



Smithsonian Institution Facilities Design Standards

January 2012



Smithsonian Institution

Smithsonian Institution Facilities Design Standards

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Office of Engineering
Design and Construction



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Introduction

These standards apply to all design, construction, maintenance and repair projects at all facilities of the Smithsonian Institution. These standards may require adapting to local codes and regional conditions for projects outside of the Mid-Atlantic United States. Any deviation from these standards shall be submitted to OEDC and OFMR for review and approval. (See General Requirements Section II for more information.)

The Design Standards are organized according to the Construction Specifications Institute MasterFormat 2004, Division 02 through Division 33, which follow the initial General Requirements section. Designers shall determine applicable standards by reviewing all divisions that will be included in their project specifications. Those responsible for review of design documents shall refer to each applicable section of the standards found in the designers specifications to verify compliance with the SI requirements.

These standards supplement but do not replace other SI standards, guides, instructions, and specifications, as referenced in the Smithsonian Institution Office of Facilities Engineering and Operations (OFEO) Codes, Standards and Guidelines, latest edition. These new standards shall be used in conjunction with the current existing SI OPS standards, OSHM standards, OCIO standards, historic preservation policy standards, accessibility standards, and the A/E Special Conditions for Services. The above standards may be viewed at the OFEO A/E Center Website.

These standards establish the required quality of design and construction to assure thoroughness and completeness of the project design, to require that all options are properly investigated and considered, and to assure conformance to the SI's policies and procedures. These standards provide the criteria to follow and methodology to use to help unify, supplement, and standardize the approaches for designing and equipping SI facilities.

Although the Smithsonian is not an Executive branch of the U.S. Government, the Institution is committed to the strategic objectives and goals of Federal energy and environmental mandates, standards, and guidelines to the fullest extent practical. The SI OFEO Codes, Standards and Guidelines, latest edition, shall be referenced for relevant Federal requirements. In addition, Smithsonian Institution Sustainability Plans, latest editions, shall be consulted for updated Smithsonian sustainability policies.

General Requirements

I. Applicable Codes, Standards and Guidelines

- 1.01 These design standards shall be used in conjunction with and cross checked with the current existing SI OPS standards, OSHM standards, OCIO standards, historic preservation policy standards, and accessibility standards. Refer to the Smithsonian Institution, Office of Facilities Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a complete list of codes, standards and guidelines. This list is available on the OFEO A/E Center Website (www.ofeo.si.edu).
- 1.02 Review applicable programmatic requirements based on facility location, master plan development, landmark status, site security or educational mission requirements that may be part of larger site context requirements. For example, all projects on the National Mall shall incorporate approved precinct studies/criteria developed by/for the Smithsonian Institution into building and site design. These include, but are not limited to: Site Security – Smithsonian Institution Security Design Criteria, Exterior Signage Master Plan, Smithsonian Institution Water Reclamation Study, Mall Streetscape Manual, Monumental Core Framework Plan, Smithsonian Institution Master Plans, Smithsonian Institution Fire Protection Master Plans, and Smithsonian Mall-Wide Perimeter Security Master Plan. Any future projects that do not follow approved precinct studies/criteria may require approval and NEPA/Section 106.
- 1.03 The A/E shall be responsible for identifying and obtaining all required approvals and permits from Federal, State, and local jurisdictions having authority over the project site.
- 1.04 Review applicable local site requirements that may influence site improvement activities including, but not limited to: historic preservation, stormwater management, landscape and tree preservation ordinances, water usage, open space, plaza area, and streetscape requirements. Verify security, planning and zoning requirements; including setbacks, visual impact assessment, amelioration and rooftop treatments. Confirm property issues including adjacencies to other properties, right-of-way, easements, utility requirements which include location of site connections, vault placement, or locational easements, and illumination (photometric) and energy requirements pertaining to site lighting.
- 1.05 The National Institute of Building Sciences (NIBS) Whole Building Design Guide is a source of information for building-related guidance, criteria and technology for Federal Facilities from a 'whole buildings' perspective (www.wbdg.org).

II. General

- 2.01 The design shall be in accordance with the Smithsonian Institution Special Conditions for Architect/Engineer Services, which is available on the OFEO A/E Center Website. Where a conflict occurs between the A/E Special Conditions and these Design Standards, generally the most stringent requirement will apply. The A/E shall discuss any potential conflict with the OFEO Design Manager to reach a resolution.
- 2.02 Any proposed deviations from these Design Standards must be submitted for Smithsonian internal review, including the Office of Engineering Design and Construction (OEDC) Engineering and

Design Division Associate Director and the Office of Facilities Management and Reliability (OFMR) Systems Engineering Division Associate Director, and any other affected OFEO or Smithsonian units, at the discretion of these two Associate Directors. In considering deviations, implications such as cost and/or schedule impacts on the project will be evaluated. Any deviation from these Design Standards requires the approval of the Smithsonian OEDC Engineering and Design Division Associate Director.

- 2.03 Every project begins on land that has been disturbed in some way by human intervention. The antecedent history and use of the land forms part of its current condition and future best use. Historic design and plan materials and antecedents should be consulted to inform new design. When deemed applicable by the Design Manager, a Cultural Landscape Report prepared to Department of Interior standards may be required if not available, and its results and recommendations will underpin any new design work. This analysis should be completed and understood as part of the project record before proceeding into design.
- 2.04 When deemed applicable by the Design Manager, a site analysis, to include program description, microclimatic data, staff and visitor, delivery and other functions, specifically requested design elements and other special requirements associated with the site may be required before proceeding into design. Urban and local context conditions – even those that impinge from off-site – should be considered and annotated before proceeding into design. Site analysis should identify code and other regulatory frameworks that will likely apply to the project outcome. This analysis should be completed and understood as part of the project record before proceeding into design.
- 2.05 Coordinate building and facility needs and these site requirements to optimize use of exterior space, water, energy and other utility requirements. Maximize fulfillment of programmatic requirements and facility mission by considering exterior space, site planning strategies and plantings as an extension of the facility for staff and visitor amenities, exhibition space, and work space.
- 2.06 Integrate site planning strategies to maximize building function, reduce energy consumption and optimize existing resources such as stormwater, existing vegetation and soils.
- 2.07 It is recommended that constructability issues should be considered throughout the design process.
 - A. This is especially important for projects that do not appear to have any specific site improvement requirements. Be sure to identify full requirements for construction access as well as material and equipment staging and storage. Often building-only projects require exterior space for trailers, laydown and delivery of materials, and non-public contractor traffic. These requirements often impact critical outdoor spaces and potentially critical cultural and historic landscape resources by compacting and contaminating soils, disturbing existing site features and vegetation, or requiring the protection of existing site features including pavements, walls, lights, and other site elements. When appropriate include a protection plan and a construction staging schedule to avoid these potential impacts.
- 2.08 For projects that require exterior space disturbance or site improvements, refer to Section VIII Site Requirements.

- 2.09 The optimization of performance and function, ease of maintenance and life cycle shall be a basic directive for design detailing and overall design – optimizing work effort and operations, maintenance materials, repair and replacement with respect to the intended design, over the established life of the project. It is recommended to integrate maintenance considerations early in the design process in order to inform critical design and material decisions. Meaningful collaboration of maintenance and design teams will produce more resilient, attractive, and cost effective designs.
- 2.10 These Design Standards apply to all Smithsonian facilities. However, since these standards have been developed and based upon environmental conditions in the Mid-Atlantic United States, for design and construction projects located outside the Mid-Atlantic region, it may be necessary to adapt the standards to local environmental conditions, as well as local codes.
- 2.11 These Design Standards apply to the National Zoo. However, animal facilities and exterior habitats have unique requirements that these Design Standards do not address; therefore, close coordination with Smithsonian design staff and National Zoo animal experts will be required for design of animal facilities. The designer may obtain standards for animal safety and animal facilities from the Zoo. Projects at the National Zoo must coordinate with all concerned departments, which include, but are not limited to: Planning & Strategic Initiatives, Horticulture, Exhibits, and Animal Programs.
- 2.12 Rehabilitation of historic buildings shall utilize best practices and technologies in retrofitting to promote long term viability of the buildings and reduce deterioration of the building structure.
- 2.13 The design of alterations to Smithsonian historic buildings shall adhere to the Secretary of the Interior's Standards for historic preservation. Refer to Smithsonian Directive 418 SI Historic Preservation Policy for guidance on historic preservation projects. A number of SI facilities have a Historic Structures Report, which identifies important historic spaces in the building and the historic character-defining elements.
- 2.14 All new construction, exhibits, barrier removal, alterations, repair and restoration of facilities and grounds, whether owned or leased by the Smithsonian, must adhere to the Smithsonian Guidelines for Accessible Design (SGAD), latest edition, which includes the Smithsonian Guidelines for Accessible Exhibit Design (SGAED) and the SI Checklist for Accessible Information Desks, and incorporates both the Department of Justice (DOJ) ADA Standards for Accessible Design and the General Services Administration (GSA) Architectural Barriers Act (ABA) Accessibility Standards for Federal Facilities.
- 2.15 Fundamental commissioning (as defined by the LEED rating systems) of all relevant design and construction projects is required, even if the project is not eligible to pursue LEED certification. Enhanced Commissioning (as defined by the LEED rating systems, including the requirement for a third party commissioning provider) is required for larger projects pursuing LEED certification, based on the size and complexity of the project.
- A. The Smithsonian may develop the Owner's Project Requirements (OPR) related to commissioning for a given project and provide it to the Architect/Engineer (A/E) with the A/E Scope of Work or program statement when requesting a fee proposal for design services for a given project. Alternatively, the Smithsonian may require the A/E team or the third party Commissioning Provider to assist in developing the OPR for a given project as part of Pre-Design services.

- 2.16 Life Cycle Cost Analysis for a given project, including total owning and operating cost, shall be submitted to the Smithsonian for evaluation. Building system and large component design shall be evaluated on the total owning and operating cost based on at least a 20-year design analysis. Refer to the Special Conditions for Architect/Engineer Services and the Architect/Engineer Scope of Work for a given project for specific deliverable requirements.
- A. Refer to Section VIII Site Requirements for incorporation of life cycle considerations for exterior spaces.
- 2.17 Design of any new Smithsonian building and landscape to be located on the National Mall or any proposed change to the exterior of any existing Mall building and landscape will be reviewed by the Federal agencies, the National Capital Planning Commission (NCPC) and the Commission of Fine Arts (CFA), as well as by the DC State Historic Preservation Office. In addition to Mall facilities, NCPC will review designs for all SI facilities within the National Capital Region.
- A. District of Columbia (DC) projects whose design or construction process includes changes impacting pedestrian and vehicular traffic may require review by the District Department of Transportation (DDOT) and/or the National Park Service (NPS), coordinated by Smithsonian Facilities Master Planning, depending on jurisdiction over streets and sidewalks.
- 2.18 During the planning process, environmental documentation shall be prepared for projects in accordance with the requirements of the National Environmental Policy Act. The design must implement specific mitigation measures listed in the Environmental Assessment Statement (EAS) or in the Environmental Impact Statement (EIS).
- 2.19 The Smithsonian has issued Risk Assessment Reports for many SI facilities. These reports contain specific recommendations for risk mitigation.
- 2.20 The standards listed above in this section apply to new construction and major renovation projects. These standards may apply to some repair and maintenance projects.

III. Quality Requirements

- 3.01 Building and Site Quality Level shall have a direct correspondence to the type of building or site, its primary purpose and function, and its anticipated service life expectancy. The four categories of building by function are:
- | | | |
|----|-----------|--|
| A. | Principal | Major, monumental buildings of historic significance and characterized by very long service life (100 years+). |
| B. | Support | Buildings of long service life of 50-100 years that support staff and related activities. |
| C. | Service | Buildings with a service life of 25 to 50 years that support service and maintenance functions. |
| D. | Research | Special conditions based on usage. |

- 3.02 All equipment shall be new unless the project scope identifies equipment to be reused. All new equipment shall be of the best quality and the latest design with proven technology, available for the application, and be inspected prior to delivery to the job site to ensure freedom from defects in workmanship and materials.
- A. All equipment and products specified and installed shall be standard items of production having not less than three years proven successful field experience which involved operation or usage under conditions equivalent to those of the project on which they are applied.
 - B. All equipment shall be specified and installed strictly in accordance with manufacturer's recommendations.
- 3.03 Materials and finishes shall meet performance criteria established in the Design Standards. The criteria are based on industry standards for museums and other large public buildings with high visitation. The criteria address design, durability, ease of maintenance, and safety issues.
- A. The A/E shall provide manufacturers' cut sheets and "third party certification" to substantiate performance claims.
 - B. Areas of concern include but are not limited to: hardness, durability, wear, use of recycled materials, ease of replacement, fire properties (flame spread, smoke development), coefficients of friction, UV protection, permanence of colors, effects of natural and artificial light, indoor air quality, low VOC content, cleaning solvents and best maintenance practices for each proposed material and finish.
 - C. To the extent possible, materials that are energy efficient shall be used, where such materials meet the user's performance requirements.
 - D. Asbestos-containing products of any kind shall not be specified or used.
 - E. Lead-containing materials, including finishes, coatings or paints, shall not be specified or used.
- 3.04 To the extent possible, consider existing soils, vegetation, and site hydrology as resources to be preserved, conserved, and enhanced through design strategies, the development of performance criteria systems selection and assembly, and materials selections. See further guidance under Section VIII Site Requirements.

IV. Sustainability and Energy Performance Requirements

- 4.01 The Smithsonian Directive 422 Sustainable Design of Smithsonian Facilities affirms SI's commitment to environmental stewardship by incorporating principles of sustainability and energy efficiency into all its building projects.
- 4.02 Although the Smithsonian Institution is not an Executive branch of the U.S. Government, the Institution is committed to the strategic objectives and goals of Federal energy and environmental mandates, standards, and guidelines to the fullest extent practical. The SI OFEO Codes,

Standards and Guidelines, latest edition, shall be referenced for relevant Federal requirements. In addition, the Smithsonian Institution Sustainability Plans, latest editions, shall be consulted for updated Smithsonian sustainability policies.

- 4.03 As of the publication of this document, the Federal energy and environmental mandates, standards, and guidelines include those referenced below. Refer to Appendix A, Smithsonian Sustainability Requirements Related to Design and Construction, dated 2011-03-09, for a summary of specific requirements extracted from several of these Federal sources that relate directly to design and construction.
- A. Public Law 109-58 - Energy Policy Act of 2005
 - B. Public Law 110-140 - Energy Independence and Security Act of 2007 (EISA 2007)
 - C. Executive Order 13101: Greening the Government through Waste Prevention, Recycling, and Federal Acquisition
 - D. Executive Order 13221 - Energy Efficient Standby Power
 - E. Executive Order 13423 - Strengthening Federal Environmental, Energy, and Transportation Management
 - F. Executive Order 13514 – Federal Leadership in Environmental, Energy, and Economic Performance
 - G. Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding
 - H. 10 CFR 434 - Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings
 - I. 10 CFR 435 - Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal Buildings
 - J. 10 CFR 436 - Federal Energy Management and Planning Programs
 - K. 42 USC Chapter 91 - National Energy Conservation Policy
- 4.04 The Smithsonian Institution has set goals for Leadership in Energy and Environmental Design (LEED) certification for eligible new construction, major renovation, and interior renovation projects, as well as selected existing buildings. New construction and major renovation projects with construction budgets greater than or equal to \$2.5 million, but less than \$5 million, will have a goal of LEED Silver Certification. Projects with construction budgets equal to or greater than \$5 million will have a goal of LEED Gold Certification. Eligible projects with construction budgets less than \$2.5 million shall have a goal of becoming LEED Certified.
- A. All projects pursuing LEED certification must be registered on the LEED online system no later than by the 35% Design Submission milestone date.

- 4.05 Projects that do not pursue LEED certification, such as exhibitions, nevertheless shall follow the sustainability goals of the Smithsonian and follow the best practices and recommendations cited in LEED regarding sustainable design.
 - A. Wherever possible, in exhibition construction the reconditioning and reuse of existing equipment and furniture shall be encouraged, as well as the use of low VOC, recycled or locally sourced materials and of energy-saving lighting and equipment.
- 4.06 Sustainable land design, construction, and maintenance practices shall be the foundation of all new design work.
 - A. For projects with a site work component, incorporate Sustainable Sites Initiative (SITES) principles as applicable and appropriate.
 - 1. Adoption of site specific metrics from (SITES) for tracking specific sustainable site practices is strongly encouraged to ensure tracking which may be missed through LEED point systems. The SITES tracking should be seen as parallel to and complementary to LEED tracking.
- 4.06 Consider site design strategies that demonstratively reveal healthy functioning and sustainable site ecological systems. Utilize on-site interpretive materials to highlight environmentally sensitive practices. This may include maps, models, or brochures that explain sustainable features or processes, operations, and maintenance.
- 4.07 Consider materials and products that minimize resource use and decrease damage to the environment caused by material harvesting, production, installation, and use.
- 4.08 Sustainable strategies and products are ever evolving. Consider new approaches and technologies that might more effectively meet the goals and standards of the project.

V. Design Requirements

- 5.01 The design shall be in accordance with the SI A/E Special Conditions.
- 5.02 The Smithsonian Directive 111 Metrication requires that measurements shall be in the Metric system. Any decision to deviate from this requirement must be made by the OEDC Director and the OPDM Director and will be made on a case-by-case basis.
- 5.03 The A/E shall prepare the Systems Design Narrative and the Design Analysis Book, including calculations and fixture cut sheets, when appropriate for the project and when required by the A/E Scope of Work.
- 5.04 All design projects are required to complete a check list for each discipline's services (i.e. Architectural Services, Mechanical Services, Plumbing Services, Electrical Services, Fire Protection Services, etc.) at each submission of the Design Development as part of the SD-410 review. Refer to the SI A/E Special Conditions and the OFEO A/E Website.
- 5.05 Each new facility or major renovation of an existing facility shall be designed so that all components comprise an integrated solution that works in conjunction with specific building

programs, so that operation of the facility, energy usage and other criteria may be optimized. Be sure to include into the project full integration and optimization of site improvements if they are required. See Section VIII Site Requirements for further guidance.

