in acoustically rated assembly.
 3. Door Size: As required.
 4. Uncoated Steel Sheet for Door: Nominal **0.060 inch (1.52 mm)**, 16 gage.
 - a. Finish: Factory prime.
 5. Stainless-Steel Sheet for Door: Nominal **0.062 inch (1.59 mm)**, 16 gage.
 - a. Finish: No. 4.
 - b. At wet walls.
 6. Frame Material: Same material and thickness as door.
 7. Hinges: Manufacturer's standard.
 8. Hardware: Latch.
 9. Provide neoprene gasket at full perimeter surround.
- E. Fire-Rated, Flush Access Doors with Exposed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame, uninsulated. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Gasket seal: neoprene.
 3. Locations: Wall and ceiling.
 4. Fire-Resistance Rating: Not less than that of adjacent construction.
 5. Uncoated Steel Sheet for Door: Nominal **0.060 inch (1.52 mm)**, 16 gage.
 - a. Finish: Factory prime.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Hinges: Manufacturer's standard.
- F. Hardware: Fire-Rated, Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame, uninsulated. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Wall and ceiling.
 3. Fire-Resistance Rating: Not less than that of adjacent construction.
 4. Uncoated Steel Sheet for Door: Nominal **0.060 inch (1.52 mm)**, 16 gage.
 - a. Finish: Factory prime.
 5. Frame Material: Same material, thickness, and finish as door.
 6. Hinges: Manufacturer's standard.
- G. Hardware:
1. Latch: Cam latch operated by screwdriver.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

- B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.
- E. Frame Anchors: Same type as door face.
- F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 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 attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
 - 2. Provide mounting holes in frames for attachment of units to metal or wood framing.
 - 3. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.5 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. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

- E. Stainless-Steel Finishes:
 - 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.

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.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 3323

OVERHEAD COILING DOORS

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. Service doors
 - 2. Insulated service doors.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
 - 5. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - 1. Include similar Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
 - 1. Curtain slats.
 - 2. Bottom bar with sensor edge.

3. Guides.
4. Brackets.
5. Hood.
6. Locking device(s).
7. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
 1. Temperature-Rise Limit: At exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than **450 deg F** above ambient after 30 minutes of standard fire-test exposure.
 2. Smoke Control: In corridors and smoke barriers, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of **3.0 cfm/sq. ft.** of door opening at **0.10-inch wg** for both ambient and elevated temperature tests.
- 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. Provide smoke detectors for releasing of overhead doors in fire rated barrier per NFPA 72.
- D. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
1. Obtain operators and controls from overhead coiling door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
1. Design Wind Load: Uniform pressure (velocity pressure) of **20 lbf/sq. ft. (960 Pa)**, acting inward and outward.
 2. Testing: According to ASTM E 330.
 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 4. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of **20 lbf/sq. ft. (960 Pa)** wind load, acting inward and outward.
 5. Rate of Descent:
 - a. An automatic closing door must close at a rate of descent of not less than 4 inches per second and not more than 24 inches per second, and come to rest without impact.

2.3 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Cookson Company](#).
 - b. [Cornell Iron Works, Inc.](#)
 - c. [McKeon Rolling Steel Door Company, Inc.](#)
 - d. [Overhead Door Corporation](#)
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Air Infiltration: Maximum rate of **0.08 cfm/sq. ft. (0.406 L/s per sq. m)** at **15 and 25 mph (24.1 and 40.2 km/h)** when tested according to ASTM E 283.
- D. Curtain R-Value: **4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W)**.
- E. Door Curtain Material: Galvanized steel.
- F. Door Curtain Slats: Flat profile slats of **2-5/8-inch (67-mm)** center-to-center height.
1. Insulated-Slat Interior Facing: Metal.
 2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

- G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from hot-dip galvanized steel and finished to match door.
- H. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- I. Hood: Match curtain material and finish.
 - 1. Shape: Round.
 - 2. Mounting: Face of wall.
- J. Locking Devices: Equip door with locking device assembly.
 - 1. Locking Device Assembly: Cremona type, both jamb sides locking bars, operable from inside and outside with cylinders.
- K. Electric Door Operator:
 - 1. Usage Classification: Heavy duty, 25 or more cycles per hour and over 90 cycles per day.
 - 2. Operator Location: Wall.
 - 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet (2.44 m) or lower.
 - 4. Motor Exposure: Exterior, wet, and humid.
 - 5. Emergency Manual Operation: Push-up type.
 - 6. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
 - a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.
 - 7. Control Station(s): Exterior mounted.
 - 8. Other Equipment: Audible and visual signals.
- L. Curtain Accessories: Equip door with weatherseals push/pull handles
- M. Door Finish:
 - 1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
 - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 FIRE-RATED DOOR ASSEMBLY

- A. Fire-Rated Service Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.
 - 1. Cookson Company.
 - 2. Cornell Iron Works, Inc.
 - 3. McKeon Rolling Steel Door Company, Inc.
 - 4. Overhead Door Corporation
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Fire Rating: 2 hours with temperature-rise limit and with smoke control.
- D. Door Curtain Material: steel.
- E. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.

1. Insulated-Slat Interior Facing: Metal.
- F. Curtain Jamb Guides: steel with exposed finish matching curtain slats.
- G. Hood: Match curtain material and finish.
1. Shape: Round.
 2. Mounting: Face of wall.
- H. Locking Devices: Equip door with locking device assembly.
1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside and outside with cylinders.
- I. Electric Door Operator:
1. Usage Classification: Heavy duty, 25 or more cycles per hour and over 90 cycles per day.
 2. Operator Location: Wall.
 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at **8 feet (2.44 m)** or lower.
 4. Motor Exposure: Interior.
 5. Emergency Manual Operation: Push-up type.
 6. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
 - a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.
 7. Control Station(s): Exterior mounted.
 8. Other Equipment: Audible and visual signals.
- J. Door Finish:
1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.5 MATERIALS, GENERAL

- 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.

2.6 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with **G90 (Z275)** zinc coating; nominal sheet thickness (coated) of **0.028 inch (0.71 mm)**; and as required.
 2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.

3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch (0.25 mm).

- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.7 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 1. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
 2. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.8 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 1. Lock Cylinders: Cylinders standard with manufacturer and keyed to building keying system.
 2. Keys: Three for each cylinder.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.9 CURTAIN ACCESSORIES

- A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.
- B. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 1. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene.
- C. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

- D. Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic-closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. Testing for manually operated doors shall allow resetting by opening the door without retensioning the counterbalancing mechanism. Automatic-closing device shall be designed for activation by the following:
 - 1. Replaceable fusible links with temperature rise and melting point of 165 deg F interconnected and mounted on both sides of door opening.
 - 2. Building fire-detection, smoke-detection, and -alarm systems.

2.10 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.11 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-rewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Chamberlain Group, Inc. \(The\)](#).
 - 2. Comply with NFPA 70.
 - 3. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.

1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
 1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 115 V.
 - c. Hertz: 60.
 2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than **8 in./sec. (203 mm/s)** and not more than **12 in./sec. (305 mm/s)**, without exceeding nameplate ratings or service factor.
 3. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
 1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed **25 lbf (111 N)**.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Provide automatic releasing mechanism or medium that is activated by the operation of approved smoke detectors installed in accordance with the requirements for smoke detectors for door leaf release service in NFPA 72.

- K. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- L. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

2.12 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.13 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
 - 1. Color:
 - a. Three-coat Metallic – Valspar; Medium Gray (Metallic); 439RZ1824M

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Fire-Rated Doors: Install according to NFPA 80.

- E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.
- F. Power-Operated Doors: Install automatic doors openers according to UL 325.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 TESTING

- A. Preliminary Tests: The following tests shall be conducted during installation and a signed test report, recording the test results, shall be submitted to the COTR prior to the scheduling of the final test.
 - 1. Release of the door by fusible link.
 - 2. Release of the door by smoke detector activation.
 - 3. Release the flame baffle by fusible link.
 - 4. Manually reopen the door after it has been released by fusible link and smoke detector activation. Door must automatically close after manually reopening.
- B. Final Inspection and Tests: OSHEM Fire Protection Engineer shall be notified by the COTR and shall witness all final tests and approve all doors and hardware before they are accepted. Submit a request for formal inspection at least five working days prior to the date of the inspection. During the final test, all preliminary tests shall be repeated and additional tests shall be conducted until it is demonstrated that all equipment complies with all contract requirements. Any cost incurred by the Smithsonian for repeat test(s) due to the failure of the doors and associated equipment during final testing shall be paid by the contractor

3.5 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather-resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 08 3513

FOLDING DOORS

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. Automatic folding Fire-rated doors.
- B. Related Sections:
 - 1. Section 05 5000 "Metal Fabrications" for support of and blocking for partition tracks, jamb conditions, pocket doors, motor operators, and controls; and for prepunching metal support members
 - 2. Section 06 1053 "Miscellaneous Rough Carpentry" for support of and blocking for partition tracks, jamb conditions, pocket doors, motor operators, and controls
 - 3. Section 08 3113 "Access Doors and Frames" for access panels to controls of fire-rated folding doors
 - 4. Section 28 3111 "Digital, Addressable Fire-Alarm System" for fire-alarm and activating signaling systems

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for folding doors.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and installation details.
 - 2. Include clearances required for operation, operating and control mechanisms, access requirements, storage pockets and pocket doors, and accessory items.
 - 3. Fire-Release System: Describe system, including testing and resetting instructions for fire-rated folding doors.
 - 4. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of exposed finish.
 - 1. Include Samples of hardware and accessories involving color and finish selection.
- D. Samples for Verification: For each type of exposed finish.
 - 1. Include Samples of hardware and accessories to verify color and finish selection.

- E. Product Schedule: For folding doors.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each fire-rated folding door, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For fire-rated folding doors, from ICC-ES.
- A. LEED Submittals: Submit at time of shop drawings.
 - 1. Product Data for LEED IEQ 4.1: For all adhesives and all sealants, provide printed statement of VOC content stated in grams per liter, less water.
 - a. All Products to meet or be below limits set by South Coast Air Quality District Rule #1168 effective July 1, 2005 and rule amended of January 7, 2005.
 - b. Aerosol adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36 requirements in effect on October 19, 2000.
 - 2. Product Data for LEED IEQ 4.2: For each product in this section, provide a printed statement of VOC content stated in grams per liter.
 - a. No flat paint is to be used in this project.
 - b. Paints and Coatings on interior walls and ceilings: Product to not exceed the VOC content limits established in Green Seal Standard GS-11, 1st Edition, May 20, 1993.
 - c. Anti-corrosive and anti-rust paints: Product to not exceed the VOC content limit in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For folding doors to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of fire-rated folding doors.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install folding doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for building occupants after completion of construction during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 AUTOMATIC FOLDING DOORS

- A. Description: Electrically-operated folding-door assembly, automatic or self-closing, listed and labeled for fire-resistance ratings indicated by a qualified testing agency, top supported, and

complete with hardware, seals, track, closing devices, releasing devices, controls, and accessories necessary for intended operation.

1. **Basis of Design Product for Fire Door:** Subject to compliance with requirements, provide Won-Door Fireguard 90 Horizontal Sliding, Accordion-Type Fire Door, or approved equal by one of the following:
 - a. Cornell Iron Works, Inc
 - b. McKeon Rolling Steel Door
- B. **Listed Assemblies:** Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252.
 1. **Oversize Doors:** For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- C. **Configuration:** As indicated on Drawings.
- D. **Features:**
 1. **Track:** Overhead track without floor guide.
 2. **Normal Position:** Assembly's normal position is the open (stacked) position. Signal from fire-alarm system initiates self-closing operation.
 3. **Manual Operation:** Allow manual operation in either conventional or emergency mode. When opened manually during emergency mode, control mechanism automatically closes assembly.
 4. **Access Control/Monitoring:** Exit hardware does not respond until activated by signal from smoke detector or fire alarm.
 5. **Non-Sway Construction:** To resist differential air pressure.
 6. **Rate of Descent:**
 - a. An automatic closing door must close at a rate of descent of not less than 4 inches per second and not more than 24 inches per second, and come to rest without impact.
- E. **Fire Rating:** 1-1/2 hour(s).
- F. **Panel Construction:** Formed-steel sheet panels connected by hinges of matching material.
- G. **Perimeter Seals and Closures:** Manufacturer's standard vinyl or neoprene vertical seals, horizontal top and bottom seals, and closures identical to products tested for fire rating indicated, and forming an effective smoke and draft seal.
 1. **Points of Access to Elevators:** Provide smoke seals that comply with requirements of authorities having jurisdiction for seals at points of access to elevators where indicated.
- H. **Track and Trolley System:** Single or dual steel or aluminum track systems, with ball-bearing roller trolleys and adjustable steel hanger rods for overhead support; designed for type of operation, size, and weight of fire-rated folding door indicated. Provide a continuous system of track sections and accessories identical to products tested for fire rating indicated, to accommodate configuration and layout indicated for door operation and storage.
- I. **Lead Posts:** Metal sheet material matching door-panel construction and connected to panels by specially adapted panels and equipped with manufacturer's standard exit hardware on each side.
- J. **Electric Operators and Controls:**

1. Automatic closing system including motor operator and releasing devices shall be a micro-processor based system rated to UL 864 (releasing control unit) and shall commence closing upon activation by fire alarm system and/or by low battery charge
 - a. Motor: 1/2 hp, controlled by reversing magnetic starter and equipped with overload protection.
 - b. Limit Switches: To prevent overtravel.
 - c. Roller Chain or Cable: Connected to lead posts by means of vertical stabilizer bar assembly.
 - d. Drive Mechanism: Protected by torque limiter and emergency clutch.
 - e. Travel Speed: 18 inches (450 mm) per second, maximum; 6 inches (150 mm) per second, minimum.
2. In case of fire, closing system is activated by building's fire- and smoke-detection equipment and automatically closes fire-rated folding doors.
3. Electrical Service: Equip for 120-V, single-phase, 60-cycle ac.
4. Battery: Electrical current connects through relay to battery charger that continuously charges 12-V dc battery and automatically maintains battery at capacity. Automatic audible signal device sounds off if battery falls below or exceeds proper charge, power loss has occurred, or high-ac line voltage has been experienced.
5. Leading-Edge Obstruction Detector:
 - a. Equip with pressure-sensitive leading edge that, on contact with an obstruction, causes door to stop and pause before attempting to re-close.
 - b. Disable leading-edge obstruction detector until fire-rated folding door has opened swinging door on the storage pocket (pocket door).
6. Fire-rated folding doors can be manually opened by pushing against leading edge.
7. Audible alarm sounds at automatic closing of door.

K. Accessories:

1. Exit Hardware: Located on both sides of fire-rated folding door. In emergency mode, slight pressure on hardware causes door to open a minimum of 32 inches (812 mm), pause for three seconds, and then automatically close. Furnish hardware that can be field programmable to allow automatic opening distances of up to the entire opening width. In conventional mode, hardware is used to operate door and move it back into storage pocket.

L. Finishes:

1. Factory-applied polyester or powder-coat finish for panels and hinges in standard color.
2. Manufacturer's standard finish for handles.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. For folding doors supported by or anchored to permanent construction, advise installers of specific requirements for placement of anchorage devices. Furnish installers of other work with templates and drawings indicating locations of anchorage devices and similar items.

- B. Fire-Rated Folding Doors: Level floor with header in path of fire-rated folding doors to tolerance of plus or minus **1/16 inch (1.6 mm)** across opening; grind or fill floor as necessary.

3.3 INSTALLATION

- A. General: Install folding doors complying with manufacturer's written installation instructions. Install track in one piece.
 - 1. Fire-Rated Folding Doors: Comply with NFPA 80 requirements for installation.
- B. Standard Floor Clearances: **1/4 to 3/4 inch (6.4 to 19 mm)** maximum (above floor finish).
 - 1. Fire-Rated Folding Doors: Comply with NFPA 80 requirements for floor clearances.
- C. Fire-Rated Folding Doors: Coordinate provisions for sensing devices, electrical service, and final connections for fire-rated folding doors.

3.4 ADJUSTING

- A. Adjust units to ensure smooth, quiet operation without warping or binding. Adjust hardware to function smoothly. Confirm that latches engage accurately and securely without forcing or binding.
 - 1. Fire-Rated Folding Doors: Verify that all operations are functional and comply with requirements of authorities having jurisdiction.
- B. Pocket Doors: Adjust to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-rated folding doors.

END OF SECTION

SECTION 087100
DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:
 - a. Swinging doors.
2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.

1.3 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - c. Type, style, function, size, and finish of each hardware item.
 - d. Name and manufacturer of each item.
 - e. Fastenings and other pertinent information.
 - f. Location of each hardware set cross-referenced to indications on Drawings.
 - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - h. Mounting locations for hardware.
 - i. Door and frame sizes and materials.
 - j. Name and phone number for local manufacturer's representative for each product.

- 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 fabrication of other work that is critical in Project construction schedule.
4. Key Schedule:
 - a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
 5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.
- C. Informational Submittals:
1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
 2. Product Certificates for electrified door hardware, signed by manufacturer:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 3. Certificates of Compliance:
 - a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
 - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
 - c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
 4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
 5. Warranty: Special warranty specified in this Section.
- D. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - e. Final approved hardware schedule, edited to reflect conditions as-installed.
 - f. Final keying schedule
 - g. Copies of floor plans with keying nomenclature
 - h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
 - i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
 1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
 - a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.
 2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 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.
 4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - 1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 - 2. Can provide installation and technical data to Architect and other related subcontractors.
 - 3. Can inspect and verify components are in working order upon completion of installation.
 - 4. Capable of producing wiring diagrams.
 - 5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
 - 2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- H. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
 - 2. Maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.
- J. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
 1. Attendees: Owner, Contractor, Architect, Installer, and Supplier's Architectural Hardware Consultant.
 2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
- K. Pre-installation Conference: Conduct conference at Project site.
 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Inspect and discuss preparatory work performed by other trades.
- L. Coordination Conferences:
 1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.
 2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
 - a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Architect and Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
1. Promptly replace products damaged during shipping.
 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- F. Deliver keys to Owner by registered mail or overnight package service.

1.7 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. 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.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- 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.
- E. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers:

- 1) Mechanical: 30 years.
 - b. Exit Devices:
 - 1) Mechanical: 3 years.
 - c. Locksets:
 - 1) Mechanical: 3 years.
 - d. Continuous Hinges: Lifetime warranty.
 - e. Key Blanks: Lifetime
2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

- E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.
1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
 2. Use materials which match materials of adjacent modified areas.
 3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.
- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.3 HINGES

A. Provide five-knuckle, ball bearing hinges.

1. Manufacturers and Products:
 - a. Scheduled Manufacturer and Product: Ives 5BB series
 - b. Acceptable Manufacturers and Products: Hager BB series, Stanley FBB Series

B. Requirements:

1. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

2. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
3. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
4. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
5. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
8. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
10. Provide mortar guard for each electrified hinge specified, unless specified in hollow metal frame specification.
11. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

2.4 CONTINUOUS HINGES

A. Aluminum Geared

1. Manufacturers:
 - a. Scheduled Manufacturer: Ives.
 - b. Acceptable Manufacturers: Select, Stanley.
2. Requirements:
 - a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.25, Grade 2.

- b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with 0.25-inch (6 mm) diameter Teflon coated stainless steel hinge pin.
- c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
- d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
- e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
- f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
- g. Install hinges with fasteners supplied by manufacturer.
- h. Provide hinges with symmetrical hole pattern.

2.5 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Trimco

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.6 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Trimco

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices if required.

2.7 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series, No Substitutions

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: Schlage 12A.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.8 EXIT DEVICES

A. Manufacturer and Product:

1. Scheduled Manufacturer: Von Duprin 98, No Substitutions

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.
4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.
5. Provide exit devices with manufacturer's approved strikes.
6. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
7. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
8. Provide hex-key dogging at non-fire-rated exit devices, unless specified less dogging.
9. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.

10. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
 - a. Lever Style: Match lever style of locksets.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
11. Provide UL labeled fire exit hardware for fire rated openings.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.

2.9 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Medeco per Owner's existing system, No Substitutions

B. Requirements:

1. Provide cylinders/cores, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Keying: Manufacturer-keyed permanent cylinders/cores, configured into keying system per "KEYING" article herein.
 - b. Features: Cylinders/cores shall incorporate the following features.
3. Nickel silver bottom pins.