VI. Building Space Requirements

- 6.01 The mechanical system shall be considered an essential element of each building with adequate space allocated for it and in a manner that will permit installation of a well designed system capable of being operated and maintained.
 - A. Provide a minimum of four (4) percent of each floor's gross floor area for air-handling equipment. Where additional equipment is required, additional space on that floor must be provided. Provide a minimum of one (1) percent of the building's gross area for the central heating and cooling plant (location to be agreed upon during the preparation of the concept submission).
 - B. Space shall be planned around each piece of equipment based on the manufacturer's recommendation, at the minimum per code, or the space required for service, whichever is the greatest.
- 6.02 The Fire Control Center (FCC) shall be located near the designated entrance in each building.
- 6.03 The Smithsonian Space Guidelines, latest edition, provide space standards for offices.
- 6.04 Collections storage rooms shall be dedicated to the purpose of storage of collections per the OSHM Fire Protection and Life Safety Design Manual requirement.
 - A. It is recommended that related activities, such as the processing, research and conservation of objects, take place in collections spaces adjacent to the storage rooms.
- 6.05 For planning purposes, a 3657-mm (12 ft.) cube shall be used to determine the space requirements for the loading dock area, the freight elevator and collections corridors.
 - A. This space requirement allows for movement of collections objects through the building.
- 6.06 Separation between public spaces and non-public, more secure spaces shall be a planning consideration for new museum facility and major renovation projects.
 - A. Public areas such as the lobby, loading dock, mail room, garage, and retail areas must be separated from more secure areas.
 - B. Refer to the SI Security Design Criteria document for more detail about required levels of security separation within a building.
 - C. Public use spaces, such as exhibition halls, conference centers, auditoria, IMAX theaters, and food service areas must be separated from other areas of the building during public events held after hours.
- 6.07 Spatial requirements for museum entrances and lobbies shall reflect program, security and egress requirements, including the following:

- A. Lobbies must accommodate security desks and magnetometers for visitor screening.
 - 1. Allow space for the visitor queue inside the lobby in front of inspection stations.
 - 2. The layout of the lobby will be based on the assumption that all desks and equipment are movable.
 - 3. The location of screening equipment shall not restrict emergency egress nor reduce the available egress width.
 - B. Lobbies also must accommodate visitor information (VIARC) desks.
 - C. Space for the visitor queue outside the entrance doors shall be considered during the planning and design of new museum facilities and major renovations.
- 6.08 Public functions, including conference facilities, exhibition halls, auditoria, and restaurant and retail spaces, shall be located near the main building lobby.
- A. Elevator and escalator lobbies shall be adjacent to the main lobby. It is preferred that the elevators and escalators shall be visible from the main entrance.
- 6.09 Provide family restrooms and collocation of men's and women's restrooms in design of new facilities and in major renovations.
- A. For facilities where high visitation by children is anticipated, and where there is enough space, consider including a child-size toilet, sink, and soap dispenser at appropriate mounting heights in the family restroom.
 - B. Provide separate staff-only restrooms in non-public areas of the building.
- 6.10 Shipping and receiving space shall be located adjacent to the building loading dock.
- 6.11 Spatial requirements for various storage needs shall be considered, including the following:
- A. Smithsonian Enterprises (restaurant and retail) require storage space for supplies and for sales merchandise.
 - B. Building management in each facility requires storage space for supplies and for items kept in stock, such as lighting fixture replacement lamps, paper products, and cleaning products.
 - C. Museum programs require storage space for exhibit cases (although the amount of space for this purpose in museums on the Mall is limited).
 - D. Special events at museums require storage space for furnishings and equipment, such as tables, chairs, and stanchions.
- 6.12 Separation between finished or public spaces and building support spaces shall address the

following concerns:

- A. Provide separation between equipment or mechanical rooms and finished or public spaces to prevent staff needing to access equipment for maintenance and repair from moving through office, exhibit, collections storage spaces as well as public restrooms.
- B. Provide a buffer between mechanical and finished space to prevent potential problems of noise, vibration and odors.

6.13 The minimum space requirements for building support spaces are as follows:

- A. Janitor Closets – The minimum size of a janitor closet shall be 1.7 m² (18 sq. ft.).
- B. Electrical Closets – The minimum size of an electrical closet shall be 5.6 m² (60 sq. ft.).
- C. Communication Closets – The minimum size of a communications closet shall be 14m² (150 sq. ft.). Communications closets shall be stacked vertically where possible.
- D. Security Closets – The minimum size of a security closet shall be 3.7 m² (40 sq. ft.) with a minimum ceiling height of 2438 mm (8 ft.). Security closets shall be dedicated to security equipment.
- E. All mechanical equipment rooms shall have a minimum height of 3658 mm (12 ft.) and shall be accessed through a pair of doors, each leaf having a minimum width of 1067 mm (3 ft. 6 in.) and a minimum height of 2134 mm (7 ft.).
- F. Provide storage space for equipment required for site maintenance including mowers, snow removal equipment, tools, fertilizers, herbicides, pesticides, and other needs.
- G. Provide space within plumbing closets or separate irrigation equipment room for backflow preventers or reduced pressure zone devices (RPZ), and system controllers. Provide adequate space for personnel access and the ability to link systems to data systems for remote monitoring and controls.

6.14 Provide an area, minimum 0.5 m² (6 sq. ft.) in size, for recycling containers in staff break rooms and vending areas.

6.15 Refer to the SI Security Design Criteria document for requirements for additional security spaces: unit control room, equipment room, security office, locker rooms, break room, and storage.

VII. Special Requirements

7.01 Museum/Exhibition

- A. Refer to the Comprehensive Master Plan or Comprehensive Development Master Plan for each Smithsonian museum for facility and program planning requirements.
- B. In new museum design and major renovations, a separate entrance for large visitor groups shall be considered.

- C. The design of permanent exhibition halls shall incorporate durable materials that will meet the life expectancy of 25 to 30 years for these spaces.
- D. Provide a secure staging area at each museum or storage facility for crating and uncrating exhibitry and collections objects as they enter and leave the building.
- E. Design of atrium spaces and other high ceiling areas generally require a smoke management study. The design must identify means and methods for cleaning skylights, replacing lamps, and maintaining fire alarm devices, etc. These tasks need to be accomplished without the use of scaffolding.
- F. In new facility design and major renovations, the location of a catering kitchen on each floor where special events will be held shall be considered.

7.02 Office/Administration

- A. The Smithsonian Space Guidelines, latest edition, provide space standards for offices.
- B. The planning module of the building ---the internal dimensions for the placement of structural columns and window mullions---must be considered when space standards are being established. This rule applies to both existing buildings and new construction. Furniture workstations and closed offices should be planned early in the design to align with the planning module and bay size dimensions of the building.
- C. The space efficiencies of a building are determined by the following: plan configuration, floor plate depth, planning module and circulation patterns. The historic character of an existing building may create significant inefficiencies in terms of established circulation, which can be wider than the current established corridor width standards, affecting the amount of available usable space for planning offices and/or workstation layouts. However, an historic building's design attributes should not be compromised to achieve greater space efficiencies.
- D. Incorporate daylight and access to views to outdoor spaces in all regularly occupied areas of the building.
 - 1. Natural light should be maximized in open space plans by keeping workstation partitions at lower heights, from 1067 mm (42 in.) high to 1651 mm (65 in.) at the spine that has overhead storage.
 - 2. In order to maximize light when closed offices are required, offices should not be located at the perimeter window line, but rather they should have an interior location at the core of the floor.
- E. Circulation patterns should be clearly recognizable and distinguishable from work areas.
- F. Space for recycling receptacles should be considered during the planning process.
- G. In designing office space, long-term flexibility for future reconfigurations should be considered. Demountable partitions may be used to meet this requirement.

- H. Open plans, with a high use of workstations rather than closed offices, have a greater degree of efficiency and flexibility, and provide easier distribution of heating, cooling and natural light to the work areas.
- I. Excluding circulation and support spaces, the average net workstation in a Federal building is 7 m² (75 sq. ft.).
- J. Well planned open plans allow for ample circulation and open space between groups of workstations.
- K. Space planning of open plan office areas shall take into consideration that copy equipment rooms must be enclosed to meet the Indoor Environmental Quality (LEED) standard.
- L. Large conference rooms shall be designed to meet audio visual and teleconferencing program requirements. Phone and data outlets shall be provided.
- M. Locate small meeting rooms provided with phone and data outlets and dispersed throughout open plan office areas. These rooms can be used for meetings, conference calls, and privacy.
- N. Provide a staff break room, equipped with refrigerator, microwave and sink, in office areas.

7.03 Collections Storage

- A. At the time of the development of these Design Standards, the Smithsonian was undertaking the development of a Collections Study with a pan-institutional representation. The Smithsonian Collections Space Plan will be available by the end of FY12 and should be consulted for best practices in the design of collections storage and related spaces.
- B. The layout of collections storage areas and the selection of collections storage equipment shall take into consideration the following Smithsonian guidelines:
 - 1. Store as much of the collections as possible inside noncombustible files or cabinets.
 - 2. Store items of extreme value in fire-resistive vaults, containers or safes.
- C. Planning of all new and renovated collections storage areas and facilities shall be in accordance with SI Security Design Criteria Appendix D, Collection Storage Risk Levels and with Smithsonian Directive 600, Collections Management Implementation Manual: Collections Space Security Standards.
- D. All designs for collections storage shall follow the intent of the Smithsonian Strategic Plan, 2010 – 2015, when practicable, in particular the Grand Challenge of “Strengthening Collections,” by striving to provide optimal collection space utilization and appropriate temperature and humidity controls for the collections to be housed in the space, with a

pan-institutional focus on shared resources.

- E. Preliminary design of collections storage areas must address floor load requirements of the collections storage system.
- F. In consultation with Collecting Unit staff and OFEO, provide appropriate seismic measures in the design of collections storage facilities and equipment including provisions for restraints for items on open shelving and anchoring of storage equipment.
- G. Neither water nor sanitary waste piping is allowed to run over collections areas. Fire sprinkler piping is an exception.
- H. Neither building utilities nor mechanical units that require regular service shall be located in collections storage areas. If absolutely required, the equipment must be electrical. Refer to Section 233600 Air Terminal Units.
- I. Refer to Division 23, Heating, Ventilation and Air Conditioning, for specific requirements for temperature and humidity sensors and automated control systems to serve collections storage rooms.
- J. Locate collections storage rooms in close proximity to the freight elevator.
- K. Provide a separate, dedicated storage space that is adequately sized for the anticipated volume of crates.
- L. Design of doors leading into collections storage areas shall meet these requirements:
 - 1. All collections storage doors shall have door closers and door sweeps for pest management.
 - 2. All collections storage doors shall be minimum 1067 mm (3 ft. 6 in.) in width to facilitate material movement and handling.
- M. Collections storage areas shall not be located in close proximity to breakrooms, kitchens, or other spaces where food may be present.
- N. Provide 1219 mm (4 ft.) high, minimum 16 gauge stainless steel corner guards at all outside corners of collections storage areas and associated corridors.

7.04 Loading Dock/Mailroom/Storage

- A. All deliveries to museum facilities must be directed to the building service entrance. This includes deliveries by shipping, courier, and the U.S Postal Service.
- B. Locate a secure storage area for delivered items and an interior staging area adjacent to the loading dock in each facility. Provide a direct route from the loading dock to the freight elevator.
- C. Locate a security booth on the loading dock. Refer to the SI Security Design Criteria

document for more detailed requirements.

- D. The mailroom shall be located on an exterior wall adjacent to the loading dock.
- E. Provide an area for recycling (multiple collections) at the loading dock.
- F. Provide a storage area for hazmat materials related to work performed in fabrication shops, laboratories and wet collections at each facility.
- G. Open loading docks must be covered a minimum of 1219 mm (4 ft.) beyond the edge of the loading dock platform over the loading berth to provide protection of materials during loading and unloading.
- H. Provide a ramp from the loading dock down to grade to facilitate deliveries from small trucks and vans. The maximum allowable slope of the ramp shall be 1:12.
- I. Provide at least one off-street loading berth adjacent to the loading dock at each facility.
 - 1. The berth must be a minimum of 4572 mm (15 ft.) wide. The length shall be based on the longest vehicle serving the building as identified by the Smithsonian facility manager.
 - 2. Provide an apron space in front of the loading berth for vehicle maneuvering equal to the berth length plus 609 mm (2 ft.).
 - 3. The minimum headroom in the loading berth and apron area shall be 4572 mm (15 ft.).
 - 4. Truck maneuvering space should occur within the site and should be designed to minimize impacts to traffic on adjacent streets and to pedestrian safety.
- J. Wherever possible, provide a separate, dedicated loading dock for food service and a separate, dedicated loading dock for collections/exhibitions receiving.
- K. In facilities that use trash containers that are picked up by a trash service contractor, provide at least one loading berth for the trash containers.
- L. Provide an office for the materials handler, who oversees supplies, adjacent to the Operations and Maintenance supply room.

7.05 Food Service/Restaurants

- A. Food service kitchens shall not be located above collections storage areas.
- B. Design built-in banquette seating on legs off the floor or with a stainless steel base in order to prevent pests from nesting in the lower concealed cavity.
- C. Provide sensor alarms on stainless steel drip pans under mechanical ductwork in areas of high humidity, such as dishwashing rooms.

- D. Provide a filtration system for the water supply to all food service equipment that requires water service.
- E. Refer to Division 23, HVAC, Part II, Section 2.03F for redundancy requirements for water-cooled food service equipment.
- F. Refer to Section 221323 Sanitary Waste Interceptors for requirements for grease interceptors in food preparation areas.
- G. Provide for on-site composting and recycling of waste including collection of oils for biofuels, bottle, can, paper, and plastic recycling. Provide signage to encourage recycling in dining areas.
 - 1. Avoid storing waste near any collections storage or collection receiving/staging spaces.
 - 2. Carefully plan composting and recycling areas to minimize attraction of rodents and other pests.
 - 3. Provide water and drainage at composting areas.
- H. Provide 1219 mm (4 ft.) high, minimum 16 gauge stainless steel corner guards at all outside corners of food service back-of-house areas and associated corridors.
- I. All doors in food service areas shall be minimum 1067 mm (3 ft. 6 in.) in width to accommodate material handling and carts.
- J. All restaurants, operated by Smithsonian Enterprises (SE) and other vendors, shall be on separate utility meters. Refer to Section 22113 Facility Water Distribution Piping and Section 262713 Electricity Metering for respective water and electric meter requirements.
- K. Provide locker area for food service employees.

7.06 Museum Shops

- A. Design of retail spaces, whether new or retrofit, must address all power and lighting requirements. Coordinate power, data, and voice drops wherever cash/wrap and sales counters are located.
- B. The main retail shop in each museum facility may be located in close proximity to the main entrance lobby. The location of the museum shop must be coordinated with the unit director.
- C. The shop area must be secured after hours by security grilles or some similar measure approved by Smithsonian Enterprises (SE) and SI OPS.
- D. All museum shops shall be on separate utility meters. Refer to Section 22113 Facility Water Distribution Piping and Section 262713 Electricity Metering for respective water and electric meter requirements.

7.07 Auditoria

- A. Provide a number of wheelchair locations in places of assembly with fixed seating. These locations shall be dispersed throughout the seating per the Smithsonian Guidelines for Accessible Design.
- B. An acoustical engineer shall review design drawings for an auditorium or a large meeting room in order to evaluate the acoustical properties of the proposed configuration and interior finishes.
- C. Neither water nor sanitary waste piping is allowed to run over auditoriums. Fire sprinkler piping is an exception.
- D. Design of auditoria must address access to relamping light fixtures and/or adjusting audio visual equipment mounted above the stage and above the sloped floor seating area. These tasks need to be accomplished without the use of scaffolding and with the provision for necessary fall protection.
- E. All auditorium fixed seating shall have the seat row letter and number identified on the seats to allow for assigned seating at events.

7.08 Restrooms

- A. Provide a plumbing fixture count that exceeds code minimums in each museum, especially in the women's restrooms, per the SI Special Conditions for A/E Services.
- B. Provide a separate unisex, accessible, "family" toilet room in museum facilities, where possible, in addition to men's and women's restrooms.
 - 1. If a family restroom is provided and if there is adequate space, provide one lavatory, one soap dispenser, and one hand dryer or paper towel holder mounted at a lower height for children.
- C. Provide a baby-changing station with its own sink in all public restrooms (men, women, and family). Consider proximity to paper towel dispenser and trash receptacle as well as space for stroller when laying out baby changing area.
- D. Provide at least one drinking fountain on every floor near restrooms and near auditoria. Refer to the Smithsonian Guidelines for Accessible Design for the required number of accessible drinking fountains.
- E. Locate wall washing strip lighting over toilet stalls minimum 914 mm (3 ft.) from wall to allow maintenance staff to relamp the strip safely.
- F. Provide a location (shelf/hook) for personal belongings while people (men or women) use the restroom facility.

7.09 Child Care Centers

- A. Design of child care centers shall be in accordance with the National Association for the

Education of Young Children (NAEYC) Program Standards and Accreditation Criteria. Refer to Standard 9 – Physical Environment for design criteria related to indoor and outdoor child care spaces.

- B. Design of child care centers shall meet all applicable requirements of federal, state and local jurisdiction code regulations. Where there is a discrepancy between different criteria, the most stringent requirement shall apply.
- C. Design outdoor spaces and play equipment for child care centers to meet the following requirements:
 - 1. Locate and design outdoor spaces associated with child care to maximize solar gain during winter months to extend outdoor space use seasonally.
 - 2. Incorporate natural elements such as water and planting in outdoor spaces to enhance shading and cooling during warmer months and to provide interactive educational opportunities.
 - 3. If play equipment is utilized comply with the latest Consumer Protection Safety Commission (CPSC) requirements for equipment, fall zones and safety surfacing.
- D. The designer shall collaborate with the child care center director to ensure that the design elements support and enhance the SI educational mission.
 - 1. Design indoor and outdoor spaces to support and encourage socialization, including small and large group activities.
 - 2. Design indoor and outdoor spaces to support and encourage physical activity and to promote mastery of gross and fine motor skills.
 - 3. Design spaces with elements that support and encourage educational activities and contact with natural elements.
- E. Locate the child care center in proximity to a building entrance (for efficient drop-off and pick-up of children by parents).
- F. Provide sufficient space for stroller parking outside of the child care center entrance without interfering with the required egress.
 - 1. In laying out the egress route, take into consideration that infants may be moved in cribs during an emergency evacuation.

7.10 Lobbies

- A. Types of signage that may be required in museum lobbies are: building orientation and wayfinding, public programs including exhibitions, and donor signage.
- B. Provide a vestibule at each building entrance that meets accessibility requirements, that

includes an air lock to conserve energy, and that has appropriate ventilation where the vestibule serves also as a queuing area for security screening.

1. The distance between inside and outside doors in the vestibule shall comply with the Smithsonian accessibility standards.
2. The depth of the vestibule shall be a minimum of 2134 mm (7 ft.) to minimize air infiltration into the lobby.
3. An air lock is required for swing doors; revolving doors do not require an air lock.

7.11 Interior Landscaping

- A. For areas where interior landscaping is considered for visual enhancement or air quality enhancement, determine performance criteria to support healthy plant functioning and survival. Coordinate across disciplines to provide adequate natural or supplemental lighting for required photo periods, including electrical requirements and circuiting specific to plant needs and locations. Coordinate HVAC requirements to provide adequate humidity, temperature and air exchanges, locate supply ducts such that air is not blowing directly on foliage or creating "hot spots". Coordinate with plumbing for irrigation and drainage requirements; coordinate with waterproofing needs as appropriate. Provide access for maintenance and understand frequency of plant rotation, soil inoculation programs, especially if used for seasonal displays.

7.12 Elevators

- A. Refer to Division 14 Conveying Systems and to Smithsonian master specification sections: 14210 Electric Traction Elevators, 14215 Electric Traction Freight Elevators, 14240 Hydraulic Elevators, 14245 Hydraulic Freight Elevators, and 14310 Escalators.

7.13 Stairs

- A. The Smithsonian Guidelines for Accessible Design document specifies that Areas of Rescue Assistance are required even in fully sprinklered buildings.
- B. Provide access to the main roof from at least one enclosed stair.
- C. The initial design effort shall address exit capacity needs of the facility throughout the life of the structure before design of the enclosed rated stairs commences.

7.14 Corridors and Circulation Pathways

- A. The minimum clear height of ceilings in corridors shall be 2438 mm (8 ft.).
- B. Egress corridors must be appropriately fire rated and shall remain free of obstructions and protrusions.
- C. Provide 1219 mm (4 ft.) high, minimum 16 gauge stainless steel corner guards at all outside corners in non-public corridors, where there is movement of carts, cases, equipment, and trash and recycle bins.

- D. Corridor walls shall be made of durable, abuse-resistant materials, including but not limited to CMU.

7.15 Security

- A. In museums and collections storage facilities, security guard posts shall be located at primary and secondary building entrances available to the public and to Smithsonian staff.
- B. Refer to the SI Security Design Criteria document for the guard post requirement at employee entrances, loading docks, and other service entrances.

7.16 Maintenance/Service

- A. Provide access to all building service closets from common public corridors.
- B. Provide at least one janitor closet per floor and one central maintenance room that is accessible to the loading dock in each building.
- C. For access by maintenance and service personnel, elimination of potential fall hazard situations should be considered first. If this is not feasible, then parapets or standard guardrails that meet applicable OSHA and ANSI requirements should be installed.
- D. Requirements for using lift equipment (weight, access) to perform maintenance of exterior building façade shall be considered during the design phase.

7.17 Penthouses

- A. Keep roof-mounted equipment to a minimum. Any roof-mounted equipment must be enclosed in a penthouse or behind screen walls.
- B. Penthouses and screen walls shall be integrated into the exterior building design and constructed of similar materials.
- C. Do not locate roof-mounted equipment directly over collections storage areas.
- D. If existing mechanical equipment on rooftops is not screened or is located over collections storage, these existing conditions should be corrected whenever the equipment is repaired or replaced.

7.18 Building Roof Treatments

- A. Where possible consider installation of roof treatments to encourage energy efficiency, water harvesting, or stormwater treatment.
- B. Consider the appearance and visual quality impacts of roof areas from public and non-public areas, especially in terms of their ability to demonstrate sustainable practices.

7.19 Temporary Facilities

- A. Smithsonian temporary facilities shall be considered those structures, i.e. shed, structure, building, trailer, or enclosure, which are intended for storage, office or service uses and are intended for a short term period of use. (The IBC building code defines the period as 180 days or less.)
- B. The design of SI temporary facilities shall comply with all applicable provisions of fire, life safety, and building and electrical codes. Requirements related to structural safety, fire safety, means of egress, accessibility, light, ventilation and sanitation must be met to ensure public health and safety.

VIII. Site Requirements

- 8.01 Protect and restore the natural ability of soils, vegetation, and associated topography to absorb rainfall, remove pollutants, evapotranspire, and recharge groundwater. When possible and appropriate, manage stormwater on site to reduce flow to storm sewers by creating absorbent soils and landscape conditions or by the use of man-made facilities.
- 8.02 Design decisions for all water needs shall be informed by data gathered during site inventory and analysis. Water analysis should focus on quantification and evaluation of absorptive capacity, surface permeability, and drainage. See Division 32 for more information.
- 8.03 Manage water as a site resource. Consider surface and stormwater management, potable water needs, irrigation, and waste water disposal.
 - A. A viable sustainable water budget shall be established for the project within the context of the overall facility. Some portion of the water budget shall be apportioned for landscape construction and maintenance. Irrigation design will adhere to the approved water budget.
 - B. Review the historic site conditions to identify previous drainage patterns, soil and vegetation conditions.
 - C. Conduct a baseline analysis of current water conditions and context that focuses on absorptive capacity, surface permeability, and drainage. Gather data pertaining to supply stream, drainage area, hydrologic features and flow paths, neighboring sites and structures, sewers, tidal conditions, and zoning and code requirements/constraints. This will act as the foundation for design decisions.
 - D. The project will be designed to decrease sewer overflows that contribute to stream contamination and flooding, and should improve groundwater recharge, evapotranspiration, and water harvesting for plantings.
 - E. Whenever possible and desirable, increase the absorption capacity of the site through the use of porous soil matrix that allows for infiltration and plants that absorb and evapotranspire moisture, and decrease areas of unnecessary impermeable surfaces in order to reduce runoff.
 - 1. Retain and infiltrate stormwater into subsurface layers to reduce the volume of runoff entering the sewers and increase groundwater recharge.

2. Capture runoff from storm events, and provide water quality treatment, while slowing and reducing discharge.
 3. Use tanks, cisterns, rain barrels, and other vertical containers located to harvest and store runoff from buildings during rain events. Dry wells may also be used to temporarily store and slowly infiltrate runoff.
 4. Use stormwater as a resource by directing stormwater runoff to plant beds where infiltration, limited ponding, detention, and pollutant filtering can occur.
- 8.04 Soil characteristics play a major role in the health of vegetation and in water management. It is essential to determine soil conditions early in the design process and is critical to achieving a high performance landscape. See Division 32 for more information.
- 8.05 Manage soil as a site resource. Soil is a dynamic natural system and soil characteristics play a major role in the health of vegetation and in water management. An understanding of the quality, contamination, percolation, and bearing capacity of existing soils shall guide design, construction, and maintenance.
- A. To the greatest extent possible, minimize soil disturbance whenever possible to preserve and protect soil resources from damage by limiting the area of site disturbance, controlling erosion and compaction during construction. This is a critical step to preserving soil structure, and maintaining infiltration and groundwater recharge. It can be a costly and time intensive process to recreate the structure and function of natural soil.
- 8.06 Identify, assess, and protect existing vegetation for aesthetic, cultural, historic, and ecological value. Preserve existing on-site vegetation and its stormwater management, air quality, and microclimate benefits. See Division 32 for more information.
- 8.07 Manage existing and new vegetation as a resource.
- A. Identify vegetation that should be preserved or enhanced and mitigate invasive vegetation as necessary.
 - B. Create species specific critical root zone (CRZ) protection areas to prevent construction damage and soil compaction.
 - C. Develop site plans and building locations in a way that preserves existing trees and other significant vegetation together with existing stormwater drainage patterns so as to not deprive vegetation of existing water resources.
 - D. Plan site stormwater management, water harvesting and irrigation strategies around vegetation needs.
 - E. Plan for and ensure adequate watering of vegetation during establishment periods for new plantings even for landscapes that will ultimately not be irrigated.
- 8.08 To ensure that projects are cost-effective and easily buildable, integrate construction planning early into the design phase. This allows for the establishment of realistic and comprehensive project

goals, budgets, schedules, and cost or time-saving strategies.

- A. Create detailed construction staging and scheduling plans to understand and control site work in order to protect soils, vegetation, and water resources throughout the duration of construction. This should improve the understanding of the scope of work, the needed construction documentation, and the accuracy of bidding and scheduling information.
 - B. Please see Division 2 for temporary tree, vegetation, and soil protection.
- 8.09 Site lighting shall take into consideration OPS security requirements, Crime Prevention Through Environmental Design (CPTED), control of light pollution, and site specific light hierarchy. For example, projects on the National Mall must consider the National Capital Planning Commission established light hierarchy.
- 8.10 All projects dealing with exterior of buildings and all exterior staging areas must coordinate with OFMR personnel including Building Management and Smithsonian Gardens and adhere to the Smithsonian Institution Gardens standard technical specification sections, which include, but are not limited to:
- A. Protection of Flora, Fauna, Irrigation Systems
 - B. Topsoil
 - C. Tree Protection
 - D. Lawns and Grasses
 - E. Irrigation

IX. Specifications

010000 Supplementary Conditions for Construction

- 9.01 The Supplementary Conditions specification section for large projects is available on the OFEO A/E Center Website.
- 9.02 The Supplementary Conditions specification section for small projects can be obtained from the OFEO design manager.
- 9.03 The A/E shall be required to edit the appropriate section according to project-specific requirements, which the A/E can coordinate with the OFEO design manager.
- 9.04 The specifications and project requirements for maintenance and repair projects not requiring a design can be obtained from the OFMR COTR.

Division 02 – Existing Conditions

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 NFPA 101 Life Safety Code
- 1.04 NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations
- 1.05 SI Security Design Criteria

II. Design Requirements

- 2.01 Construction Barriers
 - A. Refer to the SI OSHM Fire Protection and Life Safety Design Manual for all applicable requirements for construction barriers, such as the fire rating requirement for barriers between the construction area and occupied spaces.
 - B. All dust barriers shall be constructed of non-combustible or fire retardant materials per the SI OSHM Fire Protection and Life Safety Design Manual.
- 2.02 Temporary Tree, Vegetation and Soil Protection
 - A. An ISA certified arborist, who has a minimum of five years experience in the field of urban forestry and remediation of construction damage, shall identify trees to be protected with the limit of disturbance and determine the means and methods to be used.
 - B. All tree protection to be installed prior to the start of all work on site.
 - C. Equipment pathways shall avoid critical root zones. Vehicular traffic or storage of materials inside the drip-line of trees and shrubs requires approval of Smithsonian Gardens through the COTR. If it is necessary for vehicles to cross planting beds, bed bridging is required. No parking on the turf is permitted at anytime.
 - D. Generator placement on site requires approval of Smithsonian Gardens.

- E. When aerial work is being performed above plantings, a protective frame is required to be erected at least 300 mm (12 in.) above the tops of the plant material. Approval from Smithsonian Gardens through COTR is necessary to tie-back trees and shrubs. This must be performed by a certified arborist approved by Smithsonian Gardens through COTR.

2.03 Asbestos and Lead Abatement

- A. Refer to the Smithsonian master specification sections listed below for project requirements for asbestos and lead abatement in SI facilities.

III. Specifications

028xxx – Asbestos and Lead Abatement

028200 Asbestos Abatement

- A. The Smithsonian master specification section is available on the OFEO A/E Center Website.

028300 Work Activities Impacting Lead-Containing Materials

- A. The Smithsonian master specification section is available on the OFEO A/E Center Website.

Division 03 – Concrete

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 American Concrete Institute (ACI)
- 1.04 Precast/Prestressed Concrete Institute (PCI)
- 1.05 SI Security Design Criteria

II. Design Requirements

- 2.01 Concrete Stairs
 - A. Refer to the IBC building code for all requirements for stairs, such as dimensions for stair width, headroom, riser height, tread depth, and landing.
 - B. Provide integral non-slip nosings on all stair treads. Surface applied nosing type is not allowed.
 - C. Apply slip-resistive finish on concrete stair treads, ramps and platforms.

III. Specifications

033xxx – Concrete

033300 Architectural Concrete

- A. The Contractor shall be required to fabricate and erect a sample panel of exposed concrete elements prior to construction of the Work showing all of the required finishing techniques, i.e. finishes and textures.

034xxx – Precast Concrete

034500 Precast Architectural Concrete

- A. The Contractor shall be required to fabricate and erect a sample panel of exposed concrete elements prior to construction of the Work showing all of the required finishing techniques, i.e. finishes and textures.
- B. The concrete used in the sample panels shall be provided from the project concrete supplier and shall represent the approved mix for strength and texture. Designer shall consider stipulating all elements exposed to view meet the PCI requirements for “architectural concrete” for finishes and tolerances.

035xxx – Concrete Topping and Underlayment

035300 Concrete Topping

- A. Installation of cement-based, self-leveling topping over structural grade concrete must be performed by a qualified, factory-trained installer with previous experience.
- B. Specify proper concrete design mix and final floor levelness required to accommodate end use of topping slab – for example, installation of floor rail system for mobile storage shelving system.
- C. Topping shall be able to be installed from 6 mm (1/4 in.) to 51 mm (2 in.) in one pour and up to 127 mm (5 in.) with the addition of an appropriate aggregate, and topping must be tapered to match existing floor slab elevation.
- D. Topping must be coated with a wear finish coating suitable for the intended use of the floor. Finish may be high performance, water-borne acrylic concrete sealer if appropriate for use.
- E. Substrates shall be inspected and corrected for moisture and any other conditions that could affect the performance of the topping or the finish sealer.

035413 Gypsum Cement Underlayment

- A. This material shall not be used in exterior locations or where moisture migration may be an issue such as slabs on grade.

Division 04 – Masonry

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 National Concrete Masonry Association (NCMA)
- 1.04 Brick Institute of America (BIA)
- 1.05 Indiana Limestone Institute of America (ILIAI)
- 1.06 Marble Institute of America (MIA)
- 1.07 Interagency Security Committee (ISC) Security Design Criteria
- 1.08 SI Security Design Criteria
- 1.09 American Concrete Institute (ACI) 530.1 Specification for Masonry Structures
- 1.10 ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units
- 1.11 ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials

II. Design Requirements

- 2.01 Exterior Walls
 - A. Perimeter or exterior walls shall be designed in accordance with the ISC Security Design Criteria – Structural Section.
 - B. The selection of exterior building façade materials for Smithsonian buildings on or near the National Mall in Washington is subject to external review by Federal agencies including NCPCH, CFA and the Advisory Council on Historic Preservation. Refer to the SI Special Conditions for A/E Services for more detail about the review process.
 - C. Masonry facades shall be designed with primary and secondary waterproofing and air barrier systems.

- D. Project specifications shall require the contractor to assign a single point of responsibility for coordination and responsibility for exterior connection points (including, but not limited to, roofing, flashing, façade elements, and waterproofing).
- E. At a minimum, on-site air and water infiltration testing shall be required for all customized wall assemblies.

2.02 Interior Walls

- A. At a minimum, interior partitions shall be designed in accordance with space classifications as listed in the Appendix A – Security Design Criteria Matrix in the SI Security Design Criteria document.

2.03 Masonry and Stone

- A. Specify masonry/stone to match existing materials in renovations and additions. New material shall match the size, color and texture of the original masonry/stone, including color of the mortar.
- B. Specify masonry/stone that is readily available for new building design. There is limited space available for storage of “attic stock” materials for new buildings.

III. Specifications

042xxx – Unit Masonry

042000 Unit Masonry

- A. Install concrete masonry units in accordance with ACI 530.1.
- B. Install loadbearing concrete masonry units in accordance with ASTM C90.
- C. Provide concrete masonry units that comply with requirements for fire resistance ratings where needed and as determined by testing according to ASTM E119.

042113 Brick Masonry

- A. Brick masonry shall be designed and constructed according to the standards of the Brick Institute of America.
- B. The Contractor shall be required to fabricate and erect one or more sample wall panels. The minimum size of the mock-up shall equal 1.5m² (16 sq. ft.). Sample panels shall contain the proposed brick and mortar and include masonry backup, wall ties, insulation, and any limestone/precast stone trim, applicable to the project.

Division 05 – Metals

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 SI Safety Manual
- 1.04 OSHA Standards – 1910.24 Fixed Industrial Stairs, 1910.26 Portable Ladders, 1910.27 Fixed Ladders
- 1.05 American Institute of Steel Construction (AISC) 303 Code of Standard Practice for Steel Buildings and Bridges
- 1.06 ANSI/AISC 360 Specification for Structural Steel Buildings
- 1.07 ANSI/AWS D1.1 Structural Welding Code – Steel
- 1.08 Smithsonian Guidelines for Accessible Design
- 1.09 National Association of Architectural Metal Manufacturers (NAAMM) Metal Finishes Manual for Architectural and Metal Products
- 1.10 National Association of Architectural Metal Manufacturers (NAAMM) 531 Metal Bar Grating Manual
- 1.11 Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Architectural Sheet Metal Manual
- 1.12 ASTM A36 Standard Specification for Carbon Structural Steel
- 1.13 SI Security Design Criteria

II. Design Requirements

- 2.01 Metal Fabrications
 - A. The design of metal ladders (fixed and portable) and fixed industrial stairs shall meet the safety requirements identified in the SI Safety Manual and in the applicable OSHA standards.

2.02 Metal Stairs

- A. Refer to the IBC for all requirements for stairs, such as dimensions for stair width, headroom, riser height, tread depth, and landing.
- B. Refer to the SI OSHM Fire Protection and Life Safety Design Manual for requirements for stairs.

2.03 Metal Railings

- A. Refer to the IBC for all requirements for handrails and guard rails.
- B. Refer to the SI OSHM Fire Protection and Life Safety Design Manual for requirements for handrails and guard rails. Railings and guards must be approved by OSHM representatives, with regards to height and construction.
- C. The design of handrails shall comply with the Smithsonian Guidelines for Accessible Design, such as the requirements for allowable mounting height and for clearance between handrail and wall.
- D. Railings and guards must have a maintenance-free finish.
- E. Provide sufficient intermediate exterior handrails.
- F. All handrails must be of sturdy construction and durable material due to heavy use and frequent use as places for people to lean and sit.
- G. If fall hazards cannot be eliminated, OSHM prefers passive fall prevention systems such as parapets and standard guardrails that meet the height and strength requirements outlined in OSHA and ANSI standards.
- H. Match facility unique requirements as requested by the Smithsonian project manager. For example at the National Zoo, railings and guards are most often Cor-ten to mitigate rust.
- I. Consider integral lighting in the design of new handrails in public spaces and on the exterior at museum entrances.

2.04 Metal Finishes

- A. Comply with the NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designating finishes.

III. Specifications

055xxx – Metal Fabrications

055000 Metal Fabrications

- A. Exterior metal ladders shall be hot-dipped galvanized at a minimum and shall not be painted.

055100 Metal Stairs

- A. Exterior metal service stairs shall be hot-dipped galvanized at a minimum and shall not be painted.
- B. Exterior metal service stairs shall be wide enough to accommodate equipment, especially on a roof.
- C. Exterior metal service stairs shall not be visible from the ground.
- D. Metal stairs of four or more risers shall be equipped with standard handrails based on configuration and exposure as outlined in OSHA and ANSI Standards.

055213 Pipe and Tube Railings

- A. Exterior handrails shall be maintenance-free (not require painting, for example) and shall be fabricated of bronze, aluminum, or stainless steel.

055300 Metal Gratings

- A. Metal bar gratings shall comply with the ANSI/NAAMM 531 Metal Bar Grating Manual.
- B. Steel components of steel gratings shall comply with ASTM A36.
- C. Gratings shall comply with the accessibility requirements of the Smithsonian Guidelines for Accessible Design.
 - 1. Openings shall allow passage of a sphere no greater than 13 mm (1/2 in.) in diameter.
 - 2. Elongated openings shall be placed so that the long dimension is perpendicular to the dominant direction of travel.
- D. Exterior gratings shall satisfy both vehicular loading requirements and accessibility requirements for pedestrians/persons with disabilities.
 - 1. Provide close spacing of the bearing bars – 6 mm (1/4 in.) to 13 mm (1/2 in.) space between bars – to accommodate wheelchairs, high heel shoes, and bicycles.
 - 2. The gratings shall have a non-slip finish.