2.10 KEYING

- ### A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - a. Keying system as directed by the Owner.
2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Identification:

- a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
 - b. Identification stamping provisions must be approved by the Architect and Owner.
 - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
 - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
4. Quantity: Furnish in the following quantities.
- a. Change (Day) Keys: 3 per cylinder/core.
 - b. Permanent Control Keys: 3.
 - c. Master Keys: 6.
 - d. Unused balance of key blanks shall be furnished to Owner with the cut keys.
 - e. Extra Keys:
 - 1) 6 Construction Keys

2.11 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer: Telkee
2. Acceptable Manufacturers: HPC, Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4010/4110 series.
2. Acceptable Manufacturers and Products: No Substitute.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to

- meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
 3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 11/16 inch (17 mm) diameter double heat-treated pinion journal.
 4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
 5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
 6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
 7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
 8. Pressure Relief Valve (PRV) Technology: Not permitted.
 9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
 10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Trimco

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.14 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Trimco

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.15 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Trimco

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: NGP
2. Acceptable Manufacturers: Reese, Zero International

B. Requirements:

1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width

- b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.17 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.18 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 628
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Door Closers: Powder Coat to Match
6. Wall Stops: BHMA 630 (US32D)
7. Weatherstripping: Clear Anodized Aluminum
8. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, 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.
- B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Where on-site modification of doors and frames is required:
1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 2. Field modify and prepare existing door and frame for new hardware being installed.
 3. When modifications are exposed to view, use concealed fasteners, when possible.
 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

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.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Replace construction cores with permanent cores as indicated in keying section.

- I. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- L. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- M. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- N. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- O. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. 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.
- B. Occupancy Adjustment: Approximately Six (6) months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.

- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Hardware Sets:

Hardware Set No. 01

Door #(s):

120.06.1

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
2	EA	CONT. HINGE	112HD EPT	628	IVE
2	EA	POWER TRAFER	EPT10	689	VON
1	EA	KEYED MULLION	KR4954	628	VON
1	EA	PANIC HARDWARE	RX-98-EO	626	VON
1	EA	PANIC HARDWARE	RX-QEL+-98-NL	626	VON
1	EA	RIM CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
2	EA	SURFACE CLOSER	4111 CUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	DRIP CAP	142A	CL	ZER
1	SET	SEALS	188S	BLK	ZER
2	EA	DOOR SWEEP	8197AA	CL	ZER
1	EA	THRESHOLD	65A	AL	ZER
1	EA	CREDENTIAL READER	BY SECURITY SECTION		
1	EA	DOOR CONTACT	679-05	WHT	SCE
1	EA	POWER SUPPLY	PS902 900-BB KL900	LGR	VON

Operational Description:

Door normally closed and locked.

Free Egress at all times.

Entrance by presentation of a valid credential to the reader or key override.

Door remains secure with loss of power or activation of fire alarm.

RX shunts DPS and signals legal exit, DPS monitoring by access control system.

Hardware Set No. 02

Door #(s):

120.C1.2 S5.01.2

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	98-NL	626	VON
1	EA	RIM CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	DRIP CAP	142A	CL	ZER
1	SET	SEALS	188S	BLK	ZER
1	EA	DOOR SWEEP	8197AA	CL	ZER
1	EA	THRESHOLD	65A	AL	ZER

Hardware Set No. 03

Door #(s):

120.04.2 125.05.1 S5.03.1 S5.02 S4.01.2 S5.01.1

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-NL-F-12	626	VON
1	EA	RIM CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER

Hardware Set No. 03-A

Door #(s):

120.01 S4.01.1 S4.02.1 S4.03.1 S4.03.2

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC FIRE EXIT HARDWARE	98-L-F-E996-FS-12	626	VON
1	EA	RIM CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	5050B	BRN	NGP
1	EA	CREDENTIAL READER	BY SECURITY SECTION		
1	EA	DOOR CONTACT	679-05	WHT	SCE
1	EA	POWER SUPPLY	PS902 900-FA KL900	LGR	VON

Operational Description:

Door normally closed and locked.

Free Egress at all times.

Entrance by presentation of a valid credential to the reader or key override.

Trim is unlocked with loss of power or activation of fire alarm (Fail Safe).

RX shunts DPS and signals legal exit, DPS monitoring by access control system.

Hardware Set No. 04

Door #(s):

120.05.2

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
6	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	SET	CONST LATCHING BOLT	F51P/F61P AS REQ'D	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	FIRE EXIT HARDWARE	9875-L-NL-F-12	626	VON
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	SET	COORDINATOR	COR X FL	628	IVE
1	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER
1	EA	SEALS	5060B (Meeting Stile)	BRN	NGP

Hardware Set No. 05

Door #(s):

117.01E 120.C1.1 S4.02.2 T117.01K

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-BE-F-12	626	VON
1	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER

Hardware Set No. 06

Door #(s):

220.06 220.09 320.07

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	CONST LATCHING BOLT	F51P/F61P AS REQ'D	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080L 12A	626	SCH
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	SET	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
2	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER
1	EA	SEALS	5060B (Meeting Stile)	BRN	NGP

Hardware Set No. 07

Door #(s):

120.07 120.08.1 220.04 220.08 320.09 320.04

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080L 12A	626	SCH
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER
1	EA	DOOR SWEEP	39A (Doors 120.07.1, 220.08, 320.09 Only)	AL	ZER

Hardware Set No. 07-A

Door #(s):

221.01.2

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080L 12A	626	SCH
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER

Hardware Set No. 08

Door #(s):

120.06.2 121.01.3 220.01.3 120.08.2 120.01.2 321.01
 221.01.1

Note:

Masterkeyed cylinder(s) as required – coordinate with overhead door section. Balance of hardware by door manufacturer.

Hardware Set No. 09

Door #(s):

120.02 220.02 320.02

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9040 12A	626	SCH
1	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	MOP PLATE	8400 6" X 1" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER

Hardware Set No. 10

Door #(s):

120.03 220.03 220.05 320.03 320.05 320.06

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080L 12A	626	SCH
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCERS	SR64	GRY	IVE

Hardware Set No. 11

Door #(s):

120.04.1

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-NL-F-12	626	VON
1	EA	RIM CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	SET	SEALS	8150	BLK	ZER

Hardware Set No. 12

Door #(s):

121.01.1

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU STOREROOM LOCK	RX-L9080LEU-12A	626	VON
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	188S	BLK	ZER
1	EA	CREDENTIAL READER	BY SECURITY SECTION		
1	EA	DOOR CONTACT	679-05	WHT	SCE
1	EA	POWER SUPPLY	PS902 900-BB KL900	LGR	VON

Operational Description:

Door normally closed and locked.

Free Egress at all times.

Entrance by presentation of a valid credential to the reader or key override.

Door remains secure with loss of power or activation of fire alarm (Fail Secure).

RX shunts DPS and signals legal exit, DPS monitoring by access control system.

Hardware Set No. 13

Door #(s):

220.01

320.01

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	SET	AUTO FLUSH BOLT	F31P/F41P AS REQ'D	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	EU STOREROOM LOCK	RX-L9080LEU-12A	626	VON
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	SET	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
2	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER
1	EA	SEALS	5060B (Meeting Stile)	BRN	NGP
1	EA	CREDENTIAL READER	BY SECURITY SECTION		
2	EA	DOOR CONTACT	679-05	WHT	SCE
1	EA	POWER SUPPLY	PS902 900-BB KL900	LGR	VON

Operational Description:

Door normally closed and locked.

Free Egress at all times.

Entrance by presentation of a valid credential to the reader or key override.

Door remains secure with loss of power or activation of fire alarm (Fail Secure).

RX shunts DPS and signals legal exit, DPS monitoring by access control system.

Hardware Set No. 13-A

Door #(s):

320.10

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
6	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	POWER TRAFNER	EPT10	689	VON
1	SET	AUTO FLUSH BOLT	F31P/F41P AS REQ'D	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	EU STOREROOM LOCK	RX-L9080LEU-12A	626	VON
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	SET	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
2	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER
1	EA	SEALS	5060B (Meeting Stile)	BRN	NGP
1	EA	CREDENTIAL READER	BY SECURITY SECTION		
2	EA	DOOR CONTACT	679-05	WHT	SCE
1	EA	POWER SUPPLY	PS902 900-BB KL900	LGR	VON

Operational Description:

Door normally closed and locked.

Free Egress at all times.

Entrance by presentation of a valid credential to the reader or key override.

Door remains secure with loss of power or activation of fire alarm (Fail Secure).

RX shunts DPS and signals legal exit, DPS monitoring by access control system.

Hardware Set No. 14

Door #(s):

220.07.1 320.08.1

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	112HD EPT	628	IVE
1	EA	CONT. HINGE	112HD	628	IVE
1	EA	POWER TRANFER	EPT10	689	VON
1	SET	AUTO FLUSH BOLT	F31P/F41P AS REQ'D	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	EU STOREROOM LOCK	RX-L9080LEU-12A	626	VON
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	SET	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4011/4111 AS REQ'D	689	LCN
2	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER
1	EA	SEALS	5060B (Meeting Stile)	BRN	NGP
2	EA	DOOR SWEEP	39A	AL	ZER
1	EA	CREDENTIAL READER	BY SECURITY SECTION		
2	EA	DOOR CONTACT	679-05	WHT	SCE
1	EA	POWER SUPPLY	PS902 900-BB KL900	LGR	VON

Operational Description:

Door normally closed and locked.

Free Egress at all times.

Entrance by presentation of a valid credential to the reader or key override.

Door remains secure with loss of power or activation of fire alarm (Fail Secure).

RX shunts DPS and signals legal exit, DPS monitoring by access control system.

Hardware Set No. 15

Door #(s):

220.07.2 320.08.2

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	CONST LATCHING BOLT	F51P/F61P AS REQ'D	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080L 12A	626	SCH
1	EA	MORTISE CYLINDER	MEDECO PER OWNER'S KEY SYSTEM	626	MED
1	SET	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER/HOLDER	H4111	689	LCN
2	EA	KICK PLATE	8400 10" X 1 1/2" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	SEALS	8150	BLK	ZER
1	EA	SEALS	5060B (Meeting Stile)	BRN	NGP
2	EA	DOOR SWEEP	39A	AL	ZER

End of Section

SECTION 08 9119

FIXED LOUVERS

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. Fixed, extruded-aluminum louvers.
- B. Related Requirements:
 - 1. Section 07 4216 "Formed Metal Wall Panels" for perforated metal panels covering fixed louvers.
 - 2. Section 08 1113 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
 - 3. Section 08 1416 "Flush Wood Doors" for louvers in flush wood doors.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Storm-Resistant Louver - L-1, 2, & 3:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties, Inc.; Model PL-5700 or comparable product by one of the following:
 - a. Airolite Company, LLC (The).
 - b. All-Lite Architectural Products.
 - c. American Warming and Ventilating, Inc.; a Mestak company.
 - d. Greenheck Fan Corporation.
 - e. Industrial Louvers, Inc.
 - f. Reliable Products, Inc.
 - 2. Louver Depth: 7 inches.
 - 3. Louver Performance Ratings:
 - a. Free Area: As indicated on Drawings; not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
 - b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches per hour and a wind speed of 29 mph.
 - c. Maximum Intake Core Velocity: 351 fpm.
 - d. Maximum Intake Free Air Velocity: 702 fpm.
 - e. Intake Pressure Drop at 0.01 oz/ft² Free Air Velocity: 0.19 in. H₂O.
 - f. Intake Capacity: 3775 CFM.
 - 4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 - 5. Finish:
 - a. L1 & L2: 3 coat metallic
 - b. L3: Solid
- B. Horizontal Storm-Resistant Louver – L4:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ELF 6375DX by Ruskin Company or comparable product by one of the following:
 - a. Airolite Company, LLC (The).
 - b. American Warming and Ventilating, Inc.; a Mestak company.
 - c. Construction Specialties, Inc.
 - d. Industrial Louvers, Inc.
 - e. Reliable Products, Inc.
 - 2. Louver Depth: 5 inches.
 - 3. Performance Data:
 - a. Based on testing 48 inch x 48 inch (1,219 mm x 1,219 mm) size unit in accordance with AMCA 500.
 - b. Free Area: 57 percent, nominal.
 - c. Free Area Size: 9.08 square feet (0.84 m²).
 - d. Maximum Recommended Air Flow through Free Area: 1023 feet per minute (5.2 m/s).
 - e. Air Flow: 9289 cubic feet per minute (263 m³/s).
 - f. Maximum Pressure Drop (Intake): 0.15 inches w.g. (0.035 kPa).

- g. Water Penetration: Maximum of 0.01 ounces per square foot (3.1 g/m²) of free area at an air flow of 1,023 feet per minute (5.2 m/s) free area velocity when tested for 15 minutes.
4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
5. Finish: Solid

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Bird screening except where insect screening is indicated.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of **6 inches (150 mm)** from each corner and at **12 inches (300 mm)** o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Mill finish unless otherwise indicated.
 3. Type: Non-rewirable, U-shaped frames.

2.5 BLANK-OFF PANELS

- A. Insulated, Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
 1. Thickness: **2 inches (50 mm)**.
 2. Metal Facing Sheets: Aluminum sheet, not less than **0.032-inch (0.81-mm)** nominal thickness.
 3. Metal Facing Sheets: Galvanized-steel sheet, not less than **0.028-inch (0.71-mm)** nominal thickness.
 4. Insulating Core: Rigid, glass-fiber-board insulation or extruded-polystyrene foam.
 5. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard channel frames, with corners mitered and with same finish as panels.
 6. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
 7. Panel Finish: Same finish applied to louvers.
 8. Attach blank-off panels with clips.

2.6 MATERIALS

- A. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
 4. For fastening stainless steel, use 300 series stainless-steel fasteners.
 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.7 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
 2. Horizontal Mullions: Provide horizontal mullions at joints where indicated.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
1. Frame Type: Channel unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or **72 inches (1830 mm)** o.c., whichever is less.
1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
 2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with semirecessed mullions at corners.
- G. Provide subsills made of same material as louvers or extended sills for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.8 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss:
 - a. Solid – Valspar; Dove Gray; 432R1021 and fashion gray (9919)
 - b. Three-coat Metallic – Valspar; Medium Gray (Metallic); 439RZ1824M

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 09 2116

GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes: Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For shaft wall assemblies and firestop tracks, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated.
- B. STC Rating: As indicated.
- C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
 - 1. Depth: As indicated.
 - 2. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
- D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches (51 mm) long and matching studs in depth.
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
- E. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.
- F. Elevator Hoistway Entrances: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches (76 mm), matching studs in depth, and not less than 0.033 inch (0.84 mm) thick.
- G. Room-Side Finish: Gypsum board.
- H. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.
- I. Insulation: Sound attenuation blankets.

2.3 PANEL PRODUCTS

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent by weight.
- B. Regional Materials: Gypsum panel products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- D. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.
- Products:** Subject to compliance with requirements, provide one of the following:
 - [CertainTeed Corp.](#); ProRoc Shaftliner.
 - [Georgia-Pacific Gypsum LLC](#), Subsidiary of Georgia Pacific; ToughRock Fireguard Shaftliner.
 - [Lafarge North America, Inc.](#); Firecheck Type X Shaftliner.
 - [National Gypsum Company](#); Gold Bond Brand Fire-Shield Shaftliner.
 - [USG Corporation](#); Sheetrock Brand Gypsum Liner Panel.
 - Thickness: **1 inch (25.4 mm)**.
 - Long Edges: Double bevel.
- E. Gypsum Shaftliner Board, Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.
- Products:** Subject to compliance with requirements, provide one of the following:
 - [CertainTeed Corp.](#); ProRoc Moisture and Mold Resistant Shaftliner.
 - [Georgia-Pacific Gypsum LLC](#), Subsidiary of Georgia Pacific; Dens-Glass Ultra Shaftliner.
 - [Lafarge North America, Inc.](#); Firecheck Moldcheck Type X Shaftliner.
 - [National Gypsum Company](#); Gold Bond Brand Fire-Shield Shaftliner XP.
 - [USG Corporation](#); Sheetrock Brand Mold Tough Gypsum Liner Panel.
 - Thickness: **1 inch (25.4 mm)**.
 - Long Edges: Double bevel.
 - Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- F. Gypsum Board: As specified in Section 092900 "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

- A. Recycled Content of Steel: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
- Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, **G40 (Z120)** unless otherwise indicated.

- C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. [Fire Trak Corp.](#); Fire Trak System.
 - b. [Grace Construction Products](#); FlameSafe FlowTrak System.
 - c. [Metal-Lite, Inc.](#); The System.
 - d. [Steel Network Inc.](#) (The); VertiClip SLD or VertiTrack VTD Series.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.
- E. Sound Attenuation Blankets: As specified in Section 07 2100 "Building Insulation."
- F. Acoustical Sealant: As specified in Section 092900 "Gypsum Board."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 "Applied Fireproofing."
- B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
 - 2. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.033-inch (0.84-mm) minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

- I. Cant Panels: At projections into shaft exceeding 4 inches (102 mm), install 1/2- or 5/8-inch- (13- or 16-mm-) thick gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches (610 mm) o.c. with screws fastened to shaft wall framing.
 - 2. Where steel framing is required to support gypsum board cants, install framing at 24 inches (610 mm) o.c. and extend studs from the projection to shaft wall framing.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.4 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 2216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
 - 2. Section 072100 "Thermal Insulation" for insulation installed with z-shaped furring members.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For dimpled steel studs and runners and firestop tracks, from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Basis of Design: Clark/Dietrich Metal Framing; a Worthington Industries company.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.
- D. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
 - b. Depth: As indicated on Drawings.
 - 2. Dimpled Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.025 inch (0.64 mm).
 - b. Depth: As indicated on Drawings.
- E. Slip-Type Head Joints: Where indicated, provide the following:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
 - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) MBA Building Supplies; Slotted Deflecto Track.
 - 3) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
 - 4) Superior Metal Trim; Superior Flex Track System (SFT).

- F. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **Fire Trak Corp.;** Fire Trak System.
 - b. **Grace Construction Products;** FlameSafe FlowTrak System.
 - c. **Metal-Lite, Inc.;** The System.
- G. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: **0.033 inch (0.84 mm)**.
- H. Cold-Rolled Channel Bridging: Steel, **0.053-inch (1.34-mm)** minimum base-metal thickness, with minimum **1/2-inch- (13-mm-)** wide flanges.
1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than **1-1/2 by 1-1/2 inches (38 by 38 mm)**, **0.068-inch- (1.72-mm-)** thick, galvanized steel.
- I. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: **0.033 inch (0.84 mm)**.
 2. Depth: As indicated on Drawings.
- J. Resilient Furring Channels: **1/2-inch- (13-mm-)** deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
- K. Cold-Rolled Furring Channels: **0.053-inch (1.34-mm)** uncoated-steel thickness, with minimum **1/2-inch- (13-mm-)** wide flanges.
1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of **0.033 inch (0.8 mm)**.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.062-inch- (1.59-mm)** diameter wire, or double strand of **0.048-inch- (1.21-mm-)** diameter wire.
- L. Z-Shaped Furring: With slotted or nonslotted web, face flange of **1-1/4 inches (32 mm)**, wall attachment flange of **7/8 inch (22 mm)**, minimum uncoated-metal thickness of **0.018 inch (0.45 mm)**, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.062-inch- (1.59-mm-)** diameter wire, or double strand of **0.048-inch- (1.21-mm-)** diameter wire.
- B. Hanger Attachments to Concrete:
1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Cast-in-place anchor, designed for attachment to concrete forms.

- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Depth: As indicated on Drawings.
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
 - 2. Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
 - b. Depth: As indicated on Drawings.
 - 3. Dimpled Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.025 inch (0.64 mm).
 - b. Depth: As indicated on Drawings.
 - 4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
 - a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm)
 - 5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) 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 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than **24 inches (610 mm)** o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: **16 inches (406 mm)** o.c. unless otherwise indicated.
 - 2. Multilayer Application: **16 inches (406 mm)** o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: **16 inches (406 mm)** o.c. unless otherwise indicated.

- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) 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 penetrating 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 runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs **6 inches (150 mm)** o.c.
- E. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced **24 inches (610 mm)** o.c.
- F. Z-Furring Members:
1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced **24 inches (610 mm)** 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 (610 mm)** 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 (305 mm)** from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than **1/8 inch (3 mm)** from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: **48 inches (1219 mm)** o.c.
 - 2. Carrying Channels (Main Runners): **48 inches (1219 mm)** o.c.
 - 3. Furring Channels (Furring Members): **16 inches (406 mm)** o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Do not attach hangers to steel roof deck.
 - 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within **1/8 inch in 12 feet (3 mm in 3.6 m)** measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 09 2900

GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
 - 3. Product Data for Credit IEQ 4.1: For adhesives used to laminate gypsum board panels to substrates, documentation including printed statement of VOC content.
- C. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - 2. Apply or install final decoration indicated, including painting, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, 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, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
 - 1. Where Gypsum board is manufactured in Baltimore plant, local board will be required, and will be stamped with USG Baltimore code number 833.
- C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. CertainTeed Corp.
 - 2. Georgia-Pacific Gypsum LLC.
 - 3. Lafarge North America Inc.
 - 4. National Gypsum Company.
 - 5. USG Corporation.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
- C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered.
- E. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M, Level 1 and Level 2.
 - 1. Core: 5/8 inch (15.9 mm), Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- F. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch (15.9 mm), Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc or Paper-faced galvanized steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. **Fry Reglet Corp.**
 - b. **Gordon, Inc.**
 - c. **Pittcon Industries.**
 2. Aluminum: Alloy and temper with not less than the strength and durability properties of **ASTM B 221 (ASTM B 221M)**, Alloy 6063-T5.
 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
1. Interior Gypsum Board: Paper.
 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from **0.033 to 0.112 inch (0.84 to 2.84 mm)** thick.
- D. Sound Attenuation Blankets: ASTM C 665, 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.
 2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **Accumetric LLC; BOSS 824 Acoustical Sound Sealant.**
 - b. **Grabber Construction Products; Acoustical Sealant GSC.**
 - c. **Pecora Corporation; AC-20 FTR or AIS-919.**
 - d. **Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.**
 - e. **USG Corporation; SHEETROCK Acoustical Sealant.**
 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- 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 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- 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 (1.5 mm)** 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. (0.7 sq. m)** 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- (6.4- to 9.5-mm-)** wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide **1/4- to 1/2-inch- (6.4- to 12.7-mm-)** 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. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical surfaces unless otherwise indicated.
 - 2. Flexible Type: Apply in double layer at curved assemblies.
 - 3. Ceiling Type: Ceiling surfaces.
 - 4. Abuse-Resistant Type:
 - a. Level 1 board at all walls up to 4'0" AFF
 - b. Level 2 board at corridors, Public areas, lobbies, classrooms and Sensory Motor room..
 - 5. Moisture- and Mold-Resistant Type: in all bath and toilet rooms, horticulture classroom and greenhouse.