- E. Gratings shall be designed and fabricated to meet the loading requirements, clear span conditions and maximum deflections specified.
 - 1. Provide anchorages for gratings, grating frames and supports where required to secure gratings to in-place construction.
 - 2. Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly.

057xxx – Decorative Metal

057300 Decorative Metal Railings

- A. It is recommended that the design of new decorative metal railings at Smithsonian museum buildings on the exterior and in the interior public areas (lobbies, monumental stairs) shall match the profile and material of historic railings if they exist.
- B. Exterior handrails shall be maintenance-free (not require painting, for example) and shall be fabricated of bronze, aluminum, or stainless steel.

Division 06 – Wood, Plastics, and Composites

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 SI Standard Exhibit Fabrication Specifications
- 1.04 SI OPS Exhibit Case Construction and Alarming Design
- 1.05 Architectural Woodwork Institute (AWI) Quality Standards
- 1.06 ANSI A208.1 Standard for Particleboard
- 1.07 ANSI A208.2 MDF for Interior Applications
- 1.08 Forest Stewardship Council (FSC) Principles and Criteria for Forest Stewardship
- 1.09 Ozone Transport Commission
- 1.10 SI Security Design Criteria

II. Design Requirements

- 2.01 Carpentry
 - A. All wood and wood products used for walls, platforms, blocking, furring, exhibit cases, light attics with electric lighting, and similar applications shall be fire retardant, pressure impregnated (FRPI) per the SI OSHM Fire Protection and Life Safety Design Manual.
 - 1. Fire retardant coatings of intumescent paint or other fire retardant chemicals are not acceptable in lieu of fire retardant pressure treated wood per the SI OSHM Fire Protection and Life Safety Design Manual.
 - B. All exterior wood shall be rated for exterior use, shall have longevity, and shall be termite-proof, pest-resistant and weather-resistant.
 - 1. Specify pressure-treated lumber for blocking where moisture may be encountered, such as below grade locations and roof locations.

2. Specify environmentally sensitive treated lumber where the building material selections may impact the scientific or preservation work to be performed in the facility (SERC, for example).

- C. Specify that lumber shall be certified wood, which is obtained from forests certified by a FSC-accredited source to comply with FSC certification criteria.

2.02 Wood Decking and Sheathing

- A. All decking and sheathing shall be designed to meet the requirements of the SI OSHM Fire Protection and Life Safety Design Manual.

2.03 Woodwork

- A. All cabinetry shall be fabricated to conform to the Architectural Woodwork Institute Quality Standards, Section 400, for Custom Grade material and workmanship.
- B. Refer to SI Standard Exhibit Fabrication Specifications for requirements for wood products, such as plywood, medium density fiberboard and framing lumber, and for laminates to be used in exhibit case construction.
- C. Refer to the SI OPS Exhibit Case Construction and Alarming Design document for security requirements for materials used in exhibit case construction.
- D. Do not use plastic laminate as finish material in SI retail and food service areas.

2.04 Plastics

- A. Refer to the SI OSHM Fire Protection and Life Safety Design Manual for standards prohibiting the use of plastics and foamed plastics in exhibit construction unless specific criteria have been met.
- B. Refer to SI Standard Exhibit Fabrication Specifications for requirements for acrylic products to be used in exhibit case construction.
- C. Use of plastics in building construction shall conform to the requirements of IBC and the Life Safety Code.

III. Specifications

061xxx – Carpentry

061000 Rough Carpentry

- A. FRPI plywood 19-mm (3/4-in.) thick shall cover three walls of any utility or security closet to be used for mounting equipment.

061500 Wood Decking and Sheathing

- A. Specify appropriate fasteners for use with treated lumber.
- B. Bond breakers or backing materials shall be used where treated lumber is adjacent to incompatible materials.
- C. Roof sheathing shall be tongue-and-groove type or shall be fastened with clips.

062xxx – Finish Carpentry**062023 Interior Finish Carpentry**

- A. Finished carpentry and cabinet work shall be manufactured and installed by a single firm specializing in the production and installation of work matching the specified industry standard.
- B. Architectural millwork and finished cabinetry shall conform to AWI Custom Grade as established by the American Woodworking Institute (AWI) "Quality Standard".
- C. The fabricator/installer shall be a certified participant in the AWI Quality Certification Program.
- D. A fabricator shall prepare shop drawings showing locations of each item with dimensioned plans and elevations, large scale sections and details showing attachment devices, components and hardware with specifications; indicate seaming of finish materials and submit the shop drawings to the architect for review prior to commencing fabrication.
- E. A fabricator shall fabricate all millwork from field measurements with provisions for scribing as required to meet built-in conditions.
- F. In a millwork design where cabinet doors exceed 813 mm (32 in.) in height, the architect shall include the provision for 1 ½ pair of hinges per leaf. The fabricator shall verify the adequacy of the proposed hinges to support each door/leaf.
- G. The General Contractor shall refer to Power and Communication Plans and Elevations to coordinate millwork with scheduled electrical/telephone/data outlets.
- H. The fabricator shall assemble units in the shop utilizing largest components as practical to minimize field cutting.
- I. The General Contractor shall coordinate the delivery of millwork with all other applicable trades so that casework and finish carpentry are not delivered or installed until painting, wet work and similar operations which could damage finished work have been completed and HVAC systems have been properly operating for ten (10) days.
- J. The fabricator shall install casework and finish carpentry plumb, level true and straight with no disruptions.

- K. Many wood species experience off-gassing of VOCs (volatile organic compounds) which can affect artifacts and sensitive collections. Therefore, an architect/designer needs to carefully consider the selection of wood products---flooring and casework materials---for storage or display.

064xxx – Architectural Woodwork

064113 Wood-Veneer-Faced Cabinetry

- A. When specifying veneers for architectural woodwork and/or built-in or free-standing casework, the architect shall identify the specific information about the selected wood, such as:
 - 1. Wood species
 - 2. Exact log number---or flitch if amount of veneer required is less than a log
 - 3. Vendor's contact information
- B. The architect shall obtain a finished submittal from the actual log or flitch which will become the architect's control sample.
- C. When matching veneers the architect shall consider the following characteristics of veneers:
 - 1. Veneer Leaves – Describe how the leaves are to be matched, such as “All adjacent leaves to be book matched.”
 - a. Book matching will result in a mirror image between adjacent veneer leaves.
 - b. Slip matching will result in an even progression of grain between adjacent veneer leaves.
 - c. End matching is required when the elevation is taller than the veneer. Identify whether the fabricator shall book or slip the veneer at the end match line. Both the end match and the choice of either book or slip at the match line shall be indicated on the drawings.
 - 2. Veneer Panels (which apply to all types of projects using veneer such as walls and free-standing millwork due to the limited width of all veneer species) – Include a statement about the panels, such as “All adjacent panels shall have an equal number of veneer leaves and shall be centered balanced.”
 - 3. Veneer Numbering – On the elevation of the millwork and/or the architectural woodwork design, add a note requiring that “All panels across the elevation shall be sequenced and numbered.”
- D. The architect shall call out the desired Finish System on the drawings, such as “The architectural woodwork/millwork finish shall be catalyzed lacquer (conversion varnish, marine epoxy, etc.)” OR “The woodwork/millwork shall be stained to match architect's control sample.”

1. The architect shall call out the Finish Sheen, such as "The sheen of finish shall be (40% - 60%)." (Indicate percentage.)
- E. To ensure that the completed wood veneer product designed by the architect matches the control sample, the architect shall consider the following:
1. Has the control sample been stained or does it just have a clear finish? If the sample has a stain, the staining process must occur prior to the clear finish application.
 2. What is the sheen level of the finish---matte, satin or high polish?
 3. Is the design intent of the millwork/architectural woodwork to have an open pore or closed pore finish?
- F. The fabricator shall submit finished samples of each wood, from the specified log(s)/flitch(s) and with the type and level of finish specified to match the control sample in the architect's record.

064116 Plastic Laminate

- A. A gloss finish is recommended for vertical surfaces only. It is not recommended for horizontal applications.
- B. Plastic Laminate shall not be adhered directly to plaster, gypsum board (drywall), or concrete.
- C. Plastic Laminate shall not be used in areas exposed to temperatures exceeding 135° C (275°F) or for exterior applications.
- D. Plastic laminate shall be bonded to an appropriate substrate, such as #45 density particleboard (ANSI A208.1 – 2009) or Medium Density Fiberboard (MDF) (ANSI A208.2 – 2009).
- E. When specifying plastic laminate for any millwork that will be associated with excess heat, located near flames and large horizontal or vertical installations such as those associated with rolling, overhead fire doors, the architect/designer must specify fire-rated plastic laminate. In order to specify this type of plastic laminate, the architect/designer must designate either "fire-rated general purpose grade" or "fire-rated vertical grade" and add the manufacturer's designated number to the specification number. In order to achieve a Class A or 1 fire-rating in plastic laminate panels, the specifier must also---in addition to specifying fire-rated laminate---specify 2-part Resorcinol Adhesive and fire-rated particle board substrate.

064213 Stile and Rail Wood Paneling

- A. The veneer within the insert panels shall be center balance matched with an equal number of leaves per panel.

- B. The stiles and rails with veneered construction shall have either edges banded or hardwood moldings to conceal core and veneer joints.
- C. The grain on the stiles shall run vertically.
- D. The grain on the rails shall run horizontally.
- E. The joint between any interior field rails to stiles shall be simply end matched.
- F. All veneer leaves for raised/recessed panels shall be end matched or continually matched---depending on Architect/Designer preference---with the grain of the specified wood veneer. In most cases the specified wood veneer leaf should be wide enough to cover the entire raised or recessed panel. On the occasion where it does not entirely cover the panel, the Architect/Designer should call out for either a book or slip match---whichever is appropriate---on those pieces.
- G. The outside corner of stile and rail paneling shall be made with either lock-mitered or mitered-and-splined construction.
- H. All adjacent raised/recessed panels shall be sequenced and numbered (for easier clarification from panel fabricator to installer).
- I. All panels within the elevation shall be matched---center, balanced or random, depending on Architect/Designer preference.

064216 Flush Wood Paneling

- A. The veneer of the flush panels shall be center balance matched with an equal number of leaves per panel.
- B. Any exposed panel edges shall be finished in a method which has been specified by the Architect/Designer, such as solid wood, wood veneer matching the face or metal channels forming reveals.
- C. Adjacent leaves of veneer on each flush panel shall be matched---center, balanced or random, depending on Architect/Designer preference.
- D. The matched adjacent panels that shall be sequenced and numbered for easier clarification from the panel fabricator to the installer.
- E. Where there is an elevation taller than what the veneer leaf will achieve, the veneer needs an end match vertically at some horizontal point on the elevation.

064400 Architectural Woodwork

- A. All architectural woodwork shall be designed to AWI Custom Grade standards.
- B. Formaldehyde-free FR particle board may be used as cabinet carcass material for temporary exhibit millwork.

- C. Refer to AWI Custom Grade guidelines for visible connections.

064600 Wood Trim

- A. All wood trim shall be designed to AWI Custom Grade standards.
- B. Refer to AWI Custom Grade guidelines for joints and connections.

066xxx – Solid Surfacing

066116 Solid Polymer (Solid Surfacing) Fabrications

- A. Solid Surfacing is a solid homogeneous material that is a fully densified composite of modified resin and mineral filler.
- B. Solid Surfacing shall not be used in applications which involve exposure to heat sources that may elevate the material temperature above 79°C (175°F).
- C. Prior to fabrication, the Solid Surface material should be 18°C (65°F) or warmer.
- D. When Solid Surface material is used for horizontal surfaces, such as countertops, there must be a support provided every 457 mm (18 in.) for 12.7 mm (1/2 in.) thickness.
- E. Solid Surface material that is 6.4 mm (1/4 in.) thick shall not be used for horizontal applications.
- F. Wood underlayment may not be used as a support for horizontal Solid Surface.
- G. An unsupported overhang shall be restricted to 152 mm (6 in.) for 12.7 mm (1/2 in.) thick Solid Surface material.
- H. Particle board shall not be used as a substrate or support with Solid Surfacing material.

Division 07 – Thermal and Moisture Protection

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 SI Safety Manual
- 1.04 SI Security Design Criteria
- 1.05 National Roofing Contractors Association (NRCA) Waterproofing Manual
- 1.06 Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Architectural Sheet Metal Manual
- 1.07 Occupational Safety and Health Administration (OSHA) Standards
- 1.08 ASTM C1193 Standard Guide for Use of Joint Sealants
- 1.09 ASTM C1472 Standard Guide for Calculating Movement and Other Effects When Establishing Sealant Joint Width.
- 1.10 ASTM D312 Standard Specification for Asphalt Used in Roofing
- 1.11 ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
- 1.12 ASTM E 2178 Standard Test Method for Air Permeance of Building Materials
- 1.13 UL 790 Standard for Safety Standard Test Methods for Fire Tests of Roof Coverings
- 1.14 NFPA 256 Standard Methods of Fire Tests of Roof Coverings
- 1.15 National Building Code of Canada
- 1.16 ASTM E1980 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- 1.17 ASHRAE Standard 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings

II. Design Requirements

2.01 Waterproofing

- A. Membrane waterproofing should follow the recommendations of the National Roofing Contractors Association (NRCA) Waterproofing Manual.
- B. Membrane waterproofing shall be fully bonded.
- C. Below-grade waterproofing shall be applied to the positive pressure side and must be covered by a protection mat to shield the waterproofing membrane from destructive effects of construction activities, ultraviolet radiation, or aggressive vegetation.
- D. The use of redundant waterproofing systems is encouraged.
- E. Where practical, provide membrane waterproofing at entrances that extends under the entire vestibule, and sheds water toward the exterior (e.g. extensions of the plaza waterproofing) and can collect and discharge water that penetrates past the doors.
- F. Provide foundation waterproofing that turns up a minimum of 203 mm (8 in.) above grade.
- G. Waterstops shall be used at construction joints in below-grade walls, footings and other elements where a water-proof system is required. Wherever possible use level changes to create a redundancy with the substrate in the event the water barrier fails.
- H. Metal panel facades shall be designed with primary and secondary waterproofing and air barrier systems.
- I. A/E shall perform and submit dewpoint analysis for ALL building envelope components to demonstrate proper moisture prevention/removal and use of vapor retarders. At a minimum, the analysis shall address the following:
 - 1. Where the dew point will occur;
 - 2. Where the temperature profile will be;
 - 3. Where the primary vapor retarder will be located;
 - 4. How far moisture will be allowed to penetrate.
- J. Construction documents shall clearly indicate all drainage and air passages. Detailing shall indicate critical corner terminations, interface of all differing systems, proper sealant methodologies, etc.

2.02 Thermal Insulation

- A. All insulation materials shall have a flame spread rating of 25 or less (75 for sprinklered spaces) and a smoke developed rating of 450 or less when tested in accordance with ASTM E84.
- B. Provide insulation under concrete slabs on grade where a perma-frost condition exists.

- C. An air/moisture barrier shall be designed for all new construction and shall be employed wherever possible during renovation of existing exterior envelopes.
- D. Air barrier system shall be continuous from roof to wall to foundation.
- E. A/E shall perform and submit dewpoint analysis for ALL building envelope components to demonstrate proper moisture prevention/removal and use of vapor retarders.
- F. Foam plastic insulation shall be protected in accordance with IBC.
- G. When cellular plastic insulation is used in building exterior construction, these materials shall conform to the requirements of the current edition of the Canadian Building Code. Cellular plastics shall not be used for interior insulation.
- H. Thermal insulation materials shall be asbestos free.
- I. Where permitted by perimeter conditions, provide an R-30 insulation value or meet requirements of ASHRAE 90.1.

2.03 Roofing

- A. Roof designs shall have a fire-resistance rating appropriate for the building construction type per the International Building Code.
- B. All roofing materials (coverings and decks) shall be UL-listed and in accordance with UL 790 and NFPA 256.
- C. SMACNA Architectural Sheet Metal Manual shall be used as a guide for detailing and specification of sheet metal flashing and trim.
- D. Proper drainage, flashing and allowance for expansion are imperative for successful roof design.
- E. Flat roofs designed for access must include a parapet or perimeter standard guardrail at least 1067 mm (42 in.) in height.
- F. Where parapets and guardrails are not feasible, a personal fall protection system must be provided meeting requirements in OSHA and ANSI standards. Equipment shall be located at least 3048 mm (10 ft.) away from roof edges and oriented with access panels inboard of the roof edge.
- G. Roof system shall be selected that has limited maintenance demands. The selected system shall be thermally efficient, with consideration given to R-value, reflectivity and emissivity. For buildings that are intended to have a service life in excess of 20 years, a system with enhanced durability shall be selected to reasonably maximize the life of the roof.
- H. For new buildings and major roof renovations, the incorporation of rainwater harvesting through water catchment systems shall be considered to maximize the cost-effective use of water resources and minimize the amount of water run-off from the building.

- I. The use of the roof should be considered during design. This includes access for HVAC maintenance, expected foot traffic and walkways, and the frequency of these uses.
- J. Design architects shall consider peer review of roofing drawings and specifications by someone knowledgeable of the specified system, preferably a Registered Roof Consultant (RRC). Peer review shall be considered for buildings with very valuable contents or operations, projects where the cost of the roofing work is very substantial, and complex or unusual projects,
- K. For large roofing projects or roofing repair projects, specify and budget for full-time, third-party observation of the roofing installation. The third-party observer shall have a thorough understanding of the system being installed.
- L. Roofing specifications shall require the roof covering materials manufacturer to inspect the roof application on the first or second day of application, and to perform an inspection upon completion of the application. Submittal of the inspection reports shall be required.
- M. Cut-out inspections of roofing work shall occur with selective inspection of systems to verify correct installation. Project specifications shall require roofing contractor to repair inadequate work.
 - 1. All roofing materials are to be tested and analyzed for lead-based-paint and asbestos containing materials prior to any cut-out inspections.
- N. New work on an existing warranted roof system shall require review of new roofing details by existing roof manufacturer. Manufacturer must inspect the new installation before issuing a warranty. The installation shall be performed by an installer licensed in both the existing and the new roofing systems.
- O. When considering roof repairs, adjacent materials and systems shall also be examined to determine if items such as mortar joints, parapets, curtain walls, flashing or gutters have defects that are contributing to the envelope failure and need to be replaced or repaired. Consider the remaining service life of these adjacent materials/systems relative to the expected life of the repairs being planned. Consider compatibility between repair material and the original roof system material.
- P. All roofing work shall be required to be watertight at the end of each work day (including soldering, where applicable).
- Q. Project specifications shall require a minimum five year labor and material warranty on roof repairs and maintenance work and a 20-year manufacturer's material warranty and five year labor warranty on new work. The warranty for metal and slate roofs shall be 30 to 50 years.
- R. A 48-hour water test is required for all low-slope roof installations and repairs.
- S. Roof slopes for drainage purposes shall be achieved using a sloped roof structure rather than tapered insulation when possible.

- T. Single-ply roofing shall be reinforced and shall be a minimum 60 mil thickness.
- U. Photovoltaic (PV) roofs must include a primary roofing system under the PV system.
- V. Where solar panels are installed, access shall be provided to the roof below for maintenance and repair. Existing roofing that is to receive a solar panel installation shall be examined for remaining lifespan prior to installation of panels. Roof replacement should be considered if the existing roof has less than 5 years of useful life remaining.
- W. Chemicals used for roofing applications must meet VOC requirements established by the local jurisdiction and should be evaluated for compatibility with the building occupants (i.e., laboratories or animal enclosures).
- X. Limit the use of ductwork on roofs. Where required, ensure adequate insulation and weatherproofing to maximize lifespan and energy efficiency.
- Y. Ensure that minimum clearances are established for distance between rooftop mechanical equipment and roof surface for roof maintenance and future repairs.
- Z. The use of isolation curbs for rooftop equipment is encouraged.
- AA. Consider the compatibility of roofing materials to rooftop equipment (i.e., the effect of oil leaks from equipment onto roofing materials or the proximity of high-temperature steam to roofing materials).
- BB. A/E shall perform and submit dewpoint analysis for ALL building envelope components to demonstrate proper moisture prevention/removal and use of vapor retarders.
- CC. For low slope roofs, provide a Solar Reflective Index (SRI) of at least 78 and an SRI of 29 for roofs over a 2:12 slope.
- DD. Roofing materials shall not be comprised of lead-coated copper or have lead seam sealant/solder unless these are the only suitable materials. Documentation must be provided attesting to this. Roofing materials must not include asbestos felts, transite shingles, and adhesives containing asbestos.

2.04 Fireproofing and Firestopping

- A. Refer to the Smithsonian master specification section 078100 Sprayed Fire-Resistant Materials for requirements for sprayed-on fireproofing.
- B. Provide firestopping at all wall and floor penetrations by pipes, conduits, ducts, etc., in fire-rated assemblies. Refer to the Smithsonian master specification section 078413 Penetration Firestopping for identification of required firestopping locations, which include penetrations through floor slabs, fire-rated partitions, fire walls, fire-rated ceiling assemblies, and vertical shafts.
- C. All fire-rated construction and smoke barriers shall be labeled above the ceiling with a plaque or stenciled sign to notify contractors that firestopping of penetrations through these walls is required.

D. Refer to Smithsonian master specification section 078413 Penetration Firestopping for specific signage requirements for labeling all firestopped penetrations of fire-rated assemblies.

E. All fireproofing and firestopping materials shall be asbestos free.

2.05 Joint Sealants and Expansion Control

A. Exterior building envelope design shall include expansion control systems for all exterior construction. Historically, new construction and repair work has required extensive patching due to the lack of expansion systems in the roofing, facades, gutters and joints.

2.06 Fall Protection

A. Fall protection systems shall be designed by a qualified person to meet OSHA standards and ANSI fall protection codes.

B. The following preferred order of control shall be used to eliminate or control fall hazards as outlined in OSHA and ANSI standards.

1. Elimination or substitution by removing the hazard or hazardous work practice.
2. Passive fall protection such as guarding or covering.
3. Installing a fall restraint system.
4. Installing a fall arrest system.

III. Specifications

070xxx – Preparation

070150.19 Preparation for Re-Roofing

- A. Where existing roofing is to be replaced, it shall be completely removed and the substrate prepared for new roofing in accordance with roof manufacturer's written requirements.
- B. The new roofing system shall not be of greater weight than the old roofing system, unless a structural analysis shows that the framing system can carry the additional weight.
- C. Do not overlay new roofing membrane systems over existing roof membranes.
- D. Prior to repair or replacement, roofing materials shall be tested and analyzed for both lead-based-paint and asbestos containing materials.

071xxx – Waterproofing

071700 Bentonite Waterproofing

- A. Bentonite waterproofing shall only be used for below-grade applications.

- B. Do not expose to standing or moving water.

071800 Traffic Coatings

- A. Exposed-to-exterior concrete slabs formed from steel-reinforced concrete shall be finished with a highly durable traffic coating to prevent corrosion of the steel reinforcing.

072xxx – Thermal Insulation

072400 Exterior Insulation and Finish System (EIFS)

- A. Do not use EIFS on a building's exterior unless it is being used to repair or match an existing material. An insulated metal panel system is a preferred alternative for new construction.

072700 Air Barriers

- A. An air/moisture barrier is required of all new construction and should be employed wherever possible during remediation of existing exterior envelopes.
 - 1. The air barrier material of each assembly must be joined and sealed to the air barrier material of adjacent assemblies with sufficient flexibility to allow for the relative differential movement and with sufficient strength to resist expected peak air pressure differences.
 - 2. Penetrations of the air barrier system must be sealed to the air barrier system in an airtight manner.
 - 3. The air permeance of materials comprising part of the air barrier system must not exceed 0.004 cfm/ ft² at 0.3 in. wg (0.02 L/s.m² at 75 Pa) when tested in accordance with ASTM E 2178 Standard Test Method for Air Permeance of Building Materials.
 - 4. The air barrier system (and all materials and components comprising it) must last the anticipated service life of the enclosure or allow for easy maintenance, repair, and/or replacement.
 - 5. For new construction, demonstrate performance of the air barrier system for the building enclosure by testing the completed building and demonstrating that the air leakage rate of the building enclosure does not exceed 0.4 cfm/ ft² (2.0 L/s/m²) at a pressure differential of 0.3 in. w.g.(75 Pa). Tests can be conducted using either pressurization or depressurization. The building must not be tested until verifying that the continuous air barrier system has been installed as per the design in accordance with installation instructions.

073xxx – Steep Slope Roofing**073100 Shingles and Shakes**

- A. Roofing shingles shall be Class-A fire rated and shall match existing where applicable.

073200 Roof Tiles

- A. Roofing tiles shall be Class-A fire rated and shall match existing where applicable.

073300 Natural Roof Coverings

- A. Green roofs shall be considered where appropriate.
- B. Design of green roof system must protect primary roofing membrane.
- C. Tray system is preferred green roofing system.
- D. A drainage course shall be provided with all green roof systems.
- E. Provide roof access, walkways and fall protection for maintenance and watering. Provide hose bib connection on roof for watering.

074xxx – Metal Panels**074100 Metal Roof Panels**

- A. To avoid leakage problems at panel end-joint splices, it is preferable for the panels to be continuous from eave to ridge.
- B. Standing seam roofing shall be double lock type.

074200 Metal Wall Panels (see Division 8 Section 084500 Panel Assemblies)**075xxx – Membrane Roofing****075100 Built-Up Roofing**

- A. Follow ASTM D312 for asphalt roofing.
- B. When installed over polyisocyanurate, NRCA recommends a suitable cover board be installed over the polyisocyanurate. Four plies of Type IV felt is recommended.

075213 Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing

- A. To avoid surface cracking, a field-applied coating (such as aluminum-pigmented asphalt, asphalt emulsion or acrylic), factory-applied surfacing (granules or metal foil) or a sheet with protective reinforcement near the top should be specified.

075216 Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing

- A. Factory-surfacing of SBS sheets is recommended.

075316 Chlorosulfonate-Polyethylene (CSPE) Roofing

- A. Do not use CSPE roofing.

075323 Ethylene-Propylene-Diene-Monomer (EPDM) Roofing

- A. The use of EPDM roofing is not recommended for areas where there will be the potential for liquid fuel spills or where there will be high foot traffic.
- B. EPDM is susceptible to swelling when exposed to aromatic, halogenated and aliphatic solvents, and animal and vegetable oils such as those exhausted from kitchens.
- C. Reinforced sheets are recommended for mechanically attached and loose-laid air-pressure equalized applications as well as fully adhered and ballasted applications.

075419 Polyvinyl-Chloride (PVC) Roofing

- A. Use of 90 mil PVC is preferred over EPDM roofing, especially in locations where corrosion protection is required (i.e., fuel storage or laboratory exhaust) and for white roofs.
- B. PVC roofing shall not be used for ballasted roofs.
- C. Polystyrene boards shall not be in direct contact with PVC membranes, otherwise the polystyrene will leach plasticizers out of the PVC. A suitable separator shall be specified between polystyrene and PVC.

075700 Coated Foamed Roofing

- A. The use of coated foamed roofing is discouraged in the Mid-Atlantic region or any location that experiences high levels of humidity. Use of coated foamed roofing may be considered for warm, dry locations.

076xxx – Sheet Metal Flashing and Trim**076100 Metal Roofing**

- A. Architectural panels may be specified if a solid deck is provided. If a solid deck is not provided, structural panels need to be specified.

076200 Sheet Metal Flashing and Trim

- A. SMACNA Architectural Sheet Metal Manual shall be used as a guide for detailing and specification of sheet metal flashing and trim.

- B. Gutters and downspouts shall be adequately sized and transitioned.
- C. When roof alterations or additions are performed, sizes of gutters, downspouts and rain leaders should be confirmed as adequate for new conditions using engineering calculations.
- D. Window sill flashing: Use durable metal flashings (e.g. zinc-tin coated-copper or stainless steel) where sill flashings will be exposed. Slope sill flashings to the exterior; provide an out-turned drip edge over face of wall cladding. Provide an upturned leg (1 inch minimum, greater for high wind exposures) at the interior, and end dams soldered water tight. Do not penetrate the horizontal portion of flashing with fasteners. To fasten the sill frame, provide an attachment angle inboard of the window sill and fasten through the upturned leg of the sill flashing into the inboard leg of the sill frame.
- E. Window head flashing: Use durable metal flashings (zinc-tin coated-copper or stainless steel). Slope window head flashings to the exterior; provide an out-turned drip edge over top of window frame. Extend head flashings several inches beyond the window frame. Provide end dams soldered watertight. Seal head flashings to the inner face of the windows and to the jamb flashings. Provide minimum 4-inch upturned leg and counter flash with wall waterproofing membrane adhered to the vertical leg of the metal flashing. For punched windows in openings that do not allow extension of the head flashing beyond the opening (e.g. concrete openings) use dual sealant joints in lieu of head flashing to capture water and direct it to the jamb flashings.

077xxx – Roof Accessories

077200 Roof Accessories

- A. Provide stone parapet caps with adequate pins/dowels and waterproofing to prevent water infiltration into wall cavities.
- B. Provide walk pads around and to all roof-mounted equipment that will require servicing and maintenance.
- C. The installation of the following roof accessories should be considered on a building-by-building basis: Lightning Protection (refer to existing Smithsonian Institution Lightning Protection Survey of Mall buildings); cell tower antennae; snow melt systems; bird control.
- D. Elimination or guarding of fall hazards for safe access by maintenance and service personnel when conducting inspections, testing and repair must be included in the design.
- E. Snow guards for sloped roofs shall be high strength and designed for the appropriate roofing material. Through-fasteners that penetrate roof membrane shall not be used and guards should not be clamped to standing seams.

078xxx – Fireproofing

078100 Sprayed Fire-Resistant Materials

- A. The Smithsonian master specification section is available on the OFEO A/E Center Website.

078123 Intumescent Mastic Fireproofing

- A. Ensure that the proper mil thickness of intumescent fireproofing is specified in relation to the structural members receiving the coating.

078413 Penetration Firestopping

- A. The Smithsonian master specification section is available on the OFEO A/E Center Website.

079xxx –Joint Sealants

079200 Joint Sealants

- A. Sealant joints shall be designed and installed per ASTM C1193 and ASTM C1472.
- B. The use of urethane-based sealants with appropriate primer is preferred at exterior stone construction.
- C. Compatibility and adhesion testing shall be required.

079500 Expansion Control

- A. Expansion control of exterior building elements shall be fully coordinated, especially where materials overlap or are adjacent.

Division 08 – Openings

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 SI Standard Exhibit Fabrication Specifications
- 1.04 SI OPS Exhibit Case Construction and Alarming Design
- 1.05 SI Security Design Criteria
- 1.06 Smithsonian Guidelines for Accessible Design
- 1.07 NFPA 101 Life Safety Code
- 1.08 Interagency Security Committee (ISC) Security Design Criteria
- 1.09 Occupational Safety and Health Administration (OSHA) Standards
- 1.10 Glass Association of North America (GANA) Glazing Manual
- 1.11 American Association of Automatic Door Manufacturers (AAADM) Guidelines
- 1.12 ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- 1.13 ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
- 1.14 ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- 1.15 ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference
- 1.16 ASTM Standard E1300 Standard Load Practice for Determining Load Resistance of Glass in Buildings
- 1.17 The Aluminum Association's Specifications for Aluminum Structures

- 1.18 American Architectural Manufacturers Association (AAMA) 1503 Standard for Thermal Testing and CRF
- 1.19 AAMA 505 Dry Shrinkage and Composite Performance Thermal Cycling Test Procedure
- 1.20 AAMA 611, 2603, 2604, Standards for Finishing Aluminum
- 1.21 AAMA 1600 Voluntary Specification for Skylights
- 1.22 AAMA 101/I.S.2/A440-05 – Standard/Specification for Windows, Doors and Unit Skylights
- 1.23 AAMA Glass Design for Sloped Glazing
- 1.24 AAMA Structural Design Guidelines for Aluminum Framed Skylights
- 1.25 AAMA Aluminum Curtain Wall Design Guide Manual
- 1.26 AAMA 1502.7, Voluntary Test Method for Condensation Resistance of Windows, Doors, and Glazed Wall Sections
- 1.27 AISC's Specification for the Design of Cold-Formed Steel Structural Members
- 1.28 ANS I/AAMA Standard 101- 85 Specifications for Architectural Windows
- 1.29 ANSI A250.8 Recommended Specifications for Standard Steel Doors and Frames
- 1.30 ANSI/SDI A250.11 Recommended Erection Instructions for Steel Frames
- 1.31 ANSI/BHMA A156.10 American National Standard for Power Operated Pedestrian Doors
- 1.32 ANSI/BHMA A156.19 American National Standard for Power Assist and Low Energy Power Operated Doors
- 1.33 ANSI Z97.1 American National Standard for Safety Glazing Materials Used in Buildings\
- 1.34 ANSI/NAAMM-HMMA 865 Guide Specifications for Swinging Sound Control Hollow Metal Doors and Frames
- 1.35 GSA-TS01-2003 US General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings
- 1.36 NFPA 252 Standard Methods of Fire Tests of Door Assemblies
- 1.37 NFPA 288 Standard Methods of Fire Tests of Floor Fire Door Assemblies Installed Horizontally in Fire Resistance-Rated Floor Systems
- 1.38 NFPA 80 Standard for Fire Doors and Other Opening Protectives

- 1.39 Window & Door Manufacturers Association (WDMA) 1.S 1-A Specification for Architectural Wood Flush Doors

II. Design Requirements

2.01 Historic Wood Windows

- A. Refer to the SI Security Design Criteria document for standard locking method for historic wood windows in existing facilities.
- B. Replacement of windows in historic structures shall exactly match original frame and muntin profiles. Consideration should be given to rehabilitating the existing windows. Retrofitting existing monolithic glass in a nonwepted, wood sash with insulating glass units is prohibited.
- C. Historic wood windows that are to remain in Smithsonian facilities shall be finished on the exterior with a 3-step fluoropolymer coating.
- D. If it is necessary to replace historic window hardware, historic replicas made from the same materials as the original hardware shall be used to the greatest extent possible. If original hardware can be re-used, it shall be cleaned to remove any paint or varnish build-up and restored to match its original finish.

2.02 Doors and Frames

- A. All security locking arrangements on doors used for egress must comply with the requirements of the NFPA 101 Life Safety Code.
- B. At a minimum, doors shall be designed in accordance with space classifications as listed in the Appendix A – Security Design Criteria Matrix in the SI Security Design Criteria document.
- C. The design of doors shall comply with the Smithsonian Guidelines for Accessible Design, such as the requirements for clear opening width and for maneuvering clearances.
- D. Glass in doors shall be safety glazing. Fire-rated glazing is required in all fire-protection-rated doors.

2.03 Entrances and Storefronts

- A. The design of entrances and storefronts shall comply with the Smithsonian Guidelines for Accessible Design.
- B. The use of vestibules and air curtains shall be considered to control air and particulate infiltration.
- C. The exterior grade at all entrances shall slope away from the building.
- D. Entrance floor mats/grilles shall be designed for all public building entrances.

2.04 Curtain Walls

- A. Curtain walls shall be designed in accordance with the ISC Security Design Criteria – Structural Section.
- B. Curtain walls shall terminate at least 203 mm (8 in.) above grade; 305 mm (12 in.) is preferred.
- C. Curtain wall design shall be carefully integrated with adjacent elements such as other wall claddings, roofs, and base of wall details.

2.05 Windows

- A. All perimeter windows, skylights and glazing shall be designed in accordance with the ISC Security Design Criteria for blast resistance as appropriate.
 - 1. The design of blast resistant windows must take into consideration the structural capacity of the materials to which the window will be connected.
 - 2. Connections to the structure shall be engineered for the direct and rebound maximum capacity of the window framing members. The maximum capacity of each framing member shall be calculated to account for the actual provided member section and material properties.
 - 3. Design anchorage and connections to fully develop the calculated reaction forces with a safety factor of 1.5 when using the ultimate strength of the anchor.
 - 4. Steel to Concrete Connections: Steel to concrete connections utilizing embeds or expansion anchors shall be designed so that failure mode is yielding of the steel and not concrete splitting, spalling, or pulling out.
 - 5. Steel to Steel Connections: Steel to steel connections shall be designed so that the weld is never the weak link in the connection.
 - 6. Window system connections shall be designed, fabricated, and installed to resist the blast loads specified for the project within limits and under conditions indicated.
 - 7. At a minimum, the following submittals shall be required for blast resistant windows:
 - a. Submit shop drawings, including location floor plans or exterior wall elevations showing all window openings, typical unit elevations at 1/4 inch scale, and full size detail sections of every typical composite member. Show anchors, hardware, expansion provisions, flashing and drainage details and other components. Show all attachments to adjacent materials, including structural support elements. Include glazing details and standards for factory glazed units.