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 vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-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 (400 mm)** 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-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 recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus **12-inch- (300-mm-)** long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws **16 inches (400 mm)** o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced **12 inches (300 mm)** o.c.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. Bullnose Bead: Use where indicated.
 - 3. LC-Bead: Use at exposed panel edges.
 - 4. L-Bead: Use where indicated.
 - 5. U-Bead: Use where indicated.
 - 6. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 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: At abuse resistant board and where indicated on Drawings.
 - a. SHEETROCK Brand *Tuff-Hide* spray applied primer/skim coat: At all locations where abuse resistant board is used and where indicated.
 - 4. Where Level 5 gypsum board finish is indicated, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories; and apply a thin, uniform skim coat of joint compound over entire surface. For skim coat, use joint compound specified for third coat, or a product specially formulated for this purpose and acceptable to gypsum board manufacturer. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects, tool marks, and ridges and ready for decoration.
 - 5. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
 - 6. For Level 1 gypsum board finish, embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.

3.6 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
 - 1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 5113

ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of **6-inch-** (150-mm-) square samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of **6-inch-** (150-mm-) long Samples of each type, finish, and color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Size and location of initial access modules for acoustical panels.
 - 4. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.

- e. Access panels.
- 5. Perimeter moldings.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in 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. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
- 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

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

- 1. Build mockup of typical ceiling area as indicated by Architect.
- 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 50 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; 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.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is **15-3/4 inches (400 mm)** away from test surface according to ASTM E 795.
- E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.3 ACOUSTICAL PANELS – APC 1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following:
 - 1. [Armstrong World Industries, Inc.](#) Cortega
 - 2. [CertainTeed Corp.](#)
 - 3. [USG Interiors, Inc.; Subsidiary of USG Corporation.](#)

- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
 - 2. Pattern: CD (perforated, small holes and fissured)
- C. Color: White
- D. LR: Not less than 0.82.
- E. NRC: Not less than 0.55.
- F. CAC: Not less than 35.
- G. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension system members.
- H. Thickness: 5/8 inch (15 mm)
- I. Modular Size: 24 by 24 inches (610 by 610 mm)

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
- B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than **0.106-inch- (2.69-mm-)** diameter wire.
- E. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Angle Hangers: Angles with legs not less than **7/8 inch (22 mm)** wide; formed with **0.04-inch- (1-mm-)** thick, galvanized-steel sheet complying with ASTM A 653/A 653M, **G90 (Z275)** coating designation; with bolted connections and **5/16-inch- (8-mm-)** diameter bolts.
- G. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced **24 inches (610 mm)** o.c. on all cross tees.

2.5 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. **Armstrong World Industries, Inc.**
 2. **CertainTeed Corp.**
 3. **USG Interiors, Inc.; Subsidiary of USG Corporation.**
- B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than **G30 (Z90)** coating designation; with prefinished **9/16-inch- (15-mm-)** wide metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 3. Face Design: Flat, flush.
 4. Cap Material: Steel cold-rolled sheet.
 5. Cap Finish: Painted in color as selected from manufacturer's full range.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. **Armstrong World Industries, Inc.**
 2. **CertainTeed Corp.**
 3. **Fry Reglet Corporation.**
 4. **Gordon, Inc.**
 5. **USG Interiors, Inc.; Subsidiary of USG Corporation.**
- B. Extruded Aluminum Trim: Extruded aluminum alloy 6063 trim channel, 2" high Axiom Classic with $\frac{3}{4}$ inch horizontal legs, with special bosses formed for attachment to the Axiom tee-bar connection clip, color white: and Drywall bottom trim used to finish edges of 5/8 inch drywall that is applied to the bottom surface of Axiom.
- C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, provide one of the following:

1. **Acoustical Sealant for Exposed and Concealed Joints:**
 - a. **Pecora Corporation**; AC-20 FTR Acoustical and Insulation Sealant.
 - b. **USG Corporation**; SHEETROCK Acoustical Sealant.
 2. **Acoustical Sealant for Concealed Joints:**
 - a. **Henkel Corporation**; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - b. **Pecora Corporation**; AIS-919.
 - c. **Tremco, Inc.**; Tremco Acoustical Sealant.
- B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
 3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than **48 inches (1200 mm)** o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than **8 inches (200 mm)** from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than **16 inches (400 mm)** o.c. and not more than **3 inches (75 mm)** from ends, leveling with ceiling suspension system to a tolerance of **1/8 inch in 12 feet (3.2 mm in 3.6 m)**. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 6513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient stair accessories.
 - 3. Resilient molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than **12 inches (300 mm)** long, of each resilient product color, texture, and pattern required.
- E. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than **10 linear feet (3 linear m)** for every **500 linear feet (150 linear m)** or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

- B. Mockups: Provide resilient products with mockups specified in other Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.7 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
 1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Linoleum shall comply with requirements of FloorScore Standard.
- B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 RESILIENT BASE

- A. Resilient Base:
 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide the product indicated by Johnsonite 100, or comparable product by one of the following:
 - a. **Armstrong World Industries, Inc.**
 - b. **Burke Mercer Flooring Products; Division of Burke Industries, Inc.**
 - c. **Flexco, Inc.**
 - d. **Roppe Corporation, USA.**
- B. Resilient Base Standard: ASTM F 1861.
 1. Material Requirement Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
 2. Manufacturing Method: Group I (solid, homogeneous) or Group II (layered).

3. Style: Cove (base with toe).
- C. Minimum Thickness: 0.125 inch (3.2 mm).
- D. Height: 4 inches (102 mm) unless otherwise indicated.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Finish: As selected by Architect from manufacturer's full range.
- I. Colors and Patterns: High Black RWB1.

2.3 RESILIENT STAIR ACCESSORIES

- A. Resilient Stair Treads:
 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide the product indicated by Johnsonite, or comparable product by one of the following:
 - a. **Burke Mercer Flooring Products; Division of Burke Industries, Inc.**
 - b. **Flexco, Inc.**
 - c. **Roppe Corporation, USA.**
- B. Resilient Stair Treads Standard: ASTM F 2169.
 1. Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
 2. Surface Design:
 - a. Class 2, Pattern: Raised-disc design.
 3. Manufacturing Method: tread with embedded, contrasting, abrasive strips.
 4. Thickness: 1/4 inch (6 mm) and tapered to back edge.
 5. Size: Lengths and depths to fit each stair tread in one piece.
 6. Integral Risers: Smooth, flat; in height that fully covers substrate.
 7. Provide different color tread at top and bottom treads.
- C. Thickness: 1/4 inch (6 mm) and tapered to back edge.
- D. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.
- E. Risers: Smooth, flat, toeless, height and length to cover risers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
 1. Thickness: 0.125 inch (3.2 mm).
- F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 RESILIENT MOLDING ACCESSORY

- A. Resilient Molding Accessory:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. **Burke Mercer Flooring Products; Division of Burke Industries, Inc.**
 - b. **Flexco, Inc.**
 - c. **Johnsonite.**
 - d. **Roppe Corporation, USA.**
- B. **Description:**
 1. Carpet edge for glue-down applications
 2. Nosing for carpet
 3. Reducer strip for resilient floor covering
 4. Joiner for tile and carpet
 5. Transition strips
- C. **Material:** Rubber.
- D. **Profile and Dimensions:** As indicated.
- E. **Colors and Patterns:** As selected by Architect from full range of industry colors.

2.5 INSTALLATION MATERIALS

- A. **Concrete Slab Primer:** Non-staining type as recommended by flooring manufacturer.
- B. **Trowelable Leveling and Patching Compounds:** Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- C. **Adhesives:** Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.
- D. **Stair-Tread-Nose Filler:** Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.
- E. **Metal Edge Strips:** Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

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.

- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
 - 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 manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
 - 4. Moisture Testing: Perform tests recommended by manufacturer[**and as follows**]. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of **3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)** in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners: Follow Manufacturer's recommendations when job-forming corners.
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - 2. Tightly adhere to substrates throughout length of each piece.
 - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.
- D. Place resilient accessories at centerline of door openings (underneath closed door).

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products until Substantial Completion.

END OF SECTION

SECTION 09 9113

EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Galvanized metal.
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, **8 inches (200 mm)** square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 3. VOC content.

1.5 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. Paint: 5 percent, but not less than **1 gal. (3.8 L)** 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. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least **100 sq. ft. (9 sq. m)**.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 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 (7 deg C)**.
 - 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** (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than **5 deg F** (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. [Benjamin Moore & Co.](#)
 - 2. [Columbia Paint & Coatings.](#)
 - 3. [M.A.B. Paints.](#)
 - 4. [PPG Architectural Finishes, Inc.](#)
 - 5. [Sherwin-Williams Company \(The\).](#)
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: as scheduled on drawings.

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.4 METAL PRIMERS

- A. Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.

- B. Primer, Epoxy, Anti-Corrosive, for Metal: MPI #101.

2.5 WATER-BASED PAINTS

- A. Latex, Exterior Flat (Gloss Level 3-4): MPI #15.
- B. Latex, Exterior Semi-Gloss (Gloss Level 5): MPI #11.
- C. Latex, Exterior, Gloss (Gloss Level 6): MPI #119.

2.6 SOLVENT-BASED PAINTS

- A. Alkyd, Exterior, Semi-Gloss (Gloss Level 5): MPI #94.

2.7 EPOXY COATINGS

- A. Epoxy, Gloss: MPI #77.

2.8 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.

- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 3, "Power Tool Cleaning."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

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

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex System:
 - a. Prime Coat: Latex, exterior, matching topcoat.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.
 - d. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.
 - e. Topcoat: Latex, exterior gloss (Gloss Level 6), MPI #119.
- B. CMU Substrates:
 - 1. Latex System:
 - a. Prime Coat: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.
 - d. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.
 - e. Topcoat: Latex, exterior gloss (Gloss Level 6), MPI #119.
- C. Galvanized-Metal Substrates:
 - 1. Alkyd System:
 - a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.
 - 2. Epoxy System:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, gloss, MPI #77.
 - c. Topcoat: Epoxy, gloss, MPI #77.

END OF SECTION

SECTION 09 9123

INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

- B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
 3. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 2. Step coats on Samples 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: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 3. VOC content.

1.5 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. Paint: 5 percent, but not less than 1 gal. (3.8 L) 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. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 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 (7 deg C)**.
 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 (10 and 35 deg C)**.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than **5 deg F (3 deg C)** above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 1. **Benjamin Moore & Co.**
 2. **Columbia Paint & Coatings.**
 3. **ICI Paints.**
 4. **M.A.B. Paints.**
 5. **McCormick Paints.**
 6. **PPG Architectural Finishes, Inc.**
 7. **Sherwin-Williams Company (The).**

2.2 PAINT, GENERAL

- A. **MPI Standards:** Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. **Material Compatibility:**
 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. **VOC Content:** Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of

colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Colors:

1. PT-1 Paint – Benjamin Moore – Oxford White – 869
2. PT-2 Paint – Benjamin Moore – Athena – 858
3. PT-3 Paint – Benjamin Moore – Mountain Mist – 868
4. PT-4 Paint – Epoxy – Benjamin Moore – Englewood Cliffs – 1607

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.4 PRIMERS/SEALERS

- A. Primer Sealer, Latex, Interior: MPI #50.
- B. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.
- C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS

- A. Primer, Rust-Inhibitive, Water Based: MPI #107.

2.6 WATER-BASED PAINTS

- A. Latex, Interior, Institutional Low Odor/VOC, Flat (Gloss Level 1): MPI #143.
- B. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 2): MPI #144.
- C. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 3): MPI #145.
- D. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5): MPI #147.

2.7 FLOOR COATINGS

- A. Sealer, Water Based, for Concrete Floors: MPI #99.

2.8 EPOXY COATINGS

- A. Epoxy, Cold-Cured, Gloss: MPI #77

2.9 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Wood: 15 percent.
 4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- 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 equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply

additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Institutional Low-Odor/VOC Latex System:
 - 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, flat (Gloss Level 1), MPI #143.
 - d. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.
 - e. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.
 - f. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), MPI #147.
- B. Concrete Substrates, Traffic Surfaces:
 - 1. Water-Based Clear Sealer System:
 - a. First Coat: Sealer, water based, for concrete floors, MPI #99.
 - b. Topcoat: Sealer, water based, for concrete floors, MPI #99.
- C. CMU Substrates:
 - 1. Institutional Low-Odor/VOC Latex System:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1), MPI #143.
 - d. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.
 - e. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.
 - f. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), MPI #147.
- D. Steel Substrates:
 - 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer, rust-inhibitive, water based MPI #107.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1), MPI #143.

- d. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.
 - e. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.
 - f. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), MPI #147.
- E. Gypsum Board Substrates:
- 1. Institutional Low-Odor/VOC Latex System:
 - 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, flat (Gloss Level 1), MPI #143.
 - d. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.
 - e. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.
 - f. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5), MPI #147.

END OF SECTION

SECTION 10 1423

PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. This section specifies interior plastic photopolymer signage on metal base for room numbers, directional signs, code required signs, telephone identification signs and temporary interior signs.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
 - 2. Cast-Acrylic sheet.
 - 3. Tackable Surface
 - 4. Stainless Steel Edge
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Cast-Acrylic Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
 - 2. Panel Signs: Full-size Sample including edge.

3. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
4. Exposed Accessories: Full-size Sample of each accessory type.

- E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator. Sign manufacturer shall provide evidence that they regularly and presently manufacturer signs similar to those specified in this section as one of their principal products.
- B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Fabricator Qualifications: Shop that 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.
- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify recess openings and glass side lite dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 DELIVERY AND STORAGE

- A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.
- B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.

- C. Deliver signs only when the site and mounting services are ready for installation work to proceed.
- D. Store products in dry condition inside enclosed facilities.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 SIGNS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. [Allen Markings International](#).
 - 2. [ASI Sign Systems, Inc.](#)
 - 3. [Best Sign Systems Inc.](#)
 - 4. [Mohawk Sign Systems](#).
 - 5. [Nelson-Harkins Industries](#).
- B. Interior Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Acrylic Sheet: 0.060 inch (1.52 mm) thick.
 - 2. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: Square cut.
 - b. Corner Condition in Elevation: Square.
 - 3. Mounting: As indicated.
 - a. Wall mounted with concealed anchors or two-face tape.
 - b. Manufacturer's standard anchors for substrates encountered.
 - 4. Color: As selected by Architect from manufacturer's full range.
 - 5. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.

6. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus **1/16 inch (1.5 mm)** measured diagonally from corner to corner.
- C. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory paint brackets in color matching Architect's sample.
- D. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
 1. Panel Material: Opaque acrylic sheet.
 2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).
- E. Acrylic-modified P.E.T.G. with photopolymer laminate, computer-generated copy and graphics are photo-exposed to photopolymer and factory processed to create raised copy and grade 2 braille message, integral with sign background. Pictograms and other artwork to be processed photopolymer raised image.

2.3 PANEL-SIGN MATERIALS

- A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
- B. Modified Acrylic (P.E.T.G.), matte clear with photopolymer laminate sheets: Provide light-sensitive, water-wash photopolymer face layer bonded to P.E.T.G. base layer to produce a composite sheet with overall thickness of (1/8 inch, 1/16 or 1/4 inch).
- C. Raised copy, graphic symbols and braille to be integral with sign background. Glued-on or milled braille is unacceptable.
- D. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:
 1. Edge condition: Square cut
- E. Stainless Steel Edge for framed signs:
 1. Color: To match color of Valance
 2. Width: 1/4" wide
 3. Finish: #4, brushed directional or satin finish
 4. Edge condition: Square cut
- F. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Exposed Metal-Fastener Components, General:

- a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
 4. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
 5. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.
- B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 5. Internally brace signs for stability and for securing fasteners.
 6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:
1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Furnish two blank inserts for each sign for Owner's use.
 2. For frame to hold changeable sign panel, fabricate frame without burrs or constrictions that inhibit function. Furnish initial sign panel..

2.6 GENERAL FINISH REQUIREMENTS

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

- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 2. Directional Satin Finish: No. 4.

2.8 ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic P.E.T.G. Sheet: For copy and background colors, provide Pantone Matching System (PMS) colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.
- B. For photopolymer raised-copy, provide manufacturer's standard hot-stamp foil colors in full range available.

2.9 SIGN STANDARDS

- A. Topography: Provide sign copy that complies with requirements indicated below and in the sign schedule and drawings for size, style, spacing, content, mounting height and location, material, finishes and colors of signage
 - 1. Type Style: Rotis Raised Color TBD.
 - 2. Arrow: See graphic standards in drawings.
 - 3. Letter spacing: See graphic standards on drawings.
 - 4. All text, arrows, and symbols to be provided in size, colors, typefaces and letter spacing shown. Text shall be a true, clean, accurate reproduction of typeface(s) shown. Text shown in drawings are for layout purposes only; final text for signs is listed in Sign

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 signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard.
 - 1. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable.
 - 2. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
- C. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 - 2. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
 - 3. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
 - 4. Where signs are scheduled or indicated to be mounted on glass, provide matching acrylic back plate at reverse-side of glass to conceal mounting materials.
- D. Bracket-Mounted Signs: Provide manufacturer's standard brackets, fittings, and hardware for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 10 2800

TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Private-use bathroom accessories.
 - 2. Underlavatory guards.
 - 3. Custodial accessories.
 - 4. Custom Mop Basin
- B. Related Sections:
 - 1. Section 06 4116 "Plastic-Laminate-Faced Architectural Cabinets" for TA-J info.
 - 2. Section 093000 "Tiling" for ceramic toilet and bath accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Shop Drawings: Provide drawings of custom mop basin, including details at corners and drain outlet connection.
- C. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- D. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, **0.05-inch (1.27-mm)** minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), **0.036-inch (0.9-mm)** minimum nominal thickness.
- C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- D. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- E. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- F. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PRIVATE-USE BATHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. [Bobrick Washroom Equipment, Inc.](#)
 2. [GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.](#)
 3. [Tubular Specialties Manufacturing, Inc.](#)
- B. Toilet Tissue Dispenser TA-E:
1. Description: Single-roll dispenser.
 2. Mounting: Surface mounted.
 3. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
 4. Material and Finish: Stainless steel, No. 4 finish (satin).
- C. Combination Towel (Folded) Dispenser/Waste Receptacle TA-C:
1. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
 2. Mounting: Semi-recessed.
 3. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
 4. Minimum Waste-Receptacle Capacity: 4 gal. (15 L).
 5. Material and Finish: Stainless steel, No. 4 finish (satin).
- D. Liquid-Soap Dispenser TA-B:
1. Description: Designed for dispensing soap in liquid or lotion form.
 2. Mounting: Vertically oriented, surface mounted.
 3. Refill Indicator: Window type.
- E. Grab Bar TA-H:
1. Mounting: Flanges with concealed fasteners.
 2. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 3. Outside Diameter: 1-1/2 inches (38 mm).
 4. Configuration and Length:
 - a. ADA Stall & Family Toilet Rooms: Provide rear grab bar, 36 inches min. in length extending from the wall toward the open side of the water closet at back wall; side grab bar 40- 42 inches in length beginning 12 inch max. from rear wall. All grab bars shall be between 33 to 36 inches above the finished floor.
- F. Vendor TA-G:
1. Type: Sanitary napkin and tampon.
 2. Mounting: Semirecessed.
 3. Operation: Single coin (25 cents).
 4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
 5. Lockset: Tumbler type with separate lock and key for coin box.
- G. Sanitary-Napkin Disposal Unit TA-F:
1. Mounting: Surface mounted.
 2. Door or Cover: Self-closing, disposal-opening cover.
 3. Receptacle: Removable.
 4. Material and Finish: Stainless steel, No. 4 finish (satin).
- H. Seat-Cover Dispenser TA-I:

1. Mounting: Surface mounted.
2. Minimum Capacity: 250 seat covers.
3. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).