- b. Submit certified test laboratory reports by independent laboratory substantiating performance of system as specified. Include other supportive data as required or as necessary including AAMA certification.
 - c. Submit certified explosive test reports for window system installed. Tests should be conducted in accordance with GSA test standard GSA-TS01-2003 or equivalent and by a recognized independent testing laboratory.
 - d. A single representative blast resistant exterior window unit shall be individually tested for the required explosive loads. These tests should be conducted consistent with the requirements specified for the project and should replicate the installed conditions as closely as possible. If the test specimen has a smaller surface area than the unit to be installed, supplemental calculations must be submitted verifying that the test results are valid for the larger pane. Submit shock tube or arena blast resistance test reports signed by a qualified independent laboratory.
 - e. Blast calculations: Submit calculations by a qualified blast consultant, with a minimum of 5 years of relevant experience, verifying that the window glazing, frame, sub-frame/embed, and anchorages meet the specified performance requirements. Each type and size of blast resistant exterior window unit shall be verified through analysis to meet the performance requirements. Calculations performed by the blast consultant shall show that exterior window system (including frames, mullions, anchorage, and all required connections) will meet or exceed the minimum required blast load levels specified for the project. WINGARD, the approved Government software, may be used to determine the appropriate glazing edge reaction loads for the design of the frames, mullions, and anchorage system. The analysis shall show a performance condition that meets or exceeds the project's design loads.
- B. At a minimum, exterior and interior windows shall be designed in accordance with space classifications as listed in the Appendix A – Security Design Criteria Matrix in the SI Security Design Criteria document.
- C. Replacement of windows in historic structures shall exactly match original frame and muntin profiles. Consideration should be given to rehabilitating the existing windows.
- D. The design of the fenestration, size, glazing properties, and shading shall be closely coordinated with the design of the mechanical systems to maximize performance.
- E. Windows shall have a condensation resistance factor (CRF) appropriate to prevent condensation from forming on the interior surfaces of the windows. The CRF can be determined by testing in accordance with AAMA 1502.7, Voluntary Test Method for Condensation Resistance of Windows, Doors, and Glazed Wall Sections. Aluminum windows must meet the requirements of AAMA 101/I.S.2/A440-05.

- F. Window design shall be integrated with adjacent wall components to create a functioning wall system. Provide careful detailing to integrate water/air/vapor barriers with the window frames and maintain their continuity at the window perimeters.
- G. Coordinate placement of setting blocks with weep holes to avoid blocking drainage paths.
- H. Coordinate attachment details with flashing details to avoid penetrating the flashings.
- I. All glazing and caulking materials shall be PCB, lead, and asbestos free.
- J. Window frame assemblies shall not come into direct contact with building masonry. Use shims and sealants as required.
- K. Window mullions, as much as possible, shall be located on the floor-planning grid to permit the abutment of interior partitions.
- L. Window design shall provide for cleaning the interior and exterior surfaces of all windows, skylights, and other glazed openings. The A/E must demonstrate that cleaning and maintenance of interior glazing surfaces and equipment (lighting, smoke detectors, and other systems that are mounted within atrium spaces) can be achieved without extraordinary means and methods. This information shall be included in the Construction Documents.
- M. Select a window with a demonstrated track record in similar applications and exposures.
- N. For all windows, stock or custom, require construction and testing of a field mock-up representative of the wall/window for air infiltration and water leakage. Do not allow any reduction in pressure from the laboratory test.
 - 1. Air Infiltration Test: Not exceed 0.30 cubic feet per minute per foot of crack length when tested at a pressure of 6.24 psf. Adjust sash to operate in either direction with a force not exceeding 20 pounds after the sash is in motion. Perform tests in accordance with ASTM E 283 with the sash in a closed and locked position.
 - 2. Water Resistance Test: Subject window unit to a water resistance test in accordance with ASTM E 331 with no water passing the interior face of the window frame and no leakage as defined in the test method. Mount the glazed unit in its vertical position continuously supported around the perimeter and the sash placed in the fully closed and locked position. When a static pressure of 10.00 pounds per square foot has been stabilized, apply five gallons of water per square foot of window area to the exterior face of the unit for a period of 15 minutes.
- O. Require testing of production windows for quality assurance of window fabrication and installation. Require multiple tests early in the construction phase to catch problems early. Require additional testing if initial tests fail. Do not allow any reduction in pressure from the laboratory test.
 - 1. Uniform Load Deflection Test: ASTM E 330 at 50 pounds per square foot: No member deflection more than 1/175 of its span. Maintain test load for a period of

10 seconds resulting in no glass breakage, permanent damage of fasteners, hardware parts, support arms, actuating mechanisms or any other damage causing the window to be inoperable.

2. Uniform Load Structural Test: Apply a minimum exterior and interior uniform load of 75 pounds per square foot to the entire outside surface of the test unit. Maintain this test load for a period of 10 seconds. Results: No glass breakage, permanent damage of fasteners, hardware parts, support arms, actuating mechanisms, or any other damage causing the window to be inoperable. And no permanent deformation of any frame or vent member in excess of 0.2 percent of its span.
 3. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 67 deg C (153 deg F), ambient; 100 deg C (212 deg F) material surfaces.
 4. Life Cycle Test: Per AAMA 101 and AAMA 910, provide proof that the product meets the criteria including passing air and water tests at the conclusion of the cycle tests.
 5. "U" Value Tests: (Co-efficient of Heat Transfer): Test in accordance with AAMA 1503 Thermal Transmittance of Conduction with a 15 mph perpendicular dynamic wind.
- P. Require window installation shop drawings showing all adjacent construction and related work, including flashings, window attachments, interior finishes, and indicating sequencing of the work.

2.06 Skylights

- A. The use of low-emissivity glass is preferred.
- B. Placement of skylights shall be considered to prevent glare or overheating in the building interior.
- C. Coordinate the skylight configuration and proportions with the MEP design. The mechanical design must include provisions to accommodate the thermal loads imposed by the skylight.
- D. Condensation gutters and a path for the condensation away from the framing shall be integral to the skylight or sloped glazing design.
- E. Consideration shall be given to cleaning of all sloped glazing and skylights, including access and equipment required for both exterior and interior faces.
- F. Skylights shall be guarded for fall protection or meet OSHA structural requirements.
- G. Skylight design shall provide for cleaning the interior and exterior surfaces of all skylights and other glazed openings. The A/E must demonstrate that cleaning and maintenance of both interior and exterior glazing surfaces can be achieved without extraordinary means and methods. This information shall be included in the Construction Documents.

2.07 Door Hardware

- A. Refer to the SI Security Design Criteria document for security requirements for door hardware.
- B. Perimeter entry doors shall have hardware that can be repaired, replaced or adjusted with the door left in place.
- C. The design of door hardware shall comply with the Smithsonian Guidelines for Accessible Design, such as the maximum threshold height, the mounting heights for operable hardware, and the allowable door opening force.
- D. In existing facilities, specify that new hardware finish shall match building standard.

2.08 Glazing

- A. Refer to the SI OSHM Fire Protection and Life Safety Design Manual for requirements for glass used in exhibit case construction.
- B. Refer to SI Standard Exhibit Fabrication Specifications for requirements for glazing products, such as laminated safety glass, to be used in exhibit case construction.
- C. Refer to the SI OPS Exhibit Case Construction and Alarming Design document for security requirements for glass used in exhibit case construction.

- D. Refer to the SI Security Design Criteria document for requirements for the use of laminated glass in perimeter windows and in security guard booths.
- E. Refer to the IBC for code requirements for safety glazing (tempered, laminated tempered, laminated heat-strengthened) for glass used in entrances/storefronts and in railings (handrails, guard rails).
- F. The choice of single, double, or triple glazed windows and the use of low-E coatings should be based on climate and energy conservation and security requirements.

III. Specifications

080xxx – Historic Wood Windows

080152.93 Historic Treatment of Wood Windows

- A. Require Historic Treatment Specialist on site. Treatment specialist shall be a firm or individual experienced in historic treatment of windows similar in material, design, and extent to that indicated for the Project, whose work has resulted in construction with a record of successful in-service performance.
- B. Field Supervision: Require that an experienced full-time supervisor be at Project site during times that historic treatment of wood windows is in progress.
- C. Contractor shall provide a Historic Treatment Program for each phase of historic treatment process, including protection of surrounding materials on the building and Project site during operations. Describe in detail the materials, methods, equipment, and sequence of operations to be used for each phase of historic treatment work.
- D. Prepare existing windows to serve as mockups to demonstrate historic treatment methods and procedures for aesthetic effects and qualities of materials and execution. Use materials and methods proposed for completed Work and prepare mockups under same weather conditions to be expected during remainder of work.
- E. Comply with applicable requirements in AWI's "Architectural Woodwork Quality Standards" for construction, finishes, grades of wood windows, and other requirements.

081xxx – Doors and Frames

081113 Hollow Metal Doors and Frames

- A. All new doors shall have a minimum size of 914 mm (3 ft.) wide by 2134 mm (7 ft.) high by 45 mm (1-3/4 in.) thick.
- B. In existing facilities, new doors shall match building standard.
- C. Hollow metal doors and frames shall be constructed of steel sheet in accordance with ANSI A250.8. Metal frames shall be erected in accordance with ANSI/SDI A250.11.

- D. Hollow metal frames shall be welded. Do not use knocked-down frames without prior approval of the Facility Manager and the SI Design Manager.
- E. Provide rated fire doors constructed in accordance with NFPA 80. Provide fire door core construction as required to provide the fire protection ratings required by the project.
- F. Provide thermal-resistance-rated door core construction for exterior doors.

081173 Rolling Fire Doors

- A. The Smithsonian master specification section is available on the OFEO A/E Center Website.

081416 Flush Wood Doors

- A. Do not use hollow core wood doors or plastic-laminated doors.
- B. The wood door shall have an overall thickness of 45 mm (1-3/4 in.).
- C. The wood door shall have a center interior field, core, preferably of Strawboard/Wheatboard.
- D. The interior stiles of the wood door shall be a minimum of 57 mm (2-1/4 in.) wide laminated strand lumber (LSL).
- E. The interior top and bottom rails shall be a minimum of 76 mm (3 in.) wide LSL.
- F. All doors shall have a solid lumber edge of 12.7 mm (1/2 in.) thick as the visible stiles, and they shall be the same wood species as the face and back veneer if at all possible. If the same species is not possible, then a stained substitute must be presented for approval prior to fabrication.
- G. The wood door shall have 6.4 mm (1/4 in.) MDF overlay front and back and shall be calibrated perfectly flat prior to veneering the front and back of the door.
- H. The face and back veneer shall be center balance matched with an equal number of leaves per face and an equal number of leaves per back.

081433 Stile and Rail Wood Doors

- A. The wood door shall have an overall thickness of 45 mm (1-3/4 in.), measured at either the stile or the rail.
- B. Recessed panels shall be a minimum of 12.7 mm (1/2 in.) thick.
- C. Raised panels shall not exceed overall door thickness.
- D. Solid lumber shall be used to frame either recessed or raised panels and shall be the same species as the wood veneer on the face and back of the door. If that is not

possible, then a suitable alternative shall be stained and presented for approval prior to fabrication.

- E. Raised or recessed panels shall preferably be of Strawboard/Wheatboard or NAUF MDF (no added urea formaldehyde medium density fiberboard).
- F. Stiles shall be a minimum of 57 mm (2-1/4 in.) wide laminated strand lumber (LSL) or stave core.
- G. Top and bottom rails shall be a minimum of 76 mm (3 in.) wide LSL or stave core.
- H. All doors shall have a solid lumber edge of 12.7 mm (1/2 in.) thick as the visible stiles, and they shall be the same wood species as the face and back veneer if at all possible. If the same species is not possible, then a stained substitute must be presented for approval prior to fabrication.
- I. All stiles, rails, recessed or raised panels shall have 6.4 mm (1/4 in.) MDF overlay front and back and shall be calibrated perfectly flat prior to veneering the front and back of the door.
- J. Stiles shall always have the grain of the veneer running vertically, where as the rails shall have the grain running horizontally. Recessed or raised panels shall always have an equal number of leaves of veneer and shall be center balanced matched.

083xxx – Specialty Doors

083113 Access Doors and Frames

- A. Provide a continuous piano hinge and a key-operated Cam latch for access panels.
- B. Provide fire-rated access doors and frames in fire-rated wall, floor and ceiling assemblies.
 - 1. Fire-rated access doors and frames shall be UL-listed.
 - 2. Fire-rated access doors and frames must be in accordance with NFPA 252 if installed vertically and NFPA 288 if installed horizontally.
- C. Specify concealed frame access panels for interior walls and ceilings in public spaces in museum facilities.

083213 Sliding Aluminum-Framed Glass Doors

- A. Interior sliding glass doors may be used at the entrance to exhibition space. Location of the sensor is critical so that the doors do not open more than necessary.
- B. Aluminum finish shall comply with the requirements of AAMA technical standards 611, 2603 or 2604.

083323 Overhead Coiling Doors

- A. Perimeter coiling door locations in new facilities shall include vestibules or air locks.
- B. Provide foamed-in-place insulation between their exterior and interior metal skins at loading dock doors. Insulated doors shall have internal stiffeners to stiffen the face skins and provide adequate structural performance.
- C. At all exterior coiling doors, provide heavy duty weatherstripping along the jambs, a neoprene bulb wiper strip at the front of the curtain, and a neoprene baffle at the top of the coil.
- D. Replacement doors shall consider an improvement in insulation value (r-value) and should not just be a replacement-in-kind.
- E. Control devices shall be suited for high-frequency operation, open and close quickly, and have a sensor edge to detect an object beneath so as to reverse operation.

083326 Overhead Coiling Grilles

- A. Control devices shall be suited for high-frequency operation, open and close quickly, and have a sensor edge to detect an object beneath so as to reverse operation.

083473 Sound Control Door Assemblies

- A. Provide sound-control doors with manufacturer's standard sound-retardant core to achieve the STC rating required by the project.
- B. Fabricate steel sound-control doors according to ANSI/NAAMM-HMMA 865.
- C. Fabricate wood sound-control doors according to WDMA 1.S.1-A.

084xxx – Entrances and Storefronts**084113 Entrances and Storefronts**

- A. Low energy and power-assisted doors shall comply with the requirements of ANSI/BHMA A156.19.
- B. Full-powered automatic doors shall comply with the requirements of ANSI/BHMA A156.10.
- C. All power-assisted doors must comply with the "Powered Door Leaf Operation" section of the current edition of NFPA 101, Life Safety Code (Section 7.2.1.9 in the 2009 edition).
- D. It is recommended that at least one door at a museum entrance shall have an automatic operator. If there is an interior vestibule at the entrance, then at least one vestibule door shall have an automatic operator. Motion detectors and push plates are preferred over mats as actuating devices.

- E. Entrance doors and frames shall be of heavy duty construction.
- F. Doors shall be designed as part of a curtain wall system or shall have a subframe capable of supporting specified doors and hardware.
- G. Provide weatherstripping at all perimeter doors.
- H. At entrances and storefronts, provide sill flashings with a panned up interior leg and end dams to prevent water migration into the building or the interior of the frame. Shingle jamb flashing into the sill flashing.
- I. Provide adequate sealing and flashing at any door or frame device penetrations to protect devices and prevent water migration.
- J. It is recommended to use a wide stile door type because of heavy pedestrian traffic at museum entrances. Frameless, all-glass entrance doors are not recommended for museum entrances.
- K. Provide full mortise type continuous geared hinges for all museum entrance doors. The use of offset hinges for entrance doors is not recommended because of the heavy weight of the doors.
- L. Provide heavy duty surface mounted overhead closers at museum entrances because of high use of doors.
- M. The doors shall be designed for a 20-year system life. The door assembly shall have a 10-year warranty; the finish shall have a 20-year warranty.
- N. Entrance doors shall be minimum 50.8 mm (2 in.) in overall thickness with minimum 12.7 mm (1/2 in.) thick laminated glass in exterior doors and minimum 6 mm (1/4 in.) thick tempered or laminated glass in interior doors. Refer to the glazing section of these design standards.
- O. Door construction shall comply with the following:
 - 1. Doors shall have welded corner construction.
 - 2. Reinforce doors as required for hardware installation.
 - 3. In aluminum doors, the doors shall be fabricated from aluminum that is minimum 4.8 mm (3/16 in.) thick.
 - 4. In bronze doors, the doors shall be fabricated from bronze that is minimum 1.5 mm (1/16 in.) thick. The bronze door frame material shall be minimum 2.3mm (3/32 in.) thick.
- P. Door hardware on entrance doors shall include push/pull bars. Signage identifying "push/pull" is recommended.

- Q. In delegated design projects, the manufacturer shall retain an independent licensed structural engineer to prepare structural calculations and to certify that the doors meet all criteria. The stamped and sealed structural calculations shall be submitted by the contractor for Smithsonian review.
- R. Entrance door system design shall meet all performance requirements and design criteria listed below.
1. Provide entrance door system to meet structural loads – wind, seismic, blast – as identified in each project.
 2. Provide entrance door system to meet deflection of framing member criteria.
 - a. Deflection Normal to Wall Plane is limited to the edge of the glass in a direction perpendicular to the glass plane and shall not exceed $L/175$ of the glass edge length for each individual glazing lite, or an amount that restricts edge deflection of individual glazing lites to 19 mm (3/4 in.), whichever is less.
 - b. Deflection Parallel to Glazing Plane is limited to $L/360$ of clear span, or 3.2 mm (1/8 in.), whichever is less.
 3. Provide entrance door system tested according to ASTM E330 as follows:
 - a. When tested at positive and negative wind-load design pressures, system does not show evidence of deflection exceeding specified limits.
 - b. When tested at 150 percent of positive and negative wind-load design pressures, system including anchorage does not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - c. Test durations shall be as required by design wind velocity but not less than 10 seconds.
 4. Provide entrance door system that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 67° C (153°F), ambient; 100° C (212°F), material surfaces.
 5. Provide entrance door system with maximum air leakage through fixed glazing and framing areas of 0.03 L/sec/m² (0.064 ft.³/min/ft.²) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 300 Pa (0.0435 psi).
 6. Provide entrance door system that does not show evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 300 Pa (0.0435 psi).

- 7. Provide entrance door system with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.
- 8. Provide door frames that incorporate adequate thermal isolation from thermal bridges.
- S. Means of egress doors shall comply with NFPA 101 and with accessibility requirements. It shall require a force not greater than 133 N (30 lbf) to set the door in motion and not greater than 67 N (15 lbf) to open the door to the minimum required width.
- T. Provide an access panel in the bottom rail of glass doors that have the lock in the bottom rail so that the lock can be removed for service without having to dismantle the door.

084126 All-Glass Entrances and Storefronts

- A. Frameless, all-glass entrance doors are not recommended for museum entrances.
- B. Interior all-glass entrance doors shall utilize stainless steel rails at the top and bottom of the glass doors. Stainless steel shall be Type 304 and shall comply with ASTM A666.

084229 Sliding Automatic Entrances

- A. Full-powered automatic doors shall comply with the requirements of ANSI/BHMA A156.10.
- B. All power-assisted doors must comply with the "Powered Door Leaf Operation" section of the current edition of NFPA 101, Life Safety Code (Section 7.2.1.9 in the 2009 edition).
- C. The Contractor shall submit the qualifications of the sliding automatic entrance door manufacturer and installer.
 - 1. The manufacturer shall have a minimum of ten (10) years of documented experience in manufacturing doors and equipment for sliding automatic entrances. The manufacturer shall be certified by AAADM.
 - 2. The installer shall have a minimum of three (3) years of documented experience installing and maintaining sliding automatic entrances. The installer shall be certified by AAADM.

084400 Curtain Walls

- A. Aluminum curtain walls shall be designed using the AAMA Aluminum Curtain Wall Design Guide Manual.
- B. Provide thermal breaks to improve thermal performance and condensation resistance of the system.
- C. Establish the required Condensation Resistance Factor (CRF) based on anticipated interior humidity and local climate data and select a curtain wall with an appropriate CRF.

- D. If a gasketed system is used, ensure continuity of the gaskets at horizontal and vertical transitions. To mitigate shrinkage of gaskets back from the corners, the use of vulcanized corners and diagonally cut splices are recommended.
- E. Detailing of curtain wall systems shall be integral to the building envelope design including roof, parapet, waterproofing and air barrier design. See Division 7 Sections for additional requirements.
- F. Aluminum curtain wall finishes shall be either Class I anodic coatings (AAMA 611, supersedes AAMA 606, 607 and 608) or high performance factory applied fluoropolymer thermoset coatings (AAMA 2605).
- G. Select a curtain wall with a demonstrated track record in similar applications and exposures.
- H. The design of the curtain wall and perimeter construction shall permit curtain wall removal and replacement without removing adjacent wall components that will remain.
- I. Specify field mock-ups for all curtain wall systems.
- J. Specify that laboratory tests are to be conducted at an AAMA Accredited Laboratory facility.
- K. Require the field testing of curtain walls for air infiltration and water penetration resistance, for quality assurance of curtain wall fabrication and installation. Require multiple tests with the first test on initial installations and later tests at approximately 35%, 70% and at final completion to catch problems early and to verify continued workmanship quality. Require additional testing to be performed if initial tests fail.
- L. Require curtain wall installation shop drawings showing all adjacent construction and related work, including flashings, attachments, interior finishes, and indicating sequencing of the work.

084500 Panel Assemblies

- A. A/E shall perform and submit dewpoint analysis for ALL building envelope components to demonstrate proper moisture prevention/removal and use of vapor barriers.
- B. Joints between panels shall be wide enough to accommodate thermal expansion and differential movements between panels.
- C. Clearly detail air and water barrier requirements for panel assemblies on the Contract Documents.
- D. The following performance criteria shall be included in the Specifications:
 - 1. Wind Loading.
 - 2. Seismic design criteria.
 - 3. Deflection criteria.

4. Air Infiltration criteria.
 5. Water test performance criteria.
 6. Panel flatness criteria.
 7. Panel tolerance criteria.
 8. Thermal movement criteria.
 9. Performance testing criteria.
 10. Fire resistance ratings, if required.
 11. Sound transmission criteria.
 12. Insulation criteria.
 13. Performance criteria for air and moisture barrier or rainscreen.
- E. Steel panels shall be designed using AISC's Specification for the Design of Cold-Formed Steel Structural Members.
- F. Aluminum panels shall be designed according to The Aluminum Association's Specifications for Aluminum Structures.

085xxx – Windows

085113 Aluminum Windows

- A. Aluminum windows shall meet the requirements of AAMA 101/I.S.2/A440-05.
- B. Aluminum windows shall meet the requirements of ANS I/AAMA Standard 101- 85.
- C. Aluminum frames shall incorporate thermal breaks. Thermal break shall provide a continuous uninterrupted thermal barrier around the entire perimeter of the frame and all sash and not be bridged by any metal conductors at any point. Provide manufacturer's standard construction which has been in use on similar window units for a period of not less than three years, has been tested to demonstrate resistance to thermal conductance and condensation and has been tested to show adequate strength per AAMA 505.
- D. Slope the glazing pocket to promote drainage.

085123 Steel Windows

- A. Steel windows shall meet the requirements of Steel Window Institute's (SWI) Specifier's Guide to Steel Windows for the performance class required.
- B. Steel windows shall meet the requirements of the National Association of Architectural Metal Manufacturers Standard SW-1 for the performance class required.
- C. Fully weld all frame corners for watertight construction.
- D. Existing steel frames, if not substantially weakened by corrosion, can be removed, refinished and reinstalled.

085200 Wood Windows

- A. Wood windows shall meet the requirements of AAMA/WDMA 101/I.S.2/ NAFS. AW Architectural Class.
- B. Wood windows shall meet the requirements of ANS I/NWMA Standard I.S. 2-87, Grade 60.

086xxx – Skylights and Sloped Glazing Assemblies**086200 Skylights and Sloped Glazing Assemblies**

- A. Skylight design shall follow the guidelines of AAMA Standard 1600.
- B. Unit Skylights shall follow AAMA 101/I.S.2/A440-05, Standard/Specification for Windows, Doors and Unit Skylights.
- C. Design of sloped glazing shall follow the guidelines of AAMA Glass Design for Sloped Glazing and Structural Design Guidelines for Aluminum Framed Skylights.
- D. Provide a minimum skylight slope of 3:12.
- E. Provide a continuous system of gutters, integral with the skylight rafters and cross members, to collect leakage and condensation. The cross member gutters must be notched at their ends to assure drainage into the rafter gutters. Water must be drained from gutter to gutter and never onto units below.
- F. Provide an exterior wet seal in lieu of a dry gasket seal.
- G. Select a system with continuous rafters if possible.
- H. Provide a continuous metal sill flashing to collect leakage and condensation. The flashing shall be sloped and drain to the exterior. Fully integrate the sill flashing with the exterior envelope of the building.
- I. Select a system with snap-on rafter caps, rather than exposed pressure bars.
- J. Provide flush-glazed horizontal mullions without exterior applied pressure bars to avoid bucking water run-off.
- K. Coordinate the waterproofing with the attachment details.
- L. Establish the required condensation resistance factor (CRF) based on anticipated interior humidity and local climate data, and select a system that meets this CRF.
- M. Design for adequate differential movement between skylight systems and structural support members.
- N. Skylight design shall include a review of the potential for damage by adjacent structures or materials, including the possibility of gravel ballast being blown off adjacent roofs.

Providing roof parapets or avoiding gravel roof ballast altogether limit the risk of breakage. All lites in the skylight glazing shall be heat-strengthened to limit the risk of fracture. Monolithic fully-tempered glass shall not be used as the inboard lite of a skylight to avoid fall-out associated with spontaneous fracture.

- O. Design the skylight and perimeter construction to allow component replacement and include provisions for safe access and fall protection for maintenance and service personnel. Match the life expectancy of components that are mated together into an assembly.
- P. Verify skylight performance using mock-ups. The mock-ups shall include all representative perimeter construction details (sill, hip, head, rake), and shall be tested for air and water penetration resistance.

087xxx – Door Hardware

087100 Door Hardware

- A. Refer to the SI Security Design Criteria for SI standards for door hardware.
 - 1. Yale cylinder locks are the Smithsonian standard.
 - 2. Hinge pins on perimeter doors shall be non-removable.
 - 3. Door coordinators shall be provided on double doors to ensure the doors close in the proper sequence and latch properly.
 - 4. Refer to the criteria for locking requirements for roll-up doors, card-access controlled doors, perimeter doors, and construction doors.
- B. Specify heavy-duty, continuous hinges for high use doors.
- C. Specify sound gasketing on mechanical room doors that open on to public corridors.
- D. Provide kick plates on all doors subject to abuse by service carts and other similar equipment.
- E. Provide full mortise type continuous geared hinges for all museum entrance doors. The use of offset hinges for entrance doors is not recommended because of the heavy weight of the doors.
- F. Provide heavy duty surface mounted overhead closers at museum entrances because of high use of doors.
- G. Delayed egress hardware shall be specified with the activation switch incorporated into the door panic hardware. The type of delayed egress hardware that integrates the activation switch within the magnetic locking mechanism shall not be used.

087113 Automatic Door Operators

- A. Specify automatic door operators as appropriate for the weight of the doors and the frequency of use.
- B. Coordinate doors that have an automatic door operator with other building systems, such as power, smoke evacuation fans, alarms, and hydraulic lines.
- C. Specify the type of door actuator for accessibility – infrared versus wireless manual push button. SI prefers the push button actuator.
 - 1. The location of the push button (on the wall or on a pylon) is critical so that the push button does not wear out with overuse.
- D. Consider the use of electro hydraulic openers where the sound of the constant usage of a door may be disturbing to the building occupants (i.e., interior research or office spaces).
- E. Refer to the SI Security Design Criteria document for locking requirements for non-emergency exit doors equipped with automatic operators.

088xxx – Glazing**088000 Glazing**

- A. Follow GANA glazing guidelines.
- B. Use ASTM Standard E1300 Standard Load Practice for Determining Load Resistance of Glass in Buildings to select appropriate glass thickness to resist service loads.
- C. Single glazing has poor thermal performance and is suitable only for applications where thermal performance is irrelevant, such as interior applications or installations where interior and exterior temperatures do not vary substantially.
- D. Provide continuous dual seals on all insulated glazing units.
- E. Insulated glazing unit spacer shall be filled with desiccant and constructed with bent, welded, or soldered corners in lieu of corner keys.
- F. Provide setting blocks that are properly sized and spaced in order to promote moisture drainage away from glazing toward weep holes. Ensure that setting block is chemically compatible with secondary insulated glazing unit seal.
- G. Ensure that sealants that come in contact with laminated glass interlayers are compatible to avoid delamination.
- H. Protect the edges of laminated glazing from exposure to water to limit the risk of delamination.
- I. Avoid glass-to-frame contact by using setting blocks.

- J. Use heat-strengthened glass for high temperature applications, such as spandrel glass, and where greater resistance to bending and thermal stresses, compared to annealed glass, is required.
- K. Use fully-tempered (FT) glass where required by code, but avoid use in areas where breakage poses a risk to safety due to the potential for spontaneous breakage. Where the use of FT glass is unavoidable, and where its breakage poses a threat to people or property, heat-soak the FT glass to reduce the risk of spontaneous breakage.
- L. The use of laminated glass with appropriate PVB interlayers is preferred over the use of applied films for UV protection.

089xxx – Louvers and Vents

089000 Louvers and Vents

- A. Louvers and vents shall be constructed of aluminum unless heavier, more historic materials are required to match existing materials.
- B. Louvers and vents shall be designed to adequately prevent water and/or driving rain from penetrating the building envelope and shall drain water away from the building.
- C. Bird screens shall be provided at all exterior louvers and vents. Bird screens shall be coordinated with HVAC airflow requirements.
- D. Louvers and vents shall not be field-modified during installation.

Division 09 – Finishes

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 SI Safety Manual
- 1.04 NFPA 701 Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
- 1.05 NFPA 101 Life Safety Code
- 1.06 ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
- 1.07 ASTM C373 Water Absorption
- 1.08 ASTM C1028 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Substances
- 1.09 ASTM C650 Chemical Resistance
- 1.10 ASTM C1027 Abrasion Resistance
- 1.11 Mohs Scale of Hardness (MOH)
- 1.12 ASTM E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
- 1.13 SI Security Design Criteria
- 1.14 Carpet and Rug Institute (CRI) Green Label Plus Program and Texture Appearance Retention Rating (TARR) System
- 1.15 South Coast Air Quality Management District (SCAQMD) Rule #1168
- 1.16 Master Painters Institute (MPI) Architectural Painting Specification Manual
- 1.17 Ozone Transport Commission (OTC)
- 1.18 International Accreditation Service (IAS)

- 1.19 ASTM E2573 Standard Practice for Specimen Preparation and Mounting of Site-Fabricated Stretch Systems to Assess Surface Burning Characteristics
- 1.20 ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- 1.21 ASTM F2034 Standard Specification for Sheet Linoleum Floor Covering
- 1.22 ASTM F970 Standard Test Method for Static Load Limit
- 1.23 ASTM D3359 Standard Test Methods for Measuring Adhesion by Tape Test
- 1.24 ASTM D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
- 1.25 ASTM D2794 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
- 1.26 ASTM D3363 Standard Test Method for Film Hardness by Pencil Test
- 1.27 ASTM D2486 Standard Test Methods for Scrub Resistance of Wall Paints
- 1.28 ASTM D3023 Standard Practice for Determination of Resistance of Factory-Applied Coatings on Wood Products to Stains and Reagents
- 1.29 ASTM D1308 Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- 1.30 ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- 1.31 ASTM E1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
- 1.32 ASTM E1264 Standard Classification for Acoustical Ceiling Products
- 1.33 ASTM E1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
- 1.34 ASHRAE Standard 62.1 Ventilation for Acceptable Indoor Air Quality
- 1.35 ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- 1.36 ASTM C635 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
- 1.37 ASTM A641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
- 1.38 ASTM F1861 Standard Specification for Resilient Wall Base

- 1.39 ASTM D2240 Standard Test Method for Rubber Property—Durometer Hardness
- 1.40 ANSI A108.11 Specifications for the Installation of Interior Cementitious Backer Units
- 1.41 ANSI A118.9 Specifications for Cementitious Backer Units
- 1.42 ASTM C1288 Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets
- 1.43 NFPA 286 Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
- 1.44 ASTM C241/ C1353 Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
- 1.45 ANSI A108/ A118 American National Standard Specifications for the Installation of Ceramic Tile
- 1.46 ASTM C587 Standard Specification for Gypsum Veneer Plaster
- 1.47 ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
- 1.48 ASTM C840 Standard Specification for Application and Finishing of Gypsum Board
- 1.49 ASTM C842 Standard Specification for Application of Interior Gypsum Plaster
- 1.50 ASTM C1396 Standard Specification for Gypsum Board
- 1.51 NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials
- 1.52 NFPA 265 Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls

II. Design Requirements

- 2.01 Interior Walls and Ceilings
 - A. At a minimum, interior partitions shall be designed in accordance with the SI OSHM Fire Protection and Life Safety Design Manual and with the space classifications as listed in the Appendix A – Security Design Criteria Matrix in the SI Security Design Criteria document.
 - 1. Enclose all mechanical and electrical rooms with minimum one hour fire-rated construction (or higher as required by the IBC building code).
 - B. Interior finishes shall comply with the SI OSHM Fire Protection and Life Safety Design Manual, the SI Safety Manual Chapter 36, Fire Protection, all applicable NFPA code requirements, and the Ozone Transport Commission air quality regulations.

- C. Refer to SI OSHM Fire Protection and Life Safety Design Manual Section 2.6 Interior Finishes and Decorative Materials for maximum flame spread rating, maximum smoke developed rating, and flame resistance requirement for finish materials, in accordance with NFPA 101 and NFPA 701 standards and testing in accordance with ASTM E84.
- D. Consideration shall be given to using high performance coatings on walls in high traffic areas. Wall coatings and surfaces shall be durable and easily cleaned.

2.02 Acoustic Design

- A. Carpet and acoustical ceiling systems shall be specified in large public areas where it will not conflict with existing/and or historic design and in open office areas in order to minimize ambient noise levels. In addition, a white noise system should be considered in open office areas to assist in minimizing ambient noise levels.

2.03 Ceiling Heights

- A. Ceiling heights in open office areas shall promote flexibility for future floor plan changes. Office areas greater than 14 m² (150 sq. ft.) shall have a minimum ceiling height of 2700mm (9 ft.). Areas smaller than 14 m² (150 sq. ft.) shall have a minimum ceiling height of 2300mm (8 ft.).

2.04 Ceiling, Lighting and Security Design

- A. The architect/designer shall submit a thorough re-lamping narrative with every lighting and/or ceiling design as part of the Design/Construction Document submission.
- B. The architect shall coordinate the location of all ceiling-mounted security devices (cameras, motion detectors) on the reflected ceiling plans.
- C. The design shall include provision for means of access to maintain ceiling-mounted lighting fixtures and security devices. Contractor shall provide any specialized equipment required to access lighting and devices mounted on the ceiling.

2.05 Historic Finishes

- A. New work in historic buildings should maintain as much of the historic finishes as possible. Finishes should be restored using historically appropriate materials.
- B. Existing ceiling heights in historic buildings should be maintained to the greatest extent possible. Where appropriate, exposed ceiling solutions that provide for full ceiling clearances and exposure of ornamental finishes should be implemented.

III. Specifications

092xxx – Gypsum Board

092300 Gypsum Plastering

- A. Install gypsum plaster in accordance with ASTM C842.
- B. The installer shall have a minimum of five (5) years documented experience installing plaster.

092613 Gypsum Veneer Plastering

- A. Specify USG Imperial Plaster, or Smithsonian approved equal, for high traffic areas receiving veneer plaster finish.
- B. Install gypsum veneer plaster in accordance with ASTM C587.

092813 Cementitious Backer Board

- A. Qualified Installer must have a minimum of two (2) years experience with installation of similar products.
- B. Contractor shall provide the following warranties:
 - 1. Product Warranty: limited product warranty against manufacturing defects:
 - a. 13 mm (1/2 in.) nominal cement board for 20 years.
 - b. 6 mm (1/4 in.) nominal cement board for 20 years
 - 2. Workmanship Warranty: application limited warranty for two (2) years.
- C. Material shall meet the following building code compliance:
 - 1. Non-asbestos fiber-cement board to comply with ASTM C1288 and ANSI A118.9.
 - 2. Board shall meet the building code compliance National Evaluation Report No. NER 405.
 - 3. US Department of Housing and Urban Development Materials Release 1268C.
 - 4. California DSA PA-019.
 - 5. City of Los Angeles, Research Report No. 24862.
- D. Fasteners for Cementitious Backer Board
 - 1. Wood Framing fasteners:

- a. Wood framing: 32 mm (1-1/2 in.) corrosion resistant (galvanized or stainless steel) roofing nails.
 - b. Wood framing: 32 mm (1-1/2 in.) No. 8 by 9.5 mm (0.375 in.) HD self-drilling, corrosion resistant ribbed wafer head screws.
2. Metal Framing:
- a. Metal framing: 32 mm (1-1/2 in.) No. 8 by 9.5 mm (0.375 in.) HD self-drilling, corrosion resistant ribbed wafer head screws.

092900 Gypsum Board

- A. Gypsum board must meet the requirements of ASTM C1396. Metal stud systems must meet the requirements of ASTM C754. The application and finishing of gypsum board shall be in accordance with ASTM C840.
- B. Specify abuse-resistant gypsum board in all public areas (where there is no plaster or stone finish).
- C. Provide Level 5 finish for gypsum board used in all public areas, which include permanent exhibition galleries. Provide Level 4 finish for gypsum board used in temporary exhibitions and in administrative areas. Provide finish levels in accordance with ASTM C840.
- D. Specify mold-resistant gypsum board in all food service areas.
- E. Identify fire rating (UL Design Number) and sound rating (STC Number) where applicable for all new partitions.
- F. At a minimum, typical interior partition construction consists of 16 mm (5/8 in.) gypsum board each side of 92 mm (3-5/8 in.) 20-gauge metal studs at 610 mm (2 ft.) on center.
 - 1. Identify Type X gypsum board for fire-rated partitions.
- G. Extend room partitions through ceiling and anchor to structure above. Do not terminate partitions at ceiling grid without prior approval of Facility Manager and SI Design Manager.
- H. Extend all corridor partitions to structure.
- I. Provide sound insulation batts within partitions for sound control around offices, conference rooms, restrooms and other spaces identified in project scope requirements.