I. Mirror Unit TA-A:

1. Frame: Stainless-steel channel.
 - a. Corners: Manufacturer's standard.
2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
3. Size: As indicated on Drawings.

2.3 UNDERLAVATORY GUARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. [Plumberex Specialty Products, Inc.](#)
 2. [Truebro by IPS Corporation.](#)
- B. Underlavatory Guard:
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
 2. Material and Finish: Antimicrobial, molded plastic, white.

2.4 CUSTODIAL ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. [Bobrick Washroom Equipment, Inc.](#)
 2. [GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.](#)
 3. [Tubular Specialties Manufacturing, Inc.](#)
- B. Mop and Broom Holder TA-D:
1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 2. Length: **36 inches** (914 mm).
 3. Hooks: Three.
 4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
 5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal **0.05-inch-** (1.3-mm-) thick stainless steel.
 - b. Rod: Approximately **1/4-inch-** (6-mm-) diameter stainless steel.
- C. Custom Mop Basin
1. Material: Stainless Steel
 2. Size: as indicated
 3. Drain location: provide off center drain, coordinate in field.

2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.
- C. Custom Mop Basis: mechanically anchor basin to drain pipe and adjacent wall surfaces. Seal perimeter upon completion.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 10 4413

FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches (150 by 150 mm) square.
- F. Product Schedule: For fire-protection cabinets. Indicate whether recessed or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Products provided by alternate funding source.
- B. Cabinet Type: Suitable for fire extinguisher.
 - 1. **Products:** Subject to compliance with requirements, provide Larsen's model #SS-2409 or comparable product by one of the following:
 - a. [JL Industries, Inc.; a division of the Activar Construction Products Group.](#)
 - b. [Potter Roemer LLC.](#)
- C. Cabinet Construction: UL listed with fire resistance rating of wall where it is installed.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from **0.043-inch- (1.09-mm-)** thick cold-rolled steel sheet lined with minimum **5/8-inch- (16-mm-)** thick fire-barrier material. Provide factory-drilled mounting holes.
- D. Cabinet Material: Stainless-steel sheet.
- E. Shelf: Same metal and finish as cabinet.
- F. Recessed Cabinet:
 - 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backend).
- G. Cabinet Trim Material: Stainless-steel sheet.
- H. Door Material: Stainless-steel sheet.
- I. Door Style
 - 1. Basis of Design: Larsen Door vertical duo clear.
- J. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.

- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide projecting lever handle with cam-action latch.
 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- L. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 3. Door Lock: Cylinder lock, keyed alike to other cabinets.
 4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Etched.
 - 3) Orientation: Vertical.
 5. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries.
- M. Materials:
1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.
 2. Stainless Steel: ASTM A 666, Type 304.
 - a. Finish: No. 4 directional satin finish.
 3. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum **1/2 inch (13 mm)** thick.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated, to comply with requirements of authorities having jurisdiction.
 - 1. Mounting Height: Install fire extinguisher cabinets at the height required so that the top of the fire extinguisher is not more than 54 inches above the floor.
 - 2. Fire extinguisher cabinets shall protrude no more than 4 inches into corridors, passageways, or aisles.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
 - 2. Fire-Rated Cabinets:
 - a. Install cabinet with not more than **1/16-inch (1.6-mm)** tolerance between pipe OD and knockout OD. Center pipe within knockout.
 - b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."
- C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 4416
FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 10 4413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Stored-Pressure Water-Mist Type: UL-rated 2-A:C, 2.5-gal. (9.5-L) nominal capacity, with water in enameled-steel container; with pressure-indicating gage.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. [Amerex Corporation](#).
 - b. [JL Industries, Inc.; a division of the Activar Construction Products Group](#).
 - c. [Larsens Manufacturing Company](#).
 - d. [Potter Roemer LLC](#).
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Horizontal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 10 5626

MOBILE STORAGE SHELVING

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. This Section includes supply, delivery, engineering and installation of new collection storage equipment and high density mobile storage systems (except rails).
 - 2. Due to coordination requirements, etc., bidder must identify mobile system manufacturer and shelving manufacturer with proposal and provide proof of specification compliance for all mobile system components as detailed in section 2.01A through 2.01H. of the enclosed specification.
- B. Products Furnished But Not Installed Under This Section:
 - 1. Inserts in cast-in-place concrete.

1.3 COORDINATION

- A. Recessed Tracks: Coordinate size and location of recesses and inserts in concrete with installation of recessed tracks.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include mobile operation, construction details, material descriptions, dimensions of individual components and profiles, and finishes for mobile storage shelving systems and accessories.
- B. Shop Drawings: Prepared for construction details, material, description, dimensions, profiles and installation of storage equipment as well as procedures and diagrams. Include details of layout and installation including clearances, spacings and relation to adjacent construction in plan, elevation, and section; clear exit and access aisle widths; access to concealed components; components, assemblies, connections, attachments, reinforcement, and anchorage. Submit drawings showing location, ranges and extent of system. Show installation details at nonstandard conditions. Furnish floor layouts, technical and installation manuals for every unit shipment with necessary dimensions for rail layout and system configuration at the project site.
 - 1. Provide layout, dimensions, and identification of each unit corresponding to sequence of installation and erection procedures. Specifically include the following:

- a. Location, position and configuration of cases on all floors.
 - b. Details indicating method and configuration of installation on floor.
 2. Provide location and details of anchorage devices to be embedded in or fastened together construction. Furnish templates if required for accurate placement.
 3. Certified Structural Engineering Calculations: Installer shall retain an independent licensed structural engineer to certify mobile storage units and all shelving are structurally compliant. Engineer to provide full structural calculations for overturning, system structure and anchorage based on specified rated load and local seismic zones. The engineer must be licensed in the state of Maryland. Calculations will be submitted with shop drawing due after award. Engineer must certify, with the bid, the ability of manufacturer's system to meet the above criteria.
- C. Samples: For each exposed product and for each color and texture specified, 6 inches (152 mm) in size.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Warranty: Submit a written warranty, executed by Contractor, Installer, and Manufacturer, agreeing to repair or replace units, which fail in materials or workmanship within the specified warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under Contract Documents.
- C. Project Schedule: Provide a project achievement plan detailing all critical elements necessary to plan, manufacture, ship and install cases.
- D. Reference List: Provide a list of 10 installed systems of same size, scope and magnitude to be visited or called by owner or architect. Reference list must include system address, contact and phone number. A minimum of two must be specific to collection storage.
- E. Interchangeability: Successful manufacturer must provide a written certification that internal components must be interchangeable with the Smithsonian's existing casework components products specified in this section.
- F. Prototypes: The museum storage cabinet manufacturer awarded the contract must provide a prototype cabinet complete with interior components. It is mandatory that the chosen manufacturer submit samples that are compatible and interchangeable with the Smithsonian's existing casework. The sample must be received, evaluated and tested by the Smithsonian Institution. The Smithsonian Institution will provide written acceptance to the manufacturer before the manufacturer produces any product.
- G. Provide insurance certificate verifying amounts as set forth by the Smithsonian Institute.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mobile shelving systems and operating manuals to include in maintenance manuals.

1.8 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. Shelf Units: 10 of each size and type indicated.
 - 2. Accessories: Bins, labels, book ends.

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating mobile storage shelving that meets or exceeds performance requirements indicated and of documenting this performance by test reports, and calculations.
- B. Installer Qualifications: Engage an experienced installation supervisor who is an authorized and certified representative (employee) of the case unit manufacturer required for this Project with not less than 10 years experience installing systems similar to those required for this project, and licensed or certified by manufacturer. Certification required by manufacturer on manufacturer's letterhead at time of bid. Certifications by sales reps, dealers or distributors are unacceptable. Qualification must include resume of certified installation supervisor.
- C. Manufacturers Certification: Separate written certifications by manufacturers on manufacturer's letterhead at time of bid required stating compliance with all specifications.
- D. Other mandatory requirements: Must submit proof with proposal.
 - 1. Manufacturers must have a minimum of 25-years experience in the continuous manufacture of mobile systems. Manufacturer certification required with bid.
 - 2. Bidder must be ISO 9001 certified for a minimum of 3 years. Certification from ISO required with proposal. If not ISO 9001 certified, submit manufacturers established complete quality control/assurance plan.
 - 3. Bidder must have had all major system elements, finishes, lubricants, etc. chemically analyzed and tested for emissions, volatiles, etc. System shall be inert. Must supply test results from independent test lab with bid.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings". Review methods and procedures related to mobile storage units including, but not limited to, the following:
 - 1. Inspect and discuss condition and levelness of flooring and other preparatory work performed under other contracts.
 - 2. Review structural loading limitations.
 - 3. In addition to the Contractor and the installer, arrange for attendance of the following:
 - a. Other installers affected by the work of this section.
 - b. COTR
 - c. The Architect.
 - d. Manufacturer's representative.

1.10 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of support rail anchors, depressed slab, embedded conduit, and other construction contiguous with mobile storage shelving by field measurements before fabrication.

- B. Sequence and Scheduling: Sequence storage shelving system installation with other work to minimize possibility of damage and soiling during remainder of construction period.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of mobile shelving systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metals, metal finishes, and other materials beyond normal wear.
 - 2. Warranty Period: Five years from date of Substantial Completion.
 - a. The entire installation will be warranted against defects in material for 5 years and workmanship for a period of 5 years from date of acceptance by the Owner. Labor is included at no cost during the first year of the 5-year warranty period. After the first year, all labor will be charged at the prevailing current rate.
 - b. Provide lifetime warrant for all structural beam elements of mobile and shelving system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain mobile storage systems including shelving from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Mobile shelving systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Structural Performance: Provide mobile shelving systems capable of supporting the following:
 - 1. Load per Linear Foot of Carriage: 1000 lb/ft. (1488 kg/m).

2.3 SYSTEMS AND COMPONENTS

- A. General: Provide manufacturer's standard mobile storage shelving systems and components. Where components are not otherwise indicated, provide manufacturer's standard components as required for a complete system.
- B. Inserts: Furnish required concrete inserts and similar anchorage devices for installing track system, and furnish other components of work where installation of devices is specified in another Section.

2.4 MATERIALS - MOBILE STORAGE SYSTEMS

- A. Basis of Design: Products are based upon Mechanically Operated Movable Shelving Systems by Spacesaver Corp. Provide only products complying with all specifications and requirements of the contract documents specifications. Due to the delicate nature of the collection, all specifications are mandatory.
- B. Rail/ Track
 - 1. Rail shall be one piece cold drawn structural "T" section, 1035 steel extrusion 1-1/16" (27mm) high with a 2-1/8" (54mm) base flange, a 5/8" (16 mm) top surface and two anti-tip grooves. Rail shall disperse the wheel point load to a minimum 4 ¼ square inch (27.5

- cm) area at the base of the rail. All rail joints to be tongue and groove or overlapped and bolted. Rail shall have two leveling screws and two permanently mounted floor anchors maximum 36" (914mm) o.c. All rail assemblies shall be fully grouted with a non-shrink hydraulic cement type grout with an 8,000 lb. p.s.i. (562 kg/cm) strength after curing. Shimmed rails and/or butt joint rails are unacceptable.
2. Rail shall be located and positioned properly, leveled and grouted, allowing at least 1/4 inch for grout under high point. Grout to be worked under rail, any voids completely filled and trimmed up sides flush with rails. This will allow proper weight distribution from rail to subfloor.
 3. Levelness of Rails: 3/32-inch maximum variation from true level within any module; 1/16-inch maximum variation between adjacent rails, perpendicular to rail direction; 1/32-inch maximum variation in 10 feet of rail length, along any rail.
 4. Rails to be rechecked for integrity of position and levelness and anchored into structural concrete slab, using anchors in sizes and quantities as determined by manufacturer.
 5. Concrete back pour by others. All rails will be recessed into topping slab being provided for by the building contractor. Rails shall be equipped with removable concrete screed covers to facilitate and protect the rail during back pour.
 6. In rail anti-tips must be provided on a minimum of three rail assemblies.
- C. Carriages
1. Carriages shall be minimum 1,000 lbs. (1500 kg) per linear carriage foot (meter) capacity, fixture unit welded (preferred), uniframe assemblies constructed of minimum 12-gauge steel with main supporting structural face section 5-3/4" (146 mm) high with two reinforcing flanges running the full length of the carriage. Main supporting structural face sections shall provide a 3/4" (19 mm) minimum shelf mounting recess for positive shelving alignment and attachment. Wheel support section shall be minimum 12 ga. steel and shall be welded between the main support face sections, one per rail assembly. Carriage face sections shall provide a smooth clean appearance without any exposed assembly holes or protruding hardware. Carriage shall be powder coat painted from manufacturer's standard colors. Stationary platforms as shown on the drawing, shall be of the same construction and height as the moveable carriages, and shall be anchored to the rails/floor. Top mount carriages and/or riveted only carriages are unacceptable.
 2. Bumper location to be determined by manufacturer. Bumper design and profile should be rounded to minimize abrupt protrusion into the aisle. Bumper must leave a min. of 4" space between units.
- D. Carriage and Platform Splice: All carriage splices shall be tongue and groove, offset angle, tension bolted type, designed to maintain proper unit alignment and weight load distribution.
- E. Synchronized Drive System: Due to length, height and weight of carriages, and delicate nature of collection with unbalanced loading conditions, only carriages of the following drive will be acceptable to maintain proper carriage movement free of whipping, vibration and binding. (Freewheeling of carriages is unacceptable.)
1. Dual synchronized drive wheels on both sides of wheel housing(s), minimum two, to be 5" (127 mm) diameter and connected with a #40 roller chain to ensure even wheel movement. Multiple Synchro System assemblies shall be interconnected with a continuous 1" (25 mm) diameter steel minimum drive shaft for simultaneous wheel rotation and even, parallel carriage movement. All wheels to be machined from solid 1045 steel and equipped with two (2) permanently shielded bearing assemblies. Spacers to be provided on both sides of wheel bearings to eliminate friction between wheels and carriage. Or provide 1" (25 mm) diameter steel, tubular or solid steel, drive shafts driving all wheels on both sides of carriage for balanced drive.

- F. Guidance System: A minimum of 2 guide wheels per carriage are mandatory. Vendors to choose from center flange, dual flange, or roller guide bearing guidance.
- G. Steel Face Panels
1. All exposed ends (refer to drawings) shall have steel panels for mounting of Mechanical Assist operator. Panels shall be constructed of 18 gauge steel. Panels shall be free of any exposed assembly holes or protruding hardware, and shall be assembled without any exposed sharp edges. Panels shall be powder coat painted from manufacturer's standard colors. Two 3" x 5" (78 mm x 127 mm) cardholders shall be provided per aisle entry location.
 2. Panels are required to cover the entire height of the shelving unit (depth and height) as well as carriage face. Size panel depth to cover shelving/carriage depth, not including bumper extensions.
- H. System Control and Operational Requirements
1. Mechanical Assist System: The system shall be of the mechanical assist type having a chain sprocket drive system. A driving system is required to provide uniform movement along the total length of the carriage even with unbalanced loads on the carriage. The system shall have a positive drive to ensure that there is no play in the drive handle and that the carriage will stop without drifting. All components of the system shall be compatible for smooth even movement along the total length of the carriage. All components of the system shall be compatible for smooth, nonjerking, even movement along the total length of the carriage. Drive system shall have a minimum gear ratio of 1 lb. of force to 8,000 lbs. of load. All bearings used in the drive mechanism shall be permanently shielded and lubricated.
 - a. Controls shall be located on only one end of ranges as noted on drawings.
 - b. An adjustable chain tensioner shall be provided to allow chain tension adjustment without removing face panels.
 - c. Operating handles shall be three spoke type with steel spokes, approximately 17" (432 mm) diameter, which transmits power through a chain drive to the drive wheels. Handle shall be equipped with a safety locking pin, manually engaged to protect patrons in aisle. Color coding of pin is preferred for visual indicator to users.
- I. Load Bearing Requirements
1. Deflection ratio: The floors are designed to a deflection ratio of L/550, when fully loaded. The mobile equipment shall be designed to operate safely with that level of deflection. The system shall be engineered to prevent unintended movement or "drift" of ranges due to deflection of the floor.
 2. Clutch Brake (Optional): Where necessary due to deflection tolerances, each moveable carriage shall be equipped with an adjustable, mechanical positioning clutch brake that applies tension to the drive shaft to control carriage drift.

2.5 SHELVING SYSTEMS

- A. Four Post Shelving:
1. Basis of Design Spacesaver Four Post shelving
 2. Design: Wedge-lock type consisting of uprights, shelves, and shelf supports, designed to be assembled without fasteners or clips. Shelves shall not have any holes on exposed surfaces. Front and back flanges shall be flush with outside faces of posts. Design shall permit individual shelf adjustment and/or removal anywhere along the entire height of uprights.

3. Materials and Workmanship: Fabricate units from Class 1, cold-rolled steel sheet with all bends sharp and true and no exposed "knife" edges.
4. Shelves: Shelves shall be 9/16" in height and be formed of 18 ga. cold rolled steel with flanges on all four sides. Front and rear flanges shall also be turned "down" and "in". Shelves to be adjustable on 1 1/2" (38 mm) centers vertically. Shelves to be supported front and back by two shelf supports of 11 ga. min. hot rolled steel. Height of shelf (including supports) shall be 1-1/8". Canopy tops shall be supplied on all shelving sections and must be perforated to 40%. All shelves and canopy tops must be 40% perforated.
5. Uprights: Formed from steel sheet to a hollow "tee" shape for intermediate supports and formed angles for end supports. Uprights shall have keyhole slots on inner wall only. Provide with sheet steel panels full height and depth of end uprights. Provide intermediate "tee" uprights between adjacent units. Uprights shall consist of 18 ga. cold rolled steel formed into either a 2" (51mm) wide "Tee" shape common post, or a 1" (25 mm) wide "Angle" shape end post. Keyhole-shaped slots are placed on 1 1/2" (38 mm) centers vertically on the inner face of the posts. All uprights shall be closed with full 24 ga. panels spot welded between the posts.
6. Shelves must accommodate loads of 200 lbs. per lineal foot of shelf with maximum deflection .10" at mid span. Provide appropriate number of reinforcements to accommodate this standard (but must supply a minimum of 6 per adjustable shelf).
7. All shelving must be back to back for independent adjustability of shelves. (
8. All shelf openings shall have slotted 2 1/2" (64 mm) minimum high (one per shelf, not one per opening) rear backstops that engage into upright keyhole slots.
9. Shelf reinforcements shall engage the shelf support, minimum 14 ga. steel. Provide holes on surface for water flow. Provide a minimum of 6 per shelf.
10. Where indicated on drawings provide Frame Mounted Window Frame doors with round perforations. The doors must mount with a separate four-sided frame that will attach to the front of the shelving using a self-drilling screw fastener. The Window frame door must be manufactured of 18-gauge steel. The top of the frame must be flush with the shelving and the bottom must be 1-1/4" from the upright. The door frame hinge will protrude 1-3/4" beyond the front face of the door. Doors must mount to the separate four-sided frame with a lift off style pin hinge.

2.6 POWDER COAT PAINT FINISH

- A. Powder Coat Paint Finish: All parts are cleaned in a six stage surface prep machine prior to coating, including:
 1. Heated alkaline wash
 2. Fresh water rinse
 3. Heated iron phosphate coat
 4. Fresh water rinse
 5. Recirculated deionized water rinse
 6. Fresh deionized water rinse
- B. Color to be selected by COTR from manufacturer's standard color card.
 1. Finish: smooth.
 2. Minimum 1.2 mil thickness.
- C. Resistance to the finish to abrasion: Finish must resist falling sand abrasion test in accordance to A.S.T.M. method D968-51. The minimum number of liters of sand needed to expose a 5/32" area of substratum should be 30.
- D. Required testing of paint finishes:

1. Resistance to the finish to abrasion test: Finish must resist falling sand abrasion test in accordance to ASTM method D968-51. The minimum number of liters of sand needed to expose a 5/32" (4 mm) area of substratum should be 30.
2. Adhesion test: Adhesion shall be equal to 5B as determined by ASTM D3359 using a 2 mm crosscut.
3. Resistance of the finish to chemicals:
 - a. All paint finishes must be tested in accordance to ASTM 3363 (standard test methodology film hardness by pencil test) for the following chemicals in the concentrations listed below
 - b. All metal samples for testing to be prepared in accordance to ASTM D 609 (the preparation of steel panels for testing).
 - 1) Ethanol: 75% concentration
 - 2) Isopropyl Alcohol: 75% concentration
 - 3) Formalin: 10% concentration
 - 4) Glycerin: 100% concentration
 - 5) Xylene: 100% concentration
 - 6) Acetic Acid: 25% concentration
 - 7) Picric Acid: 10% concentration
 - 8) Aqueous Mixture: Propylene glycol, propylene phenoxytol 10% concentration, 5% Formalin Seawater (36 ppt) buffered with sodium bicarbonate.
 - c. Note, the Smithsonian will provide all adequate amounts of chemicals listed above to independent lab for testing purposes.
 - d. The chemicals shall be tested to the shelf finish and data recorded as follows by independent test lab.
 - 1) 2 hours
 - 2) 24 hours
 - 3) 5 days
4. Note all tests as noted above must be performed by independent test lab. All results shall be submitted to Smithsonian with all required mock-ups. All cost associated with tests are the responsibility of shelving/mobile vendors. However, if vendor has conducted similar tests with the Smithsonian within the past 18 months, vendor shall only resubmit test results.