093xxx – Tiling

093000 Tiling

- A. Porcelain tile, with a low rate of absorption of less than 1/2 of 1% per ASTM C373, is the preferred ceramic tile material for use as a floor tile. A low rate of absorption is a measurement of durability in that it has a higher breaking strength than other ceramic tile types. The various porcelain types are through body, color body, double loaded or glazed.

- B. A minimum static coefficient of Slip Resistance of .60 for a floor tile per ASTM C1028 must be met, when wet, and when the tile is dry, a coefficient rate higher than .60 must be met.
- C. A floor tile shall have a minimum MOH Scale Hardness of 7.0. In very high traffic facilities, the MOH should be 7.5—8.0 for scratch hardness.
- D. Chemical Resistance is measured on a pass/fail basis using ASTM C650-04, and it is important for the porcelain floor tile selected to have passed this test.
- E. The classifications of tile which has been subject to ASTM C107-99 range from Class Zero---not recommended for use on a floor---to Class Five---heavy commercial. A minimum of Class Four shall be applied to all SI floor tile installations with Class Five used for buildings or sections of buildings having the highest traffic.

095xxx – Ceilings

095123 Acoustical Tile Ceilings

- A. The Acoustical Tile Ceiling's surface texture shall be fine.
- B. The composition of the Acoustical Tile Ceiling shall be mineral fiber.
- C. The color of the Acoustical Tile Ceiling shall be white.
- D. The Acoustical Tile Ceiling shall have the following Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton, 0.70.
- E. The Acoustical Tile Ceiling shall have the following Ceiling Attenuation Class (CAC): ASTM E1414; Classified with UL label on product carton, 35.
- F. The Acoustical Tile Ceiling shall pass the following Emissions Testing: Section 01350 Protocol, < 13.5 ppb of formaldehyde when used under typical conditions required by ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality."
- G. The Acoustical Tile Ceiling shall pass the following test for Flame Spread: ASTM E 1264; Class A (UL).
- H. The Acoustical Tile Ceiling shall pass the following test for Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.90.
- I. The Acoustical Tile Ceiling shall have Antimicrobial Protection: BioBlock Plus - Resistance against the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.
- J. The Acoustical Tile Ceiling shall have a one (1) year warranty from date of substantial completion.

095436 Suspended Grid Systems

- A. The Suspended Grid System shall consist of the following components: All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A 653. Main beams and cross tees are double-web steel construction with 9/16 IN type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel (aluminum or stainless steel) in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).
 - 1. Structural Classification: ASTM C 635 HD.
 - 2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.
 - 3. Acceptable Product: Interlude XL 14 mm (9/16 in.) Dimensional Tee as manufactured by Armstrong World Industries, Inc.
- B. The Suspended Grid System shall have the following Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- C. The Suspended Grid System shall have the following characteristics for the Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least three times design load, but not less than 12 gauge.
- D. The Suspended Grid System shall have the following Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.
- E. The Suspended Grid System is to have a ten (10) year warranty from date of substantial completion.

095443 Stretched-Membrane Ceiling Systems

- A. The stretched-membrane ceiling system must be UL-approved.
- B. The fabricator/installer must specialize in stretched-membrane ceiling systems and must have a minimum of five years documented successful experience with such ceilings. The installation shall be performed by skilled workmen thoroughly trained in this type of work.
- C. The size and characteristics of the membrane shall be as follows:
 - 1. The membrane shall be minimum 0.17 mm (0.01 in.) thick.
 - 2. The width of sheeting between two factory welds shall be minimum 1676 mm (5 ft. 6 in.).

3. The membrane shall be washable.
- D. Coordinate the layout and installation of the ceiling system with other building elements that penetrate the ceiling, such as light fixtures, HVAC, fire suppression, and partitions.
- E. The membrane shall be stretched over the subsurface and hooked into the supporting rails without glue or clips.
- F. The stretched-membrane ceiling shall be removable by hand and approved tools for visible inspection, to provide access above the stretched membrane, and to provide for subsequent reinstallation.
- G. The following conditions must be met on site before the membrane can be installed:
 1. The space to receive the stretched-membrane ceiling shall be enclosed.
 2. Sufficient heat is provided. Maintain uniform temperature and humidity during installation.
 3. All wet work is completed and dry.
 4. Dust-generating activities have terminated.
 5. Overhead mechanical, plumbing (sprinkler), and electrical work is completed, tested and approved.

096xxx – Flooring and Base

096200 Specialty Flooring

- A. Design of glass floors and glass stair treads requires load calculations performed by a structural engineer. The design shall meet the load requirements of the IBC building code. Careful consideration shall be given to applying point and impact loads to glass.
 1. Surface damage of the glass can occur by impact from hard objects. Therefore, redundancy and safety factors must be used in the design of glass flooring.
 2. Identify the edge support conditions (four-, three-, or two-sided) in order to determine the load-carrying capabilities of the glass.
- B. The types of glass products used in floors and stair treads include:
 1. Laminated glass – two or more pieces of glass bonded together with an interlayer. The glass may be heat-strengthened or fully tempered. The interlayer can contribute to reduction of sound transmission.
 2. Glass block – a decorative glass building block that is set in a frame and sealed.
- C. Since pedestrian safety is a critical objective, the glass must provide an acceptable level of slip resistance.

1. Glass floors must have a minimum static coefficient of friction of 0.60 per ASTM C1028.
 2. To create the slip resistant top surface of glass floor treads, specify textured glass ceramic enamel that is permanently fused to the glass surface during the glass strengthening process at temperatures in excess of 649°C (1200°F).
- D. Some type of marking, such as dots on the stair treads, is recommended on glass stairs in public areas of museums with high visitation in order to assist people to distinguish between the last stair tread and the landing.
- E. The proper sealant that is compatible with the glass flooring shall be selected.
- F. Since glass floors are not typically fire resistant, the design of adequate fire barriers between floors must be developed.

096229 Cork Flooring

- A. Cork flooring shall be made with harvested bark from living cork oak trees that are never felled.
- B. The binder of the cork flooring shall be a polyurethane agglomomerative resin. The proportion of cork material to binder is 5%-7% granulated cork mass to agglomerate resin.
- C. The binder shall be formaldehyde-free with no emissions from the finished product.
- D. The glue used to adhere the cork flooring shall be a solvent-free composition based on an aqueous copolymer emulsion of synthetic resins.
- E. The pigment added to the cork flooring during the manufacturing process shall be inked-based nitro-cellulose with the pigment (titanium dioxide), a blend of alcohol-based solvents.
- F. The finish of the cork flooring shall be factory applied varnish---gloss or matte---and should be applied in three layers.
- G. A polyurethane finish must be applied to the cork flooring upon completion of the installation. Three coats of the polyurethane finish are required.

096340 Stone Flooring

- A. In Smithsonian museum facilities, the Architect/Designer shall only specify Stone Flooring that passes the ASTM C241/C1353 test for abrasion resistance for Heavy Traffic. This is measured by abrasive hardness (Ha).
1. The minimum value of abrasive hardness is 10.0 Ha for general areas.
 2. The abrasive hardness value increases to 12.0 Ha for stairways, elevator halls, and other concentration areas.

3. Exterior paving shall always have a minimum Ha of 12.0.
 4. Polished finish on stones with abrasion indices ≤ 20.0 are not suitable for most moderate and any heavy-traffic areas.
 5. Thermal finish is recommended for exterior paving.
- B. If several varieties of stone are used together, care shall be taken to ensure that the abrasive hardness (Ha) of the stones is similar. Proper testing (ASTM C241 or ASTM C1353) shall be performed on each stone variety.
- C. Joints between stones shall be of sufficient width to ensure that the grout being used can be placed at the bottom face of the stone and properly compacted within the joint. In no case shall natural stone be installed with tight joints.
1. Exterior Stone Pavement has a typical stone joint width of a minimum 6.4 mm (1/4 in.), preferably 9.5 mm (3/8 in.). Joints of 13 mm (1/2 in.) or larger are frequently required for a large unit size installation.
 2. Interior Stone Flooring has a typical stone joint width of a minimum 1.6 mm (1/16 in.), preferably 3.2 mm (1/8 in.). Joints of 6.4 mm (1/4 in.) or larger are frequently required for a large unit size installation.
 3. Movement Joints are also required in fields of paving. Refer to ANSI A108.01 section 3.7 and ANSI A108.02 section 4.4 for guidance on movement joint location.
- D. The Architect/Designer shall specify Stone Flooring with the following minimum thicknesses:
1. Exterior Stone Pavers, Pedestrian Traffic: 32 mm (1-1/4 in.).
 2. Exterior Stone Pavers, Vehicular Traffic: Is best determined by engineering analysis, but is generally 76 mm (3 in.) or thicker.
 3. Interior Stone Flooring, Heavy Duty/High Traffic: 19 mm (3/4 in.), or 32 mm (1-1/4 in.) pending stone variety selection. Stone tile that is 9.5 mm (3/8 in.) thick is only acceptable for areas with light traffic.
- E. The Architect/Designer shall specify membranes to be used in the design of stone walking surface installations.
1. Cleavage membranes are used in thick-bed installations below a reinforced mortar bed to intentionally prevent the bond between the stone setting system and the substrate slab in order to allow independent movement (free floating) of the stone and setting system. Cleavage membranes can be either sheet applied or liquid applied.

2. Crack Isolation membranes are used to isolate the stone from minor cracking of the substrate surface in thin-set applications. Crack Isolation membranes can be sheet applied, trowel applied, or liquid applied and must meet ANSI A118.12.
3. Uncoupling membranes are sheet applied and geometrically configured to provide a small airspace which accommodates lateral flexibility between the tile and the substrate, reducing the transfer of stresses to the thin-set stone installation system.
4. Waterproof membranes are used to prevent the migration of liquid water. These membranes can be sheet applied, sheet metal, or liquid applied. In many cases these membranes are installed by other trades and must meet ANSI A118.10.

096400 Wood Flooring

- A. The wood for the flooring shall be planks, which is milled from tree trunks and larger tree branches.
- B. The planks shall be kiln dried in order to avoid shrinkage, warping, cupping, bowing and splitting.
- C. The flooring shall be Premium Select Grade.
- D. The finished wood planks standard thicknesses are 19 mm (3/4 in.), 16 mm (5/8 in.) and 12.7 mm (1/2 in.).
- E. The species for the floor planks shall be from a hard wood species such as Ash, Walnut, Cherry, Oak, Maple and Sycamore.
- F. Many wood species experience off-gassing of VOCs (volatile organic compounds) which can affect artifacts and sensitive collections. Therefore, an architect/designer needs to carefully consider the selection of wood products---flooring and casework materials---for storage or display.

096513 Resilient Base and Accessories

- A. A Sanitary Butt-to Wall Base is manufactured from a proprietary thermoplastic rubber formulation designed specifically to meet the performance and dimensional requirements of ASTM F-1861, Type TP, Group 1 (solid) Standard Specification for Resilient Wall Base.
- B. The physical characteristics of the Butt-to-Wall Base are as follows:
 1. Size: 102 mm (4 in.) high with 51 mm (2 in.) toe
 2. Thickness: 2.8 mm (1/8 in.) thick
 3. Length: 30.48 m (100 ft.) coils
 4. Packaging: 1 coil per carton 30.48 m (100 ft.), 21 kgs (46 lbs).
- C. The Performance of the Butt-to-Wall Base are as follows:

1. Hardness - ASTM D 2240: 85 Shore A
2. Flexibility - Will not crack, break, or show any signs of fatigue when bent around a 6.4 mm (1/4 in.) diameter cylinder.
3. Meets or exceeds the performance requirements for resistance to heat/light aging, chemicals, and dimensional stability when tested to the methods, as described, in ASTM F-1861.
4. Fire Resistance:
ASTM E 84/NFPA 255 (Steiner Tunnel Test) - Class B
ASTM E 648/NFPA 253 (Critical Radiant Heat Flux) - Class 1

D. The Manufacturer must provide a one (1) year Warranty for the Resilient Base.

E. The resilient base shall extend behind equipment located in the space.

096516.13 Linoleum Flooring

- A. The specified Linoleum must be Class I, not less than 0.45 watts per square centimeter for the Critical Radiant Flux Classification as determined by ASTM E 648 or NFPA 253.
- B. The Floorcovering Contractor shall maintain ambient temperatures not less than 18°C (64°F) or more than 29°C (84°F) in spaces to receive resilient products during the 48 hours prior to installation, installation and 48 hours after installation.
- C. The Floorcovering Contractor shall maintain the ambient relative humidity between 40% and 60% during installation.
- D. The Floorcovering Contractor shall prepare the substrate according to ASTM F710.
- E. The Linoleum that is specified must meet or exceed ASTM F2034 for Linoleum Sheet Flooring, Static Load Limit 3103 kPa (450 psi) per ASTM F970, ASTM E-682/NFPA 258 -- 3103 kPa (450 psi) or less; ASTM E-648/NFPA 253, Class 1.
- F. A currently certified Manufacturer's Associate or Master Mechanic who will provide proof of certification, as well as proof of demonstrated expertise in using all aspects of the product prior to the start of the job, must be used to install linoleum with appropriately installed heat welded seams. Multi-colored heat welds shall be used in order to hide the appearance of the seams.
- G. The Linoleum manufacturer shall provide a Manufacturer's Warranty with a warranty period minimum of five (5) years.

096623 Epoxy Terrazzo Flooring

- A. The terrazzo contractor must be a current and active member of the National Terrazzo & Mosaic Association (NTMA).

- B. The terrazzo contractor must have a minimum of seven (7) years of experience of providing and installing epoxy terrazzo.
- C. All thin-set Epoxy Terrazzo shall be 10 mm (3/8 in.) thick.
- D. Divider strips shall be made of zinc and shall be set at no further apart than 6096 mm (20 ft.) on center.
- E. The preparation of the floor shall be vacuum blasted to meet CSP3-5 which is based on the ICRI (International Concrete Repair Industry) surface profile for bonded flooring materials.
- F. The finish of the Terrazzo shall be 220 grit sealed with an acrylic sealer.
- G. The Epoxy Terrazzo supplier must have a crack isolation membrane and barrier primer to meet requirements of slab detailing cracks and high vapor emission rates.

096813 Tile Carpeting

- A. Carpeting materials shall have a minimum critical radiant flux of 0.45 watts/ cm², when tested in accordance with ASTM E-648.
- B. For high-traffic areas, all Carpet Tile shall be specified with Solution Dyed fiber, Nylon Type 6 or 6, 6.
- C. The Carpet Tile shall have 100% loop construction.
- D. The loop construction of the Carpet Tile shall be dense and have a low pile height, no greater than 12.7 mm (0.5 in.), for use in high traffic areas.
- E. The minimum face weight of the Carpet Tile shall be 794 g/m² (28 oz/yd²).
- F. The specified carpet tile must be Green Label Plus. The adhesive must meet low emitting materials standards per the SCAQMD Rule #1168.
- G. The Carpet Tile shall have a TARR Rating (Texture Appearance Retention Rating) for Severe Traffic of 3.5 – 4.0.
- H. The floor surface receiving the Carpet Tile shall be free of defects and indentations.
- I. The backing system for the Carpet Tile shall be non-vinyl with a minimum of 50% recycled content and have a manufacturer's lifetime warranty against edge ravel, delamination and dimensional stability against cupping/curling.
- J. Provide five (5) % attic stock from the same lot as the original carpet tile.

096816 Broadloom Carpeting

- A. For high-traffic areas, all Broadloom Carpet shall be specified with Solution Dyed fiber.

- B. The Broadloom Carpet shall have 100% loop construction.
- C. The loop construction of the Broadloom Carpet shall be dense and have a low pile height, no greater than 12.7 mm (0.5 in.), for use in high traffic areas.
- D. The minimum face weight of the Broadloom shall be 907 g/ m² (32 oz/yd²).
- E. The specified Broadloom Carpet must be Green Label Plus. The adhesive must meet low emitting materials standards per the SCAQMD Rule #1168.
- F. The floor surface receiving the Broadloom Carpet shall be free of defects and indentations.
- G. The backing system for the Broadloom Carpet shall be a unitary backing or equivalent and must have a 15 year warranty against edge ravel and delamination.

096900 Access Flooring

- A. Access flooring may be used in changing gallery exhibition space. The potential problems of moisture and pests under the access floor will need to be addressed at each facility.
- B. Access flooring must be accessible for cleaning.
- C. Specify a clear concrete sealer on concrete floor under access flooring.

097xxx – Wall Coverings

097200 Wall Coverings

- A. All wall coverings shall be specified as minimum Type II, Commercial Grade.
- B. Specify high performance, woven, direct- glue installed wall coverings with either a paper-backing or an acrylic-backing. The high performance, woven wallcovering that is most desirable can be cleaned with a solution of diluted household bleach.
- C. The high performance, woven wallcovering must pass and/or comply with the following tests:
 - 1. NFPA 255
 - 2. NFPA 265
 - 3. ASTM E84 Adhered
 - 4. Tensile Strength: Fed Spec. CCC-T-191b 5100
 - 5. Tear Strength: Fed. Spec. CCC-T-191 5132

097723 Fabric-Wrapped Panels

- A. The definition of Fabric-Wrapped Panels is a site-fabricated stretched fabric panel system with continuous perimeter track profile mounted directly to sheetrock substrate. System shall provide for face fabric to be perfectly tensioned over core materials, leaving fabric floating over core surface.
- B. System shall allow for the removal and replacement of fabric facing from individual panels. Removal of fabric shall allow access to surface behind fabric without dismantling, removal or replacement of track members or core.
- C. The Architect/Designer shall determine what acoustical properties are required for the system and select from the following core materials:
 - 1. Acoustical: Fiberglass Rigid 12.7 mm (1/2 in.) fiberglass - 96 kg/m³ (6 pcf) density or 25 mm (1 in.) fiberglass - 96 kg/m³ (6 pcf) density
 - 2. Acoustical/Tackable: HD Fiberglass 25 mm (1 in.) or 19 mm (3/4 in.) - 96 kg/m³ (6 pcf) density with 6.3 mm (1/4 in.) - 160 kg/m³ (10 pcf) density face
 - 3. Tackable/High Impact: 12.7 mm (1/2 in.) Micore by USG; 19 mm (3/4 in.) Micore by USG; 12.7 mm (1/2 in.) Armstrong Privacy Guard Max; or 19 mm (3/4 in.) Armstrong Privacy Guard Max
- D. The Architect/Designer must make sure that the fabric that is selected has been tested and approved for the intended use in a vertical application as a Fabric-Wrapped Panel by the fabric manufacturer.
- E. The installer shall fabricate the Fabric-Wrapped Panel system on the jobsite to conform precisely to existing conditions in areas indicated