2.7 SHELVING

- A. Stainless Steel shelving: Basis of Design Metro, Super Adjustable Super Erecta Shelf system.
 1. The wire shelving must use a corner release system for quick and easy adjustability without tools. The wire shelving must be interchangeable with existing wire shelving components. Posts must provide a visual guide with a double groove for easy shelf placement.
 2. Shelving posts must be adjustable on any 1" increment vertically. As necessary shelving must have longitudinal full height dividers.
 3. Each shelf must be capable of holding up to 800 pounds. The shelving finish must be Type 2304 Stainless Steel.
 4. Seismic anchoring is required for all wire units. Additionally, all wire units must be tied together at the top using a metal plate. Full height longitudinal dividers must be included when necessary to comply with the Draft Appendix to the SI Fire Protection and Life Safety Design Guide
- B. Wide Span Shelving - Basis of Design: Ridg-U-Tier by Ridg U Rak

1. Upright Frames: Wide Span Upright Frames are made from heavy gauge steel, 100% fully welded at the factory into one rigid assembly containing posts, diagonal and horizontal braces and foot plates. There is no assembly required. Many sizes are available. All upright frames to have a safety factor of 1.67 based on minimum yield of steel.
 2. Posts are punched on the faced to provide positive independent beam placement on 2" vertical centers. The posts are marked on 12" centers to facilitate placement of shelf levels. A slot on each side of the post accepts an optional locking device at the end of each beam. Frames to be six bend design structural integrity. Floor shims to level frames must be sm-s-03.37-04.75-2s 05-75-1E-0 with Hilti EZ screw anchors ½ x 3".
 3. Beams: Beams shall be constructed of a cold formed steel step sections with a heavy gauge, three lug hook connector welded to each end. The face of the beam shall be smooth for easy labeling while minimizing exposed edges. Beams to be designed for acceptance of wood, particle board, wire or steel decks. Beams to be a closed step-beam type with a three-lug hook to attach to upright frame. Beams to have a factory welded on connector with auto-Matic spring lock to provide positive beam to frame column connection.
 4. Punch Deck Plus with Flat Top or Wire Mesh Rack Decking:
 - a. Wire Mesh Decking: 2.5 x 4.5, 4 gauge welded steel wire, 24 inch, 30 inch, 36 inch and 48 inch depths; electro-zinc plated finish. Shelf placement is to be vertically adjustable on 2-inch centers. The shelving shall be designed with lateral supports for added rigidity and support of shelf loads. Shelves to be boltless.
 - b. Punch Deck Plus: Shall consist of a smooth top surface with a 50% open area over galvanized corrugated decking. The flat cap over the standard open Punch Deck surface provides an ideal surface for collections. The repeating corrugations must provide uniform strength and rigidity across the entire shelf regardless of length.
 5. Wide span shelving shall comply with Rack Manufacturers Institute (RMI) design criteria. All components to be made from high strength steel. Sharp edges and welding burns to be ground smooth.
 6. Welded- on Baseplate shall have offset anchoring hole. Base plates to be welded in place at factory. Base plates to be 3-3/8" x 4-3/4" x 1/8". Base plates to have two offset holes ½" in diameter.
 7. All parts of identical dimensions shall be totally interchangeable without modification.
- C. Industrial Cantilever: Basis of Design – Ridg-U-Rak Structural Cantilever
1. Cantilever racks shall conform to Rack Manufacturers Institute (RMI) design criteria. All cantilever components must meet ASTM A992 specifications for high strength steel with a minimum yield of 50,000 psi. Arms shall be bolted to the columns per drawing, a bed frame design shall be attached to the arms. Arms to have minimal to no incline.
 2. Cantilever shall be freestanding units with two arm levels and a base level. Cantilever structural steel columns shall be 8" deep, pre-punched on 4" vertical centers, cantilever column horizontal hole center to center spacing shall be 2-3/4". All bolt and anchor holes shall be 13/16 diameter.
 3. Components to be made from high strength steel. Hardware to be grade 5. Sharp edges and welding burns to be ground smooth.
 4. Rack to consist of towers, structural steel channel bases a minimum of 8 inches high, arms, diagonal and horizontal bracing as required for structural integrity.
 5. High Performance Bracing: Horizontal bracing must incorporate built-in, hook and slot rigidity. Diagonal cross bracing must be bolted in place to assure lateral stability.
 6. High Performance bases must be extra wide, from 8-3/4" to 13-3/4" to provide maximum stability over a wide range of loading requirements. All bases must be a double channeled design for strength and rigidity.

7. High Performance Boot base must be incorporated into the design to create 100% fixation between bases and columns. The base and column combined form the upright making a rigid connection with no need for cross aisle ties. Cross aisle ties are unacceptable.
8. Minimum adjustment for arms to tower along tower length is 2 inches; maximum 4 inches. All arms shall be straight and rated to a minimum of 1,500 lbs. per arm.
9. Supply wire mesh rack decking as follows: 1,500 lbs. capacity uniform; 4 feet, 5 feet, 6 feet depths; 50 lbs. per square foot; 2.5 x 4.5 x 4 gauge welded steel wire; two lateral cross bars, electro-zinc plated finish.

2.8 MUSUEM STORAGE CABINETS AND ACCESSORIES

A. Basis of Design: Spacesaver Viking

B. Materials

1. Museum Storage Cases: Each case to include a minimum of 18 gauge CRS material for the following items: Sides, Back, Top, Doors, and Base. Identify what areas are reinforced and how reinforcements are attached. Cabinet reinforcements stiffeners, channels and corrugated liners range from 22 gauge to 12 gauge. Top cap must be reinforced and watertight, door frames shall be fusion welded for rigidity. Cases shall include reinforced corners for stacking purposes. All corners shall be rounded and all exposed edges shall be deburred. The metal finish shall be powder coated finish P-233 White.
2. Doors and Gasket System: Doors shall be 18 gauge CRS and reinforced with 22 gauge CRS channel stiffeners. Each door will lift off with a 180 degree swing and include a recessed handle with a compatible lock. A 3-point locking system with a keying sequence will be required. Cabinets shall include a recessed channel around the door perimeter with an adhesive backed closed cell elastomeric seal.
3. Drawers: Drawers shall be fabricated of no less than 20 gauge steel. Drawers shall be installed in a case in such a manner that they enclose in the case without contact with the door when fully closed. The drawer support sides must move smoothly through support system. Each drawer shall include two handles and a label holder. All full height cabinets and drawers and shelves must be adjustable on $\frac{3}{4}$ inch centers. Drawers must support an evenly distributed load of 100 lbs. without permanent deflection. Drawer track channels must be made from no less than 16 gauge material.
4. Shelves: Shelves shall be fabricated of no less than 18 gauge steel. Shelves shall be installed in a case in such a manner that they enclose in the case without contact with the door when fully closed. Shelves shall be adjustable and attach to corner posts using a heavy-duty plated shelf clip. Shelves must support an evenly distributed load of 100 lbs. without permanent deflection. Heavy-duty shelves must be reinforced and shelf clips must be made from one-piece construction.

C. Fabrication

1. General: Work fabricated of steel shall be free from rust, scale, pits, scratches, rough and sharp edges, gaps, protrusions, indentations, and other defects or imperfections which might impair the appearance, strength or serviceability of the fabricated item, cause harm to the user, or damage a collection object. Deburr or bevel edges to eliminate sharp corners. Sharp edges and corners on shelves, braces, and inserts are not acceptable for use in the storage cabinet. Complete the mechanical finished of flat steel metal surfaces before fabrication, whenever possible.
2. Connections: Cabinets and component parts shall be of all welded construction. Label holders on doors and drawers along with the drawer handle can be pop riveted.

3. Hinges: Should hinges protrude beyond the cabinet end panel; hinges on the door frame of one cabinet shall be vertical with those of the adjacent cabinet.
4. Door Seals: The edges of the channel formation on the front of the top, bottom and sides of the outer case shall be joined, welded and ground smooth at all four corners to form a continuous recessed channel formation around the cabinet front for a door seal gasket. A strip of specially molded, fumigant resistant closed cell elastomeric gasket with an adhesive back shall be placed into the recessed channel around the entire cabinet front. This recessed channel construction for the door seal shall provide a completely air-tight compartment insert when the door is closed, and prevent "crawling" or loosening of the door gasket material after repeated door opening and closing.
5. Maintainability: Components that might be subject to failure shall be accessible for repair. To the maximum extent possible such components shall be standard items from the manufacturer's catalogue. Cabinets shall be designed for easy maintenance.
6. Leveling Devices: Each cabinet shall be adjustable to a level position by means of leveling devices provided in sufficient number to support cabinet weight when loaded with collections and provide adjustability to a level position. Each leveling device shall be accessible without removing all cabinet contents and shall be adjustable without use of special tools. Each leveling device must be operable when the cabinet is loaded to its full weight capacity and shall provide vertical adjustability of not less than 5/8 inch(+or 0 5.16 inch). The devices must not compromise the enclosure requirements for retaining fumigant vapors. When cabinets are leveled the doors shall function properly and accessories shall be level.
7. Surface Preparations: Painted metal components shall be thoroughly cleaned and phosphatized prior to the application of a hybrid powder coated paint. Prior to painting all exterior and interior unplated metal surfaces including hinges, shall be thoroughly cleaned of all grease, oil, scale, rust and other extraneous matter, by immersion or hand washing, followed by vapor bathing or other approved methods.
8. Hardware: Hardware, latches, and door hinges shall be of the materials hereinafter specified and shall conform to the applicable requirements of this specification. Rivets, screws, lock washers, and other accessories shall be of steel, brass or copper and shall be made to resist rust or corrosion by electro galvanizing, or by zinc, chromium or cadmium plating.
9. Finishes: Chemical resistant, capable of withstanding powerful fumigants consisting of a high quality, hybrid powder coated finish that contains agents to resist chalking and yellowing, and conforms to the performance criteria and the inspection and testing requirements specified. Paint must be non-reactive, solvent free and certified tested for inertness. Touch paint must be high quality, air drying, compatible with cabinet factory finish, as approved by the Contracting Officer and the Smithsonian.
10. Sealant: One-part silicone formulation, moisture curing, compatible with coating materials used, and free excluding substances referenced ASTM C920, Type S (single component), grade NS (non-sag), Class 25, US NT (non-Traffic). Acetoxy curing sealants are not acceptable.
11. Attachment of Cases: All cases shall be leveled and shall be bolted to adjacent cases beside and/or behind them. Installation connections shall not penetrate the air-tight envelope of the case. This work is to be accomplished by personnel trained and experienced in the installation of specialized museum storage cabinetry.

D. Model # 220

1. Unit Dimensions:
 - a. 56-3/4" x 39-5/8" x 38-9/16"
 - b. 56-3/4" x 30" x 38-9/16"
 - c. 56-3/4" x 60" x 38-9/16"
2. Two solid, reinforced, lift-off type with side hinge.

- a. Construction: Furniture steel, welded, each door reinforced on inside face with full length stiffener; perimeter designed for closing and sealing against gasket mounted in case channel.
- b. Hinges: Heavy 4 inch slip- off type, allowing quick lift-off removal and replacement of doors.
- c. Door Handles: Hansen recessed handle.
- d. Provisions for Locking: Punch-out size and location to accommodate 5- pin tumbler lock. Punch- out shall be cut at level of and to the right of handle on the right hand door so the lock bolt engages the closing mechanism to securely lock the cabinet.
- e. Latching: Three point positive engagement at top, bottom and center, keeping door sealed tight against the elastomeric seal and providing a completely insect proof, light protective barrier eliminating dust and foreign matter from cabinet and retaining fumigant vapors. Lock bars and latch shall be zinc-plated to resist 12 gauge steel and locking bars not less than 3/16 inch steel bar. Lock bars will have a silencing mechanism which helps to eliminate the rattling noise caused by locking bars hitting against the guides.
- f. Silencers: Located on latches at top and bottom of cabinet.
- g. Label Holders: Bright chrome, size for 3 x 5 inch card; one mounted on outside face of each door leaf; approximately 14 5/8 inches from outer edge of centerline
- h. Case: Stackable, all-welded construction; fabricated of heavy gauge furniture grade steel, stretcher level quality, rigidly formed.
 - 1) Body: Reinforced and braced to withstand the weight requirement of stacked loaded cases without distortion, warpage or impairment of the positive seal. Side posts to doubly reinforce four corners adding to case rigidity. Provide cushioned back strips to prevent drawers and shelves from striking the back of the case.
 - 2) Corrugated Liners: Perma-slide corrugated track panels with spacing ribs on 1/2 inch centers to allow maximum use of inside storage space and affords versatility in stacking drawers.
 - 3) Perimeter Seal: Specially molded, fumigant- resistant, closed-cell elastomeric gasket formulated for long life; mounted on the case in a recessed steel channel around the entire perimeter of door, secured with adhesive.
 - 4) Center Divider: Removable, sliding easily in or out for conversion of case to accommodate either single or double size drawer storage.
 - 5) Steel Drawers: To have a capacity of 100 lbs. evenly distributed either in 1.5 inches high or 3.5 inches high. Each case must provide drawer flexibility and have a capacity to hold up to 34 drawers.
 - 6) Drawer Pulls and Card Holders: Bright nickel plated.
 - 7) Sealant: One-part silicone formulation, moisture curing, compatible with coating materials used. Acetoxy curing sealants are not acceptable. Color to match cabinet finish.
 - 8) Leveling Devices: Each cabinet shall be adjustable to a level position by means of leveling devices provided in sufficient number to support cabinet weight when loaded with collections and provide adjustability to level position. Each leveling device shall be accessible without removing a cabinet and shall be adjustable without special tools.

E. Model #238

1. Unit Dimensions
 - a. 58 9/32" x 84" x 30 3/8 "
2. Two Solid, reinforced, lift-off type with side hinge.

- a. Construction: Furniture steel, welded, each door reinforced on inside face with full length stiffener; perimeter designed for closing and sealing against gasket mounted in case channel.
 - b. Hinges: Heavy 4 inch slip-off type, allowing quick lift-off removal and replacement of doors.
 - c. Door Handles: Hansen recessed handle.
 - d. Visual Doors: Safety shatter proof glass, or acrylic UF to prevent photochemical damage caused by ultraviolet radiation
 - e. Provisions for Locking: Punch-out size and location to accommodate 5-pin tumbler lock. Punch -out shall be cut at level of and to the right of handle on the right hand door so the lock bolt engages the closing mechanism to securely lock the cabinet.
 - f. Latching: Three point positive engagement at top, bottom and center, keeping door sealed tight against the elastomeric seal and providing a completely insect proof, light protective barrier eliminating dust and foreign matter from cabinet and retaining fumigant vapors. Lock bars and latch shall be zinc-plated to resist corrosion and to eliminate flaking paint. Latch plate to be made of not less than 12 gauge steel and locking bars not less than 3/16 inch steel bar. Lock bars will have a silencing mechanism such as a rubber cushion which helps to eliminate the rattling noise caused by locking bars hitting against the guides
 - g. Silencers: Located on latches at top and bottom of cabinet.
 - h. Label Holders: Bright chrome, size for 3 x 5 inch card; one mounted on outside face of each door leaf; approximately 13-1/2 inches from outer edge and 64 inches to center line above floor.
 - i. Finish: Chemical resistant, capable of withstanding powerful fumigants consisting of hybrid powder coatings containing agents to resist chalking and yellowing, and, conforming to the performance criteria and the inspection and testing requirements specified herein.
3. Case: All welded construction, fabricated with a heavy gauge furniture grade steel, stretcher level quality, rigidly formed.
- a. Body: Reinforced and braced to withstand the weight requirement of stacked loaded cases without distortion, warpage or impairment of the positive seal.
 - b. Side Posts: To support case shell and doubly reinforce the four corners, adding to case rigidity.
 - c. Base: Reinforced forklift truck base with removable front access cover.
 - d. Perimeter Seal: Specially molded, fumigant- resistant, closed-cell elastomeric gasket formulated for long life; mounted on the case in a recessed steel channel around the entire perimeter of door, secured to adhesive.
 - e. Sealant: One part silicone formulation, moisture curing, compatible with coating materials used. Acetoxy curing sealants are not acceptable. Color to match cabinet finish.
 - f. Leveling Devices: Each cabinet shall be adjustable to a level position by means of leveling devices provided in sufficient number to support cabinet weight when loaded with collections and provide adjustability to level position. Each leveling device shall be accessible without removing a cabinet and shall be adjustable without special tools. Built in, adjustable from inside the case.
 - g. Standard Shelves: Full length; adjustable every $\frac{3}{4}$ inch with weight load capacity of 300 lbs. evenly distributed. Clips for shelves to be one piece construction requiring no tools or fasteners to install or remove.
 - h. Adjustability: Shelves and drawers must be adjustable on $\frac{3}{4}$ " centers.
- F. Model # 348 Unit Dimensions
1. Unit Dimension
 - a. 51 $\frac{1}{2}$ x 84 x 225/ 8 inch

2. Two solid, reinforced, lift off type with side hinge.
 - a. Construction: Furniture steel, welded, each door reinforced on inside face with full length stiffener; perimeter designed for closing and sealing against gasket mounted in case channel.
 - b. Hinges: Heavy 4 inch slip-off type, allowing quick lift-off removal and replacement of doors.
 - c. Door Handles: Hansen recessed handle.
 - d. Visual Doors: Safety shatter proof glass or acrylic, or acrylic UF to prevent photochemical damage caused by ultraviolet radiation.
 - e. Provisions for locking: Punch-out size and location to accommodate 5-pin tumbler lock. Punch -out shall be cut at level of and to the right of handle on the right hand door so the lock bolt engages the closing mechanism to securely lock the cabinet.
 - f. Latching: Three point positive engagement at top, bottom and center, keeping door sealed tight against the elastomeric seal and providing a completely insect proof, light protective barrier eliminating dust and foreign matter from cabinet and retaining fumigant vapors. Lock bars and latch shall be zinc-plated to resist corrosion and to eliminate flaking paint. Latch plate to be made of not less than 12 gauge steel and locking bars not less than 3/16 inch steel bar. Lock bars will have a silencing mechanism which helps to eliminate the rattling noise caused by locking bars hitting against the guides.
 - g. Silencers: Located on latches at top and bottom of cabinet.
 - h. Label Holders: Bright chrome, size for 3 x 5 inch card; one mounted on outside face of each door leaf; approximately 13-1/2 inches from outer edge and 64 inches to center line above floor.
 - i. Finish: Chemical resistant, capable of withstanding powerful fumigants consisting of hybrid powder coatings containing agents to resist chalking and yellowing, and, conforming to the performance criteria and the inspection and testing requirements specified herein.
3. Doors: Four solid, reinforced, bi-fold lift-off type with side hinge
 - a. Construction: Furniture steel, welded, each door reinforced on inside face with full length stiffener; perimeter designed for closing and sealing against gasket mounted in case channel.
 - b. Hinges: Heavy 4 inch slip-off type, allowing quick lift-off removal and replacement of doors.
 - c. Door Handles: Hansen recessed handle.
 - d. Provisions for Locking: Punch- out size and location to accommodate 5-pin tumbler lock. Punch-out shall be cut at level of and to the right of handle on the right hand door so the lock bolt engages the closing mechanism to securely lock the cabinet.
 - e. Latching: Three point positive engagement at top, bottom and center, keeping door sealed tight against the elastomeric seal and providing a completely insect proof, light protective barrier eliminating dust and foreign matter from cabinet and retaining fumigant vapors. Lock bars and latch shall be zinc-plated to resist corrosion and to eliminate flaking paint. Latch plate to be made of not less than 12 gauge steel and locking bars not less than 3/16 inch steel bar. Lock bars will have a silencing mechanism which helps to eliminate the rattling noise caused by locking bars hitting against the guides.
 - f. Silencers: Located on latched on top and bottom of cabinet.
 - g. Label Holders: Bright chrome, size for 4 x 6 inch card; mounted on outside face of the two inside doors.
 - h. Finish: Chemical resistant, capable of withstanding powerful fumigants consisting of epoxy powder coatings containing agents to resist chalking and yellowing and

- conforming to the performance criteria and the inspection and testing requirements specified herein.
4. Case: All-welded construction, fabricated with heavy gauge furniture grade steel, stretcher level quality, rigidly formed.
 - a. Body: Reinforced and braced to withstand the weight requirement of stacked loaded cases without distortion, warpage or impairment of the positive seal.
 - b. Side Posts: Six posts provided to support the corners and the middle of each end, adding to case rigidity.
 - c. Base: Reinforced four-way forklift base with removable front access cover.
 - d. Perimeter Seal: Specialty molded, fumigant-resistant, closed-cell elastomeric gasket formulated for long-life; mounted on the case in a recessed steel channel around the entire perimeter of door, secured with adhesive.
 - e. Sealant: One-part silicone formulation, moisture curing, compatible with coating materials used. Acetoxy curing sealants are not acceptable. Color to match cabinet finish.
 - f. Leveling Devices: Each cabinet shall be adjustable to a level position by means of leveling devices provided in sufficient number to support cabinet weight when loaded with collections and provide adjustability to level position. Each leveling device shall be accessible without removing a cabinet and shall be adjustable without special tools. Unit requires eight levelers built in, adjustable from inside the case.
 - g. Standard Shelves: Shelves are a unitized platform design, multiformed channels, easy to handle and to reposition.
 - h. Adjustability: Shelves and drawers must be adjustable on $\frac{3}{4}$ " centers.
- G. Model # 395
1. Unit Dimensions:
 - a. 94 $\frac{1}{2}$ inch x 78 $\frac{3}{4}$ inch x 50 inch
 - b. 86 inch x 42 inch x 64 inch
- H. Case: Stackable, all-welded construction; fabricated of heavy gauge furniture grade steel, stretcher level quality, rigidly formed.
1. Body: Reinforced and braced to withstand the weight requirement of stacked loaded cases without distortion, warpage or impairment of the positive seal. Side posts to be doubly reinforce four corners adding to case rigidity. Provide cushioned back strips to prevent drawers and shelves from striking the back of the case.
 2. Corrugated Liners: Perma-slide corrugated track panels with spacing ribs on $\frac{1}{2}$ inch centers to allow maximum use of inside storage space and affords versatility in stacking drawers.
 3. Perimeter Seal: Specially molded, fumigant-resistant, closed-cell elastomeric gasket formulated for long life; mounted on the case in a recessed steel channel around the entire perimeter of door, secured with adhesive.
 4. Center Divider: Removable, sliding easily in or out for conversion of case to accommodate either single or double size drawer storage.
 5. Steel Drawers: To have a capacity of 100 lbs. evenly distributed either in 1.5 inched high or 3.5 inches high. Each case must provide drawer flexibility and have a capacity to hold up to 34 drawers.
 6. Drawer Pulls and Card Holders: Bright nickel plated.
 7. Sealant: One-part silicone formulation, moisture curing, compatible with coating materials used. Acetoxy curing sealants are not acceptable. Color to match cabinet finish.
 8. Leveling Devices: Each cabinet shall be adjustable to a level position by means of leveling devices provided in sufficient number to support cabinet weight when loaded with

collections and provide adjustability to level position. Each leveling device shall be accessible without removing a cabinet and shall be adjustable without special tools.

2.9 POWERED SYSTEMS

- A. Motors: UL-listed, DC voltage, geared, in-line motor for connection to 115-V ac power source. Size as required for loads indicated.
- B. Drive Shaft: Continuous tubular or solid steel shaft, capable of transmitting torque from motor without distortion.
- C. Control System: Manufacturer's standard operation system to automatically open aisles at selected locations with controlled acceleration and deceleration of carriages. Provide dual controls centrally mounted on end panels.
- D. Safety Devices: Manufacturer's standard safety devices as required to stop carriage motion. Provide the following:
 - 1. Emergency Stop Button: Momentary contact, red push-button switch to immediately stop carriage motion. Provide sign or lettering on button indicating "Emergency Stop."
 - 2. Safety Sweep: Hinged safety bar consisting of an impact-pressure-activated, internal-contact switch plate mounted along full length of each carriage at [bottom edge] [mid-height]. Maximum 1 lbf (4.45 N) results in immediate stop of carriage motion.
 - a. Dual Flange
 - b. Center Flange
 - c. Roller bearing
 - 3. Aisle-Length Presence Detector: Pulsed infrared, sender-receiver assembly operating along length of open aisle that prevents motion in adjacent carriages while aisle is occupied.
 - 4. Aisle Entry Presence Detector: Pulsed infrared, sender-receiver assembly at entry to open aisle that stops motion in adjacent carriages when aisle is entered and prevents motion while aisle is occupied.
 - 5. Aisle Floor Presence Detector: Weight-activated, internal-contact switch plate mounted beneath aisle floor that prevents motions of adjacent carriages while aisle is occupied.

2.10 SYSTEM ACCESSORIES

- A. Aisle Lights: Manufacturer's standard aisle lighting system that automatically turns on when aisle is open and shuts off when aisle is closed. Provide [one] <Insert number> light unit per aisle.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, minimum recess depth, and other conditions affecting performance of mobile shelving systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Level and plumb tracks to a tolerance of **0.09 inch in 120 inches (2.4 mm in 3.048 m)** with no more than **0.06-inch (1.5-mm)** variation between adjacent rails. Use permanent shims or non-shrink grout as indicated by manufacturer.
- B. Recessed Track Systems: Solidly fill gaps between slab and rail according to manufacturer's written instructions to secure tracks and prevent movement.
- C. Carriage Installation: Mount mobile carriages on track system with anti-tip brackets engaged by rails and adjust for smooth operation. Provide non-moving carriages securely fixed to rails where indicated.

3.3 SHELVING INSTALLATION

- A. Attach shelving units to carriages according to manufacturer's written instructions and as required to prevent vibration during movement.
 - 1. Level and plumb shelving units to a tolerance of **1/8 inch in 96 inches (3 mm in 2438 mm)**.
- B. Install shelves in shelving units at locations indicated on Drawings and according to manufacturer's written instructions.
- C. Shelving Enclosure Panels: Install end panels and canopy tops with concealed fasteners.

3.4 CLEANING AND PROTECTING

- A. Repair or remove and replace defective work as directed on completion of installation. Provide new matching units, installed as specified and in manner to eliminate evidence of replacement
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- C. Adjust: Adjust components and accessories to provide smoothly operating, visually acceptable installation.
- D. Protect installed products from damage during remainder of the construction period. Advise Owner of additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain mobile storage shelving.

END OF SECTION

SECTION 12 4813

ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Carpet entrance mats.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and grilles.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For sealant, documentation including printed statement of VOC content.
 - 2. Product Data for Credit IEQ 4.3: For low emitting materials.
 - 3. Product Data for Credit IEQ Credit 5: Indoor chemical and pollutant control.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes:
 - 1. Floor Mat: 12 inch by 12 inch.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Entrance Mats: Full-size tile units equal to 2 percent of amount installed, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND GRILLES, GENERAL

- A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.2 CARPET ENTRANCE MATS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Mats Inc., Berber or a comparable product by one of the following:
 1. American Floor Products Company, Inc.
 2. American Mat & Rubber Company.
 3. Balco, Inc.
 4. Consolidated Plastics Company, Inc.
 5. C/S Group.
 6. Durable Corporation.
 7. Musson Rubber Company.
 8. Pawling Corporation; Architectural Products Division.
 9. Sbemco International Inc.; Matting by Design.
 10. Tepromark International, Inc.
 11. U.S. Mat & Rubber Corporation.
- B. Carpet-Type Mats: Polypropylene Olefin Polyester carpet bonded to 1/8- to 1/4-inch- thick, flexible vinyl backing to form mats 3/8 or 7/16 inch thick with nonraveling edges.
 1. Colors, Textures, and Patterns: Charcoal
 2. Mat Size: Rolls, Custom width:
 - a. Provide rolls in sufficient width to avoid seaming.
 3. Total Weight: 64 oz.
 4. Overall Thickness: 3/8 inch.
 5. Backing: High Density Rubber

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes and other conditions affecting installation of floor mats and frames.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Floor Mats
 1. Install with manufacturer approved adhesive.

2. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION

SECTION 1f3 0340

ARCHIVAL ROOMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install archival rooms. Include all insulated walls, ceilings, doors, mechanical refrigeration systems, controls, gages, internal lighting, and other ancillary items required for completely fabricated and operational Archival Rooms.
 - a. The generator size under Alternate 3A is based on sequential start-up of Collections Storage Cold Room and Collections Storage Cool Room equipment. Provide programming of Environmental Chamber control panels to ensure components start in the sequential order and with the time delays indicated on Drawing E-401FP.

1.2 RELATED DOCUMENTS:

- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- C. Submit five (5) copies to be retained and distributed by the Owner, Architect and/or Owners Representative. Submit complete materials list, including catalog data of all materials, equipment, and products for Work in this Section. Include refrigeration calculations and electrical requirements.
- D. Submit complete shop fabrication and installation drawings, including plans, elevations, sections, and details. Drawings shall be in the form of reproducible or photocopies and not to exceed 11 x 17 inches in size.
- E. Submit detailed anchorage and attachment drawings and calculations provided by a licensed engineer. Rooms shall be designed and constructed to meet the requirements for the seismic zone appropriate for the area in which construction is taking place.
- F. Submit record "As-Built" drawings
- G. Submit complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement parts.

1.3 DESCRIPTION OF WORK:

- A. This section specifies the manufacture, fabrication, installation and testing of cold storage rooms and attendant acclimatization chambers indicated on drawings together with required refrigeration and humidification systems and related controls and instrumentation necessary to provide complete, fully operational controlled environment rooms.
 - 1. Controlled archival rooms for this project are indicated on the drawings and include the following:

- a. Archival Rooms:
 - 1) Cold Storage Room 320.09 with conditioned Vestibule, located on the 3rd floor.
 - 2) Cold Storage Room 220.06 with conditioned Vestibule, located on the 2nd floor.
 2. Provide controlled archival room complete with internal insulated partitions, where shown on plans.
 3. The archival rooms are field erected complete units with the following:
 - a. Environmental control air handling units with all necessary refrigeration, heating, humidification and dehumidification.
 - 1) Reverse osmosis water system supplied for and connected to each humidifier.
 - 2) Air-Cooled refrigeration systems to be mounted on building roof on concrete pads.
 - b. Room lighting and receptacles with light fixtures, devices, conduit, wiring and switches.
 - 1) Provide level of 25fc 40" AFF within rooms.
 - 2) Provide 10 duplex outlet per cold storage room.
 - c. Control panel for maintaining room environmental conditions and monitoring systems alarms. Provide interface with building BAS for remote monitoring.
 - 1) Control panel will be stand-alone for each cold room. Room manufacturer will provide a suitable interface at each room to pick up the following points: General Alarm, Room Temperature, Room Relative Humidity.
 - d. All interlocks necessary to shut-off each room Air Handling Unit if clean agent fire suppression system is activated.
 - e. Blocking or substrate for other trades to use when mounting conduit, piping and devices.
 - f. Power from control panel to junction box for room receptacles within the boundary of each Cold Room.
 - g. Power from control panel to junction box for room lights within the boundary of each Cold Room.
- B. Coordination Between Trades: Coordinate work of different trades, required to complete work
1. Electrical:
 - a. Power to each air handling unit, condensing unit, dehumidifier, and room control panel terminated with a fused disconnect within 3 ft. from each device.
 - b. All devices and conduit will be attached at points provided by the room manufacturer.
 2. Sprinkler:
 - a. Sprinkler heads, piping and other fire protection devices within the room.
 - b. Clean agent suppression system with tanks, piping, nozzles, detectors and controls.
 - c. All attachments to room panels will be at points coordinated with and penetrations provided and sealed by the room manufacturer.
 3. Fire Alarm:
 - a. Heat detectors, strobes, wiring, conduit and other fire protections items within the room.
 - b. All attachments to room panels will be at points provided by the room manufacturer.
 4. BMS:
 - a. Interface with cold room control panels for monitoring space temperature, humidity and summary alarms.

- b. All attachments to room panels will be at points provided by the room manufacturer.
- 5. Door Hardware:
 - a. Specialty door hardware to accommodate security devices per Section _____.
- 6. Security:
 - a. Security systems as shown on documents.
- 7. General information:
 - a. Reactivation Air Inlet Insulated Supply Ductwork to each desiccant drier.
 - b. Reactivation Air Outlet Insulated Exhaust Ductwork from each desiccant drier.
 - c. Provide mechanical and electrical connections to building systems in accordance with applicable requirements of Divisions 15 and 16 specification sections.
 - d. Storage Furniture: Storage units for controlled environment rooms, where applicable, are as indicated on the drawings and specified in Division 10 "Prefabricated Storage Shelving" and "High Density Storage Systems" sections. These storage units are Not In Contract.
 - e. Related Work: Work specified in other sections related to the work of this section includes, but is not limited to, the following:
 - a. Concrete floors within environmental rooms are constructed in accordance with applicable requirements of Division 3 "Cast-In-Place Concrete" section and are Not In Contract.

1.3 PERFORMANCE REQUIREMENTS:

- A. Definitions: The following terms are used to describe performance characteristics of the Cold Rooms, and the definitions provided herein shall apply wherever the terms are used. The terms do not apply during defrost activity unless specifically noted herein.
 - 1. Temperature Control: The absolute value of the difference between the highest and lowest temperatures at the control sensor over the time period of specified under "Performance Testing" herein.
 - 2. Temperature Uniformity: The absolute value of the difference between the highest and lowest temperatures measured at numerous locations throughout each chamber, specified under "Performance Testing" herein, at a single point in time.
 - 3. Relative Humidity Control: The absolute value of the difference between the highest and lowest relative humidity measurement at multiple locations over the time period specified under "Performance Testing" herein.
 - 4. Stable or Stabilized: After a change in set point or disturbance to the room conditions, the point at which the room performance is again within the specified performance limits for control and uniformity.
- B. Climate Controlled Environments: Provide controlled temperature and humidity for controlled environment rooms as follows:
 - 1. Cold Storage Room 320.10:
 - a. Temperature: 2.8°C, temperature control of +/- 2.2°C.
 - b. Relative Humidity: 30%, humidity control of +/- 5%.

2. Vestibule 320.09 (Cold Storage Room 320.10):
 - a. Conditioned No Control.
 3. Cold Storage Room 220.06:
 - a. Temperature: 10°C, temperature control of +/- 2.2°C.
 - b. Relative Humidity: 45%, humidity control of +/- 5%.
 4. Vestibule 220.05 (Cold Storage Room 220.06):
 - a. Conditioned No Control.
- C. Fire Performance: Provide UL labeled floor, wall, partition and ceiling panels tested for fire performance in accordance with ASTM E 84 and rated as Class 1 assemblies with flame spread rating less than 25, smoke developed rating less than 450.
- D. Charcoal Filters: Each air handling system shall include charcoal filters 12" (300 mm) deep for the return air to remove potentially damaging products which may be released by the stored products.

1.4 SUBMITTALS:

- A. Provide samples of each type of product materials, support components, finishes, and accessories illustrating installed products, finishes, and color.
 1. Submit 300 x 300 mm minimum size samples of typical wall, ceiling and floor panels showing insulating core and metal finishes to be used
- B. Detailed manufacturer product data sheets, for each proposed product type, which provides the necessary information to describe and evaluate the product and its performance. Including, all major components, but not limited to: Chamber wall panels, Air Handling Units, Condensing units, dehumidifiers, RO System, Steam Generators, Control Systems, Temperature sensors, Humidity sensors.
- C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details, schedules, and 3-dimensional layouts (as necessary). Minimum scale shall be 1:50. Show relationship to adjoining materials and construction, layouts of controlled archival rooms, together with approximate connection locations of lighting contactor box and outlet contactor box. Indicate field verified dimensions. Show conditioning equipment locations and electrical connection locations. Indicate connections to building systems that are performed as work of other specification sections. Shop drawings shall depict final product design and installation. Shop drawings shall be prepared electronically and submitted in the form of reproducible or photocopies, prepared in standard Architectural drawing formats and scaled to defined dimensions.
- D. Testing Procedures for certification of Archival room performance, including testing apparatus and current calibrations certificates.

- E. Test reports, by an independent testing laboratory, certifying that component parts perform as specified.
- F. Upon completion of installation, operation and maintenance instructions will be furnished. Operation instructions shall include manufacturer's name, size, model, type, and serial numbers for the various elements of system; detailed drawings, wiring diagram, repair parts lists, lubrication manuals, and general maintenance instructions. Provide services necessary to properly instruct personnel on operation and maintenance of all systems.
 - 1. Provide the following certified items:
 - a. Operating and maintenance procedures.
 - b. List of recommended spare parts.
 - c. Approved shop drawings.
 - d. Certified performance curves for equipment.
 - e. Warranty certificates.
 - f. As-built drawings.
 - g. Test reports.
 - h. Procedural instructions for future wall penetrations and proper sealant to be used.
 - 2. Warranty Statement: Supply a description of vendor's warranty for the project once accepted by and turned over to the COTR. Warranty statement must show compliance with the warranty requirements stated in this document.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide, install and performance test archival storage controlled environment chambers complete including insulated and sealed floor, wall and ceiling enclosures; air temperature and humidity conditioning and control systems including ductwork, refrigeration system piping and electrical conduit; doors and operation hardware and interior lighting furnished and installed by a single manufacturer responsible for the successful erection and operation of all controlled environment rooms for this project.
- B. Manufacturer: Provide controlled archival rooms produced by a manufacturer regularly engaged in the production and installation of the specified systems, that has an established reputation in this field with a minimum of five years proven experience in turnkey archival applications and be able to provide a list of (5) successful projects completed within the past 5 years. The referenced projects must show the production and installation of work similar in function and scope to that specified herein. The chamber manufacturer shall provide factory-trained technicians employed by the company (crews) for factory installation of the chamber or provide supervision of sub-contract personnel under the direction of a factory supervisor. Manufacturer shall offer an ongoing Preventative Maintenance (PM) program. Manufacturer shall have available periodic service training seminars (schools).
- C. Performance: Manufacturer of controlled archival rooms is responsible to provide spaces that meet or exceed specified performance requirements for controlled temperature and humidity set points and

uniformity and for provision of adequately sealed structure to assure minimal transmission of vapor into controlled spaces.

D. Coordination:

1. Meet with the COTR during preparation of the shop drawings to confirm room layouts and locations of storage shelving finished by other section in order to coordinate layout of lighting and other fixtures.
2. Provide coordinated general arrangement drawings showing work of other trades indicating sufficient attachment points for conduit and devices by other trades.

E. Field Supervision: Manufacturer of controlled archival rooms must provide full-time, experience, qualified, on-site technical supervision to coordinate installation of rooms and environmental control systems and to monitor start-up and testing of completed units. Retain same project field manager throughout entire course of this work unless prior approval for change is obtained from the COTR.

1.6 PROJECT CONDITIONS:

- A. Verify all critical dimensions in field before fabrication. Make provision for adjustments where field verification would delay work. Do not install controlled environment rooms until spaces to receive them are ready to receive same.
- B. Coordinate with other trades as necessary for proper installation and function of the work.
- C. Building must be dried-in and closed to external ambient prior to beginning of installation work for controlled environment chambers.

1.7 DELIVERY, STORAGE AND HANDLING:

- A. Deliver all parts and components to the site according to procedures normally followed by controlled environment chamber manufacturer. Parts and components must be protected from damage in manufacturer's original protective packaging and crating (or other means) and store in area protected from weather and construction operations in accordance with manufacturer's instructions. Handle in manner to prevent damage.

1.8 WARRANTIES:

- A. Manufacturer shall warranty entire installation of controlled environment rooms to be free from defects in materials and workmanship for one year after start-up. Warranty shall cover parts, labor and travel necessary to replace or repair components found to be defective. Normally expendable items shall be excepted from warranty.
- B. In addition to the above warranty, manufacturer shall provide a concurrent 10 year warranty for parts only covering the room enclosure and door hardware. Warranty shall provide for replacement of defective parts only, excluding abuse.

- C. Contractor shall provide a concurrent 5 year compressor replacement warranty. Warranty shall cover the replacement of any compressor that fails due to defects in material or workmanship. Replacement shall cover compressor parts.

1.9 SPECIAL DOCUMENTATION REQUIREMENTS

- A. Labeling of Conductors: Label ungrounded current carrying conductors as follows:
1. Field installed conductors shall be numbered at both ends with the same number. Conductors within the control panel shall be numbered in the same fashion.
 2. All numbered conductors shall have discrete number labels that are not found on any other conductor on the controlled environment room.
 3. The number labels on each numbered conductor shall correspond to labels on the control panel component layout and control system schematic drawings which indicate the point of connection of each labeled conductor.
- B. Closeout Documentation: Provide the following documentation at project completion in addition to requirements of Division 1. Illustrate and describe the as-built condition of the completed work. Provide two complete sets of documentation for each numbered room installed, in three ring binders, with project name and room identifier on the cover.
1. Drawings of completed installation showing locations of all equipment and fixtures.
 2. As-built refrigeration piping schematic.
 3. Complete parts list with all control and refrigeration system parts and the original manufacturer's name and part numbers.
 4. As-built control panel and electrical wiring diagram indicating the terminal connections for all ungrounded conductors. Indicate all conductor label numbers. Conform with other control system documentation requirements of this section.
 5. Control panel interior component layout drawing indicating the numbered wire connections and terminal connection locations for each component. Conform with other control system documentation requirements of this section.
 6. Field Test Reports: Record and submit to the COTR copies reports of all field test protocols and test data for controlled environment rooms. Identify spaces tested and indicate test methods used. Describe deviations from specified procedures. Record test data and indicate whether units tested pass or fail to meet requirements.
 7. Catalog Cutsheets: Supply catalog cutsheets identifying selections for all major components including, but not limited to: Chamber wall panels, air handler, condensing unit, control system, temperature sensor, and humidity sensor.
 8. Approved copy of operating procedures manual.
 9. Warranty Statement: Supply a description of vendor's warranty for the project including extended warranty for panels, doors/door hardware and compressors. Warranty statement shall show compliance with the warranty requirements specified herein.

PART 2 – PRODUCTS

2.1 CONTROLLED ARCHIVAL ROOMS:

- A. General: Provide and install prefabricated controlled environment rooms and acclimatization chambers complete, including entire enclosures, doors and door hardware, prewired and tested climate control systems and controls, lighting and appurtenances necessary for complete operation in locations and configuration indicated on drawings.
1. All controls requiring servicing, adjustment or reading must be externally mounted/located to the controlled environment rooms. This requirement is made to separate archival materials and artifacts from service personnel to the extent possible.
- B. Basis for Design: Controlled archival rooms selected as the basis for design for this project are products of Bahnsen Environmental Specialties, LLC, utilizing insulated panels as manufactured by or equal to Imperial – Brown Manufacturing, 2271 N.E. 194th, Portland, Oregon 97230.
1. Naming of manufacturer/supplier is only for the purpose of establishing the kind and quality level of desired equipment and is in no way intended to limit bidding to the named manufacturer nor does it exempt the named manufacturer from conformity with all applicable portions of the general and particular requirements of this specification. Products of equal performance and quality meeting the general and particular requirements of this specification and conforming to dimensions shown on the drawings are acceptable for the work of this project. The COTR is the sole judge of acceptability of products offered in fulfillment of this specification.

2.2 ROOM ENCLOSURE CONSTRUCTION:

- A. General: Provide factory insulated, metal faced, urethane insulated wall and ceiling panels 100 mm (4 inches) thick, in manufacturer's standard sizes to greatest extent possible. Integrate custom sized panels into project where necessary to meet dimensioned requirements shown on drawings.
- B. Wall and Ceiling Panel Construction: Provide panels aluminum faced both sides with a minimum 100 mm (4") thickness of foamed-in-place urethane insulation core with molded urethane tongue-and-groove panel edges having continuous, flexible vinyl gasket seals at interior and exterior edges of each tongue to assure tight fit to adjacent panels. Make panel connections with cam-type fasteners locking panels together from inside face of panels providing a minimum of three locking devices per vertical edge spaced not more than 1168 mm (46") apart. Wall to floor mounting angles and bolts to be stainless steel and the bolts to be a grade 5.
1. Facing: Embossed aluminum, 0.8 mm minimum thickness, for interior and exterior panel faces.
 2. Insulation: Foamed-in-place urethane with minimum 97% closed cell structure impervious to moisture, 35 kg per cubic meter (2.5#/CF) density, thermal conductivity (K factor) not exceeding .033, R=29 or better.
 3. Corners: Provide manufacturer's standard 90-degree, corner panels.
 4. Use of metal or wood framing in panels, or any other material bridging between panel faces to cause through-wall heat transfer, is not permitted.
- C. Partition Panels: Same construction as specified above for wall and ceiling panels.

- D. Floors: Insulated floors consisting of two layers of cast-in-place concrete slabs with extruded polystyrene rigid board insulation infill constructed under other sections of the specifications. Floors are not the work of controlled environment rooms manufacturer or installer.
- E. Doors: Provide single-leaf and double-leaf swing-type doors of construction and finish similar to wall panels for openings sized and indicated on drawings. Doors shall be in-fitting and flush mounted with continuous gaskets of thermoplastic material along head and both vertical edges of each door leaf and with an adjustable rubber double wiper gasket along bottom edge. Provide gasket material and/or heating for each door to prevent air at door openings. Door frame shall be supplied with either a structural fiberglass pultrusion or PVC structural extrusion around the entire door frame.
1. Door Hardware: Doors shall be self-closing type pin and cam hinges with a minimum of three hinges per door. Automatic closing type door handle and catch assembly that does not require manipulation of strike release mechanism to open. The door latch shall be designed to open easily by breaking the magnetic force of the door gasket. The door latch shall have a cylinder lock and provisions for padlocking. Coordinate with and provide accommodation for security monitoring equipment and locking devices specified elsewhere under security systems specifications. Doors must be supplied with a multi-pane heated vision panel.
 - a. Doors labeled 15/3 have no external operable hardware. These are egress doors only.
 - b. For other double-leaf doors, the left leaf to be inactive with no external operable hardware.
 2. Safety Release: Provide interior safety release to permit opening within room even if door is locked or padlocked from the outside.
 3. Removable Mullions: Provide removable center mullions at meeting stiles of paired doors to permit clearing of opening to required maximum dimension.
 4. Size of Doors: See Door Schedule for height and width requirements of doors.
- F. Lighting and Receptacles: Lighting and receptacle requirements are listed in the Description of Work. Coordinate equipment and openings with requirements specified in applicable Division 16 sections.
1. Pilot Lights: Provide a pilot light for controlled environment spaces on exterior side of each door and at main entrance to indicate that interior lights are on or off. Locate pilot lights next to latch jamb of door.

2.3 Temperature Conditioning Air Handling Units (AHUs):

- A. Air Handlers (Storage Area): Provide air handlers, as indicated, designed and built to maintain the required condition in each Controlled Environment Room. It shall be the responsibility of the manufacturer to design, fabricate and install the systems to maintain the required conditions throughout the entire storage area. Air volumes, velocities, cooling and heating capacity and all other facets of the air handler design are the manufacturer's responsibility. The following features shall be incorporated into each unit:
1. Cabinetized construction with all components mounted inside the unit housing.
 2. Urethane insulation with no through metal design, minimum 3" (76 mm) nominal thick double walls.

3. Cabinet constructed with 0.050" (1.3 mm) aluminum walls with internal support frame.
4. Direct expansion coils shall be fabricated from copper tubes expanded into aluminum fins. The coil assembly shall be framed and set into the cabinet so that it can be removed or replaced without having to dismount the air handler cabinet from the Controlled Archival Room ceiling.
5. Insulate the cabinet on the interior with material that will not significantly degrade under the intended operating conditions and which will provide condensation free operating.
6. Motors shall operate on 480 volts, 60 Hertz 3 phase power disconnect switch.
7. Reheat section shall be electric resistance heat type. Heaters shall be Incoloy sheathed Nichrome wire with a maximum watt density of 23 watts/in². Mount heaters on downstream side of evaporator to achieve proper reheat. Heated surfaces shall not contact evaporator fins or tubes. Heaters shall be positioned inside the air handler cabinet to prevent any human contact with the heated surfaces.
8. Heater safety control shall be provided and mounted within the air handler. Electronic control shall sense heater element surface temperature and de-energize heater power if surface temperature rises above a safe operating level.
9. Heater power control shall be by a solid state device type device with zero-cross switching operations. Unit shall have appropriate snubbers and I²t fusing to provide adequate circuit protection.
10. Inlet pre filter shall be provided to protect coil and internal components from the accumulation of dust.
11. Provide access doors to facilitate the servicing or replacement of any internal component without the need to dismount the air handler from its installed position.
12. Stainless steel condensate drain pan with adequate access for cleaning.
13. External condensate piping connection for connection of piping to drain.
14. Charcoal Filters: 12" (300 mm) deep within the air handling unit.
15. Smoke detectors: (4) smoke detectors total with sampling tubes located inside air handling unit main supply and return ductwork and interlocked with the AHU fans.

2.4 CONTROLS AND INSTRUMENTS

- A. General: All instruments, controls and electrical control components shall be installed in a NEMA 12 rated enclosure located on the exterior of the room where directed by the COTR. Fabricate control enclosure from steel with all seams continuously welded, painted with acrylic enamel or equal. Provide a hinged service door for front access to control and electrical components. The control panel shall include all of the electrical hardware for the control system, without remotely located instruments or devices other than sensors. Wire control for single point power connection with separate branch circuit protection, utilizing circuit breakers, for all circuits necessary for the operation of the room except for those circuits specifically indicated on the plans for identified equipment units. Provide ground fault and over current protection for main supply circuit. Separate branch circuit protection shall be provided within the control panel for various control circuits and output devices. Provide a fused main disconnect switch that interlocks with the enclosure door. Load mechanical equipment of the cooling systems on separate branch circuits derived from the control panel mains, each with its own over current protective devices. Provide necessary transformers as part of the control system.
- B. Safety and Quality Assurance:

1. All ungrounded conductors in the control panel and their field wired extensions shall be uniquely numbered at each end with a suitably applied labeled. The labels shall be permanent and machine printed. Hand marking of conductors or applications of tapes with hand written markings will not be accepted.
2. Control panel components shall be assigned a name, tag or other identifier which shall be utilized throughout the system documentation to describe or refer to that component.
3. Complete control panel assembly shall be tested and certified by a NRTL to be in accordance with UL508A and NFPA 79. A certifying label from the testing agency shall be applied to the exterior of each control panel.
4. Provide as-built documentation for every control panel and completed system which details the following:
 - a. Scaled illustration of the physical component layout of the control panel face and interior with designations for each component which are common to all other documentation. Terminals on each component shall be indicated and the identifying numbers of the conductors connected to each terminal documented on the drawings.
 - b. Schematic of control system using industry accepted format, individual wire numbers for all ungrounded conductors and textural information indicating basic function of each logical portion of the schematic.
 - c.

C. Control Panel Components and Functions:

1. Main Control Unit: Environmental parameter control, equipment sequencing and operation, defrost actuation and termination and all monitoring and alarm function shall be performed using a single industrial control unit. The minimum configuration shall consist of the following:

A. Control Panel

The NEMA 4/12 gray painted enclosure houses and protects the controls, recorder and alarms, and distributes power to the chamber interior components. Control panel features include:

1. Independent, third party certification of control panel assembly, which includes listed panel components and devices. Third party certification shall be compliant with UL listing standards.
2. Stainless steel/epoxy painted front for impact resistance and durability. All door panels/sections shall be lockable and hinged.
3. Lockable control system interface cover with Lexan window. The cover shall protect from unintended tampering.
4. Single point chamber power connection with lockable over-current protection. All branch circuit loads shall be fuse or circuit breaker protected within the panel.

B. Control System

The control system shall provide process control, process alarming, and circuit switching. Control system features shall include the following:

1. Microprocessor based I/O hardware with fixed programmed logic. The control logic program shall be stored on a non-volatile, high capacity memory card EE-prom. All control parameter settings, alarms and setpoints shall be maintained during power failure, and restart shall be automatic upon power restoration.
2. Backlit, alphanumeric LCD color touchscreen shall provide operator access to all system parameters through intuitive, Windows® style drop down menus. The six inch display shall be compatible with low to high room light levels. Menu selections and on-screen instructions with on-screen help shall provide sufficient detail to allow for typical day-to-day use without reference manuals.
3. Conformance to the FDA 21 CFR 11 requirements for data recording, audit trails of controller settings modification, alarm history logs, operator event logs and secure file transfers (with paperless recording option activated at the factory). Operating data shall be encrypted and stored in user defined time length log files, and shall be viewable on the touchscreen, or remotely by PC. Password protection shall provide multiple levels of user access and defined rights. Password aging and re-authentication for process changes shall also be provided per 21 CFR 11 specifications. High level encryption and digital signatures shall be supported for paperless operation.
4. Real-time trending of temperature and humidity parameters and setpoints. The touchscreen shall provide auto-scaled and user definable scaled plots over a 1 minute to 12 hour time period. A 'drag and zoom' feature shall allow for magnified views of the trend within a specific plot period. The trend graphs shall be printable by pressing an on-screen print icon and connecting an optional printer. Historical data logging shall be provided with the paperless recording option activated at the factory.
5. Interface USB port for data transfer to printer or removable memory stick to maintain local 'paper trail' requirements. A touchscreen 'print' icon shall allow one touch printout of data trends in report or graphic format. The removable memory stick shall allow export and import of profiles, alarm files, audit trail files, and other data files. File utilities shall be available with the paperless recording option activated at the factory.
6. Independent, adjustable high and low alarm set points for temperature and humidity. Automatic alarms shall disable specific controlled devices (heaters, blowers, steam generators, etc), and shall trigger backup mechanical conditioning system operation. Operators shall be notified of alarms through a change to red screen background on the active screen, the activation of an audible alarm, the switching of a remote alarm contact set, and the creation of an alarm log with time, date, and type of alarm. Historical alarm logs shall be available with the paperless recording option activated at the factory.
7. Independent time delay action for each alarm parameter. Alarm action delays and audible alarm delays shall each be adjustable from 0 to 60 minutes in 1 minute increments. 'Common alarm' contacts shall activate after alarm action delay (Form C relay - N.O. and N.C contacts shall be provided).
8. "Intelligent" adaptive defrost timer; time-or-temperature initiated, and time-or-temperature terminated. By sensing chamber coil temperature, the timer shall minimize temperature rise due to a defrost cycle. The adjustable fan time delay or an evaporator coil temperature sensor shall terminate the defrost cycle and pre-cool the evaporator coil to an operator selected temperature before re-energizing the fans. Defrost shall be automatically disabled through either a user set coil temperature above freezing, or by exceeding a maximum chamber temperature rise setpoint.
9. "Intelligent" enabling/disabling of humidification and dehumidification. Humidification shall be disabled below freezing, and dehumidification shall be disabled at factory-selected conditions where drying is not required.

10. Adjustable electric heater on-delay. A percent-delay setting shall allow the electric heat to stage in earlier or later depending upon heat demand and control capability of the refrigeration hot gas.
11. Solid state, "zero switching" outputs, for refrigeration and humidity control. Zero switching outputs shall prevent radio frequency interference. Standard solenoid or solid state relay cycling shall be provided on an adjustable time base of 4 to 32 seconds.
12. Proportional control valve outputs for refrigeration control. Control shall be provided by 4-20 mA DC.
13. Ethernet connectivity shall be provided by an RJ-45 modular connector for cable. This shall allow for remote viewing of chamber process variables and alarms through a web browser. These shall include: actual temperature, actual humidity, process setpoints, and system alarms with name and date/time of alarms. Data shall be "read only", and the internal stored data shall not be alterable.
14. Ramp/soak profile capability through drop down menus. Up to 99 steps with cycle repeats shall be available to provide a virtually unlimited number of profile steps and unlimited number of profiles (programs). Setup of each profile shall require desired setpoints, event output state, ramp/soak times, and number of cycles. Help menus shall provide assistance as needed. Multiple profiles shall be nameable and stored on the internal memory card for future use. The profiles shall also be configurable to start at a specific time and day of month.
15. Remote monitoring capability provided via 4-20 mA DC scaled outputs. Monitoring and control shall also be provided via RS-485 Modbus communication protocol. These options shall provide access to all user-selectable parameters and measured values, as well as file transfer and viewing of collected data.

C. Recorder

1. The CCS-3000 (basis of design) control system shall provide electronic recording of temperature and humidity parameters and setpoints. Recorder data transfer shall be performed by USB port memory stick or USB port printer download.
2. A circular chart recorder shall be provided to record the temperature and humidity within each chamber. The recorder shall feature a pre-printed 10" (250 mm) diameter chart with switch selectable 8 hour, 24 hour, or 7 day chart rotation.
3. A circular chart recorder shall be provided to record the temperature and humidity within each chamber. The recorder shall feature a self-draw 12" (300 mm) diameter chart with fully programmable chart rotation.

D. Temperature Sensor

1. A hermetically sealed platinum 100 OHM RTD temperature sensor probe shall be provided for the chamber, and shall be located as shown on the Drawings.

E. Humidity Sensor

1. A solid-state variable capacitance sensor shall be provided for the chamber, and shall be located as shown on the Drawings.

F. Temperature and Humidity Alarm Indications

1. Common temperature and humidity alarms shall be provided for the chamber. The alarms shall be audible and visual, and shall deactivate the appropriate conditioning system components in the event of a high or low alarm condition. The high and low activation points

shall be user programmed in the control system, along with programmable delay periods for action and audible alarm silence.

G. Temperature and Humidity Alarms Interface

1. High and low temperature and humidity alarms shall be annunciated on a SPDT common alarm relay. The high and low alarm events shall be monitored by a remote data collection system. Connections shall be by others.

H. Temperature and Humidity Conditions Interface

1. Monitoring and control of chamber temperature and humidity conditions shall be provided by digital communication capability provided within the control system. The communication type shall be RS-485, and shall follow industry standard Modbus RTU protocol. Connections shall be by others.
2. Remote monitoring of chamber temperature and humidity conditions shall be provided by analog communication capability provided within the control system. The communication type shall be 4-20 mA DC, with full range scaling capability for a remote data collection system. Connections shall be by others.

I. Uninterruptible Power Source (UPS) Backup

1. In the event of a power failure, an automatic (20) minute back-up shall be provided for each control panel controls circuit, including alarms, controllers, and recorder. Refer to individual equipment specifications.

2.5 MECHANICAL DESIGN

A. Refrigeration System: Provide each room with the type and quantity of mechanical cooling systems specified herein. The refrigeration systems shall be an integral part of the control and conditioning system. Condensing units shall be located as indicated on the drawings, with piping and wiring extending to and from the Cold Room and its control panel. All piping and wiring between remote components and rooms shall be installed by the manufacturer of the environmental chamber system.

1. System shall be of the industrial type designed to operate continuously when selected by the control system. Provide all components necessary to accomplish effective, efficient, serviceable installation. System shall consist of, but not be limited to, semi-hermetic compressor, heated and insulated receiver, oil separator for pipe runs over 50 ft., air cooled condenser, evaporator, moisture indicating sight glass, liquid filter-drier, adjustable dual pressure controls, suction accumulator, suction line filter, liquid and hot gas solenoid valves, expansion valve (s), oil level sight glass, manual shut-off valves for suction, hot gas and liquid lines at both condensing unit and evaporator, condenser pressure regulating devices and all interconnecting piping and wiring. All system components shall be listed and approved for operation in the environment in which they are installed.
 - a. Compressor: Heavy duty industrial type, semi-hermetic design, with pressure, current and temperature safety devices, oil level sight glass, suction and discharge service valves. Install with vibration absorbers on suction and discharge lines and compressor vibration absorbing mounts. Insulated clamps shall be used on suction and hot gas lines between condensing unit and evaporator. Provide Armacell Armafix, K-Flex or equal.
 - b. Liquid Refrigerant Filter-Drier: replaceable core type with three-valve arrangement that allows the core to be isolated and changed while the system remains in operation.

- c. Condenser Pressure Control: Flooded condenser type system with adjustable control point which maintains a constant head pressure. Provide differential pressure actuated bypass into receiver to maintain liquid line pressure.
 2. Provide hot gas and /or electric defrost controlled by the main control unit (as required) in the manner described previously to eliminate the temperature rise in the room associated with defrost under normal operation conditions as required to maintain chamber conditions. Manufacturer shall provide all necessary controls and interconnecting piping and wiring. All rooms with operating temperature ranges extending below +6°C (42.8°F) shall be provided with defrost controls to allow for operation of the room with temperature control only for extended periods of time in the case of dehumidifier failure.
- B. Refrigerant for each system shall be one of the following:
 1. R-404A
 2. R-507
 3. R-448A
 4. R-449A
- C. Humidifier: Provide humidifiers on rooms where required to meet specified performance. Humidifiers shall be electrically heated evaporative steam type suitable for continuous operation from a pressurized reverse osmosis water supply. Atomizing or spray type humidifiers are not acceptable. Basis of Design: BES KW series or equal.
 1. Unit shall have a vaporizing chamber which can be either cleaned or replaced at the service technician's option. The chamber and gasketed cover shall be fabricated from stainless steel with all seams heli-arc welded and passivated.
 2. Immersion heaters shall be Incoloy sheathed resistance type elements, mounted on the vaporizing chamber's removable cover. A cut-off device with manual reset shall de-energize the heating element if evaporating chamber temperature exceeds a safe limit.
 3. A water level control system shall maintain the water level in the humidifier at the proper level. Provide a low water cut-off device which de-energizes the heaters when water level is too low.
 4. The humidifier shall be capable of operating continuously without having to periodically drain and refill.
- D. Dehumidifier: Provide dehumidifiers for rooms where required to meet specified performance. The dehumidification system design and capacity selection shall be the responsibility of the environmental chamber system manufacturer. The system shall meet the requirements specified in this section and shall be coordinated fully with surrounding work and the building operation. Provide all interconnecting wiring, ductwork and insulation. Provide reactivation air ductwork and insulation to the outdoors. Acceptable Manufacturers: Munters Cargocaire or equal.
 1. General Description: Automatic, continuous duty, dry desiccant type for continuous, unattended operation. The dehumidifier shall be completely factory assembled, wired and tested. It shall be self-contained and shall include a rotary cylinder type desiccant drum assembly filled with chemical desiccant. The dehumidifier shall be complete with a process air fan and motor, reactivation air fan and motor, drum drive system, electric reactivation air heating system, access panels, filters and controls for complete automatic operation.

2. Construction: Construct dehumidifier of corrosion resistant materials and provide access panels which are designed to allow complete internal inspection and servicing of the desiccant drum and drive assembly. Provide priming and painting consistent with corrosion prevention standards. Construct casing air and vapor tight throughout.
 3. Desiccant: Charge desiccant shall be high absorption capacity silica gel or activated alumina.
 4. Electrical: Provide electric control panel mounted on, or integral to, the cabinet which shall house the motor starters, overload protection devices, unit pilot lights, control relays, switches, safeties and all protective fuses and necessary components to insure continuous, safe, automatic operation.
 5. Process Air Cooling: Provide each dehumidifier with its own independent cooling system. The cooling unit shall condition the dehumidified outlet air to the room set point prior to discharge from the unit. An automatic temperature controller shall be housed in the main control panel and shall automatically derive its set point from the main control unit, negating any need to manually adjust the temperature on the dehumidifier. The cooling system shall meet all refrigeration system requirements of this section.
- E. Refrigerant Piping: Refrigerant piping shall be hard drawn Type L AC& R grade copper with silver brazed joints. Brazing material shall be 15-55% sil-phos or silver solder. Utilize only cleaned and capped pipe lengths which are specifically manufactured for refrigerant duty. All brazing shall be performed while using a low pressure nitrogen gas purge for system cleanliness.
- F. Insulation for refrigerant lines: Suction and hot gas lines shall be insulated with closed cell flexible foam plastic. "Armaflex" or equal. The material shall be tubular in form and sized properly for the pipe being insulated. Install in accordance with insulation manufacturer's recommended practices. Bond joint thoroughly using the adhesive recommended by the insulation manufacturer and using 3-piece elbows. Suction lines shall be insulated with minimum 1-1/2" (38mm) wall thickness insulation and hot gas lines with 3/4" (19 mm) wall thickness insulation.

2.6 REFRIGERATION AND HUMIDITY SYSTEMS:

- A. The refrigeration system shall be an integral part of the control and conditioning system. Refrigeration equipment shall be located as indicated on the contract drawings. All piping and wiring between remote components and rooms shall be installed by the manufacturer of the environmental chamber system except that any coring through walls or floors not of insulated panel construction described above shall be provided by others. Final connections to building utilities shall be made by the subcontractor responsible for the installation of the utility rough-in.
- B. System shall be of the industrial type designed to operate continuously. Provide all components necessary to accomplish effective, efficient, serviceable installation. System design, sequence of operation; capacity and layout shall be subject to the approval of the COTR. System shall consist of, but not be limited to the following:
1. Semi-hermetic compressor.
 2. Air-cooled condensing unit.
 3. Heated and insulated receiver.

4. Evaporator in accordance with specifications above.
 5. Moisture indicating sight glass.
 6. Liquid refrigerant filter-drier, replaceable core type with bypass ball valves.
 7. High and low pressure controls.
 8. Crankcase pressure regulator.
 9. Crankcase heater.
 10. Combination suction accumulator/heat exchanger.
 11. Suction line filter, replaceable core type.
 12. Liquid and hot gas solenoid valves.
 13. Hot gas flow modulator.
 14. Expansion valves.
 15. Liquid injection devices and controls (if required for good system design).
 16. Manual liquid and hot gas shut-off valves.
 17. Oil pressure sensing and safety cut-off valves (for compressors with external oil pumps).
 18. Phase loss protection circuit and indicator light.
 19. 2-valve head pressure control system.
 20. Thermal overload protection for compressor motor.
 21. Necessary starters (DP contactors acceptable) and other electrical items required for operation.
 22. Isolation ball valves at condensing unit and evaporator.
- C. Condensing units shall be mounted on vibration isolators, racked two units high, and be grouped in a manner which is logical and functional for the intended application and subject to approval by the COTR. All components of the system shall be applied in a manner that is in accordance with the component manufacturer's recommendation.
- D. Refrigeration Piping Materials and Methods: All refrigerant piping shall be ACR hard drawn tubing, factory cleaned, dehydrated and capped. Insulation shall be closed cell Armaflex, minimum wall thickness 1-1/2" (38mm) and 3/4" (19 mm) respectively. Insulate all hot gas and suction lines. All vertical suction risers shall have traps installed at 10 foot (3048 mm) intervals. Piping shall be supported in accordance with the requirements of the general mechanical specifications and the requirements as stated in this specification.
- E. Defrost on all rooms shall be by timed bypass of compressor discharge gas to the evaporator and electric heating elements as required to maintain chamber conditions. Manufacturer shall provide all necessary controls and interconnecting piping and wiring. Set defrost initiation time and duration for each room so that temperature increase is minimized while achieving complete removal of accumulated frost. Coordinate defrost times of various systems within a single room so that at least one system is always online.

2.7 HUMIDIFICATION SYSTEM (ARCHIVAL STORAGE CHAMBERS):

- A. Humidifier(s) shall be of the dry type wherein the entrained condensate is removed from the steam.

- B. Steam shall be admitted to the air stream by means of a stainless steel dispersion tube of length as required to meet the performance requirements.
- C. Humidifier shall be provided with fill and drain valves, water level control devices, automatic drain down system and safety shutoff.
- D. Dispersion tubes shall be provided with discharge openings located 1-1/2" (38 mm) on center over the entire length of the tube. These openings shall contain replaceable, press fit, brass inserts having drilled orifices properly sized by manufacturer to pass the specified steam quantity in a uniform pattern along the entire length of the tube. These openings shall be aimed up and down alternately to provide a "V" pattern of steam dispersion.
- E. Manufacturer shall provide properly sized and configured humidifier(s) to achieve operating parameters of each system.
- F. R.O. Unit: Shall be provided to remove ionized salts, colloid and organic molecules down to 100 molecular weight. The system operation shall be completely automatic with pressure switches, inlet/outlet pressure gauges, flow regulator, pressure regulator, filter change out cartridge, and storage tank. Capacity shall be 15 gallons per day (GPD) generating minimum 0.8 gallons per hour (GPH) at 25 PSIG. The quality of the water required minimum hardness shall be less than 20 PPM, resistance 25 K-OHMS to 15,000 K-OHMS. Chlorides shall be less than 20 MG/L. Unit shall be located above the chamber adjacent to humidifier boiler. RO unit supply water shall be piped with stainless steel to humidifier with shut off valve.

PART 3 EXECUTION

3.1 PREPARTION:

- A. Inspect construction prior to installation of controlled environment rooms and notify the COTR of defective or improper work affecting installation. Do not proceed with installation of controlled environment rooms until faulty work is corrected.

3.2 INSTALLATION:

- A. Install controlled environment rooms, acclimatization chambers and all attendant temperature and humidity conditioning equipment and controls in strict accordance with manufacturer's instructions and approved submittals.
 - 1. Connect rooms to emergency power system.
- B. Provide full-time supervision of installation as required under "Quality Assurance" specified above.
- C. Coordinate connections to building service to be performed under work of other specification sections.

3.3 COMPLETION:

- A. Perform start-up and field tests of each controlled environment room to verify proper operation of all components and systems. Notify the COTR in advance prior to start-ups and testing and perform in the presence of the COTR unless the COTR directs otherwise.

3.4 TESTING:

- A. General: Test each room in accordance with the procedure outline below. Deficiencies in performance or operation evidenced by the tests shall be remedied by the manufacturer and the room shall be retested.
- B. Refrigeration System Piping Testing:
1. Pressure test refrigeration system and piping with dry nitrogen charge to 250 PSIG for a period of 24 hours.
 2. Pressure shall not drop more than 2 PSIG after accounting differences due to temperature changes. A pressure drop of greater than 2 PSIG indicates a failed test.
 3. Pressure test start and completion shall be witnessed and signed-off by the NASM site supervisor or other personnel designated by the COTR.
- C. Refrigeration System Evacuation Testing:
1. Once pressure test (item B. above) has been successfully completed and signed-off, the dry nitrogen gas charge shall be bled off and a vacuum pulled on the entire refrigeration system. Evacuation shall be a minimum of either a triple evacuation or held for a minimum of 24 hours.
 2. Once vacuum has achieved a level of 500 microns (or better) for a minimum of at least 12 hours, the vacuum pump shall be isolated from the refrigeration system for a minimum of at least 20 minutes. After 20 minutes, the vacuum shall hold 500 microns or better in order to achieve a successful test.
 3. Evacuation test start, blank-off test start and completion of both shall be witnessed and signed-off by the NASM site supervisor or other personnel designated by the COTR.
- D. Operation Function Testing:
1. Simulate and verify all alarm and limit functions.
 2. Operate and verify all defrost functions and their coordination with other room functions.
 3. Verify operation of all specified functions and switches.
 4. Prepare a detailed written report indicating the step by step procedure used to perform tests. Indicate the specific results of each step.
- E. Performance Testing
1. Test all rooms for temperature control and uniformity specification compliance. Additionally, test for door opening recovery time, set point conversion and defrost temperature rise.
 2. Rooms with relative humidity control shall be tested for humidity control performance and recovery.
 3. Test instrumentation shall have documented accuracy sufficient to effectively test the rooms. Submit calibration report as evidence of accuracy. Resolution shall be 0.1°C or better for temperature, 1% for relative humidity.
 4. Test set points for temperature:

- a. Rooms with a temperature span (difference between highest and lowest operating temperatures) of 10 degrees or less shall be tested at the lowest selectable temperature set point only.
 - b. Rooms with a temperature span greater than 10 degrees, but less than 21 degrees, shall be tested at the highest and lowest set points in the range.
 - c. All other rooms shall be tested at the highest, lowest and midpoint operating temperature set points.
5. Test conditions for relative humidity:
 - a. Test rooms at their lowest specified relative humidity at the applicable test temperatures.
 6. Test rooms for automatic switchover to emergency power.
- F. Test Procedure:
1. Calibrate test instrument prior to performing tests for this project. Provide calibration report with testing documentation. Successful calibration shall have been performed within 1 year of the test date.
 2. Synchronize data logger system time with current real time at test location.
 3. Locate thermocouples throughout the chamber interior as follows:
 - a. 1 point at 12" (300 mm) above the floor surface, approximately in the center of the room. A second point 12" (300 mm) below the insulated panel ceiling surface or, if room is provided with a suspended ceiling, 3" (75 mm) below the finished ceiling.
 4. Locate minimum of 2 relative humidity sensors in the chamber interior. Sensors shall be located in the normal work zone of the chamber, at least 12 feet (3.6 m) apart.
 5. Test instrument shall be data logger type, with output resolution of 0.1 degree and 1% relative humidity. Data records, consisting of a reading of all sensor values at a point in time, shall be logged at maximum one minute intervals. All logged values shall be raw, with no averaging or other mathematical filtering.
 6. Initial test set point shall be lowest set point specified above under paragraph "Test set points for temperature". Operate room and record test data until room has stabilized and for at least 2 hours thereafter. If only one test temperature is required, extend test duration to 24 hours after stabilization.
 7. Second test set point, as applicable, shall be highest set point specified above under paragraph "Test set points for temperature". Record test data until room has stabilized, and for at least 2 hours thereafter.
 8. Third test set point, as applicable, shall be midrange set point specified above under paragraph "Test set points for temperature". Record test data until room has stabilized, and for at least 2 hours thereafter.
 9. Relative humidity test conditions, if applicable, shall be tested in conjunction with temperature test conditions whenever specified relative humidity test condition coincides with one of the temperature test conditions. Otherwise, operate room at highest and lowest specified relative humidity test conditions and record data for at least 2 hours after stabilization at each condition.
 10. Perform door opening recovery test at each test condition by opening the entry door fully for the specified time. Record the data logger system time at which the door was opened.
 11. Execute a defrost cycle at every test temperature which is below 43 deg F (6 deg C). Indicate in the report the time the cycle was started. Allow cycle to terminate automatically.

- G. Test Report: Submit written report documenting the performance of each test. Include all of the following:
1. Tabulated printout of logged data for completed testing sequence. Table shall indicate the real time of each data record, an identification tag for the sensor, the chamber set point conditions at the time of the data record, and the recorded sensor reading.
 2. Mark the date table to indicate the occurrence of events for which test is being conducted, such as change of set point, door opening, defrost cycle initiation and others as needed.
 3. Scale drawing of each room tested, illustrating sensor locations.

3.5 INSTRUCTION AND MAINTENANCE:

- A. Instruct Smithsonian Institution personnel in the proper use, operation and daily maintenance of controlled archival room systems. Review emergency provisions, including procedures to be followed at time of failure in operation and other building emergencies. Train SI personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions. Confer with the contracting Officer on requirements for a complete maintenance program. Provide two separate sessions of a minimum of 4 hours duration each as follows:
1. An operational training session for Smithsonian Institution staff.
 2. A maintenance training session for SI maintenance personnel.
- B. Make a final check of controlled archival room systems operation, with Smithsonian Institution personnel present, and just prior to date of Substantial Completion. Determine that conditioning and control systems and operating devices are functioning properly.
- C. Maintenance Service: Provide full maintenance service by skilled, competent employees of the installer for a period of 12 months following date of Substantial Completion. Include monthly preventative maintenance, performed during normal working hours. Include repair/replacement of work or defective parts or components and lubrication, cleaning and adjusting as required for proper operation in conformance with specified requirements. Exclude only repair/replacement due to misuse, abuse, accidents or neglected caused by persons other than installer's personnel.

3.6 PROTECTION:

- A. Protect completed controlled environment rooms and their climate control systems from damage by subsequent construction operations throughout the remainder of the construction period.

3.7 USE OF CONTROLLED ARCHIVAL ROOMS:

- A. Use of controlled archival rooms by Contractor or any construction personnel for storage of construction materials or any other purpose is strictly prohibited.

PART 4 – BIDDERS PREQUALIFICATION

4.1 EXPERIENCE/QUALITY COMPLIANCE:

- A. In order to assure the best quality product to NASM, all Bidders are required to provide a list containing a minimum of (5) successful Project completed within the past 5 years of Turnkey Archival Applications. The Project list submitted must be complete including Client name and detailed contact information.

4.2 FINANCIAL COMPLIANCE:

- A. In order to assure NASM of the Bidders financial ability to execute the project, all Bidders are required to provide a notarized letter of commitment duly signed by two Company Officials: Titled Chief Financial Officer or Company Treasurer and Chief Executive Officer or General Manager. The commitment letter must also include the Name of the Bonding Agency and confirmation of the amount in USD equivalent to the cost of the Project under Specification 13034. The validity term of the bond must be until the completion of the Project.

4.3 DISQUALIFICATION:

- A. NASM/NASM's assigned Representative reserves the right to reject Bidders due to noncompliance with clauses 4.1 and 4.2 above (noted within Part 4 of Section 13034).

END OF SECTION

SECTION 14 2400

HYDRAULIC ELEVATORS

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 hydraulic passenger elevators.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary use of elevators for construction purposes.
 - 2. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
 - 3. Section 042000 "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
 - 4. Section 055000 "Metal Fabrications" for the following:
 - a. Attachment plates and angle brackets for supporting guide-rail brackets.
 - b. Hoist beams.
 - c. Structural-steel shapes for subsills.
 - d. Pit ladders.
 - 5. Section 099123 "Interior Painting" for field painting of hoistway entrance doors and frames.
 - 6. Division 22 Section for sump pumps, sumps, and sump covers in elevator pits.
 - 7. Division 26 Section for telephone service for elevators.
 - 8. Section 28 3111 "Fire Detection and Alarm System" for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.

1.3 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.4 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment.
 - 2. Include large-scale layout of car-control station.
 - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
- C. Samples for Initial Selection: For finishes involving color selection.
- D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch- (75-mm-) square Samples of sheet materials; and 4-inch (100-mm) lengths of running trim members.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
- C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard two-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.10 WARRANTY

- A. **Manufacturer's Special Warranty:** Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: 1 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Basis-of-Design Product:** Subject to compliance with requirements, provide Otis HydroFit Holeless Hydraulic or comparable product by one of the following:
 - 1. Fujitec America, Inc.
 - 2. KONE Inc.
 - 3. Schindler Elevator Corp.
 - 4. ThyssenKrupp Elevator.
- B. **Source Limitations:** Obtain elevators from single manufacturer.
 - 1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. **Regulatory Requirements:** Comply with ASME A17.1/CSA B44.
- B. **Accessibility Requirements:** Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.
- C. **Certified Wood:** Plastic-laminate cabinets shall be made from wood products certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
1. Rated Load: 45,000 lb.
 2. Rated Speed: 100 fpm.
 3. Operation System: Single automatic.
 4. Auxiliary Operations:
 - a. Battery-powered lowering.
 5. Security Features: Keyswitch operation.
 6. Car Enclosures:
 - a. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
 - b. Car Fixtures: Satin stainless steel, No. 4 finish.
 - c. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish below handrail
 - d. Door Faces (Interior): Satin stainless steel, No. 4 finish.
 - e. Door Sills: Aluminum, mill finish.
 - f. Ceiling: Luminous ceiling.
 - g. Handrails: 1-1/2 inches (38 mm) round satin stainless steel, No. 4 finish, at sides and rear of car.
 - h. Floor prepared to receive resilient flooring.
 7. Hoistway Entrances:
 - a. Width: 180 inches (4572 mm).
 - b. Type: Single-speed side sliding.
 - c. Frames: Primed steel.
 - d. Doors: Satin stainless steel, No. 4 finish.
 - e. Sills: Aluminum, mill finish.
 8. Hall Fixtures: Satin stainless steel, No. 4 finish.
 9. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
 - b. Provide hooks for protective pads and one complete set(s) of full-height protective pads.

2.4 SYSTEMS AND COMPONENTS

- A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
1. Pump shall be tank-top-mounted type with fan-cooled, squirrel-cage induction motor, and shall be mounted on oil tank with vibration isolation mounts and enclosed in prime-painted steel enclosure lined with 1-inch- (25-mm-) thick, glass-fiber insulation board.
 2. Motor shall have solid-state starting.
- B. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.

- C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.
- D. Hydraulic Fluid: Nontoxic, biodegradable, fire-resistant fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives and approved by elevator manufacturer for use with elevator equipment.
 - 1. Product: Subject to compliance with requirements, provide "Hydro Safe" by Hydro Safe Oil Division, Inc.
- E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- F. Car Frame and Platform: Welded steel units.
- G. Guides: Roller guides; polymer-coated, nonlubricated sliding guides; or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.
- B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
 - 1. Single-Car Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 - 2. Independent Service: Keyswitch in car-control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.
- C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
 - 1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control stations and hall push-button stations. Key is removable only in deactivated position.

2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

- A. General: Provide steel-framed car enclosures with nonremovable wall panels, with car roof, access doors, power door operators, and ventilation.
1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
1. Subfloor: Exterior, underlayment grade plywood, not less than **5/8-inch (15.9-mm)** nominal thickness.
 2. Floor Finish: Specified in 09 6519- - Resilient Tile Flooring.
 3. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 4. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to **1/2-inch (13-mm)** fire-retardant-treated mdf with plastic-laminate panel backing and wood edge trim. Panels have a flame-spread index of 75 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range.
 5. Fabricate car with recesses and cutouts for signal equipment.
 6. Fabricate car door frame integrally with front wall of car.
 7. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 8. Sight Guards: Provide sight guards on car doors.
 9. Sills: Extruded metal, with grooved surface, **1/4 inch (6.4 mm)** thick.
 10. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
 11. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
1. Primed-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied, rust-resistant primer for field painting.
 2. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than **3 inches (76 mm)** high, on both inside surfaces of hoistway door frames.
 3. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 4. Sight Guards: Provide sight guards on doors matching door edges.
 5. Sills: Extruded metal, with grooved surface, **1/4 inch (6.4 mm)** thick.

6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers or LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
 1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 283111 "Fire Detection and Alarm System"
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push-Button Stations: Provide one hall push-button station at each landing.
 1. Provide manufacturer's standard wall-mounted units.
 2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
- G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:
 1. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
- I. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above hoistway entrance at ground floor. Provide units with flat faceplate for mounting and with body of unit recessed in wall.
 1. Integrate ground-floor hall lanterns with hall position indicators.
- J. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal

that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

- K. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

- A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- E. Stainless-Steel Bars: ASTM A 276, Type 304.
- F. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
- G. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, Alloy 6063.
- H. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Install piping above the floor, where possible. Install underground piping in casing.
- E. Lubricate operating parts of systems as recommended by manufacturers.
- F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- G. Leveling Tolerance: **1/4 inch (6 mm)**, up or down, regardless of load and travel direction.
- H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- I. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
 - 1. Place hall lanterns either above or beside each hoistway entrance.
 - 2. Mount hall lanterns at a minimum of **72 inches (1829 mm)** above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for elevator used for construction purposes:
 - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - 2. Provide strippable protective film on entrance and car doors and frames.

3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).
- B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 1. Perform maintenance during normal working hours.
 2. Perform emergency callback service during normal working hours with response time of two hours or less.
 3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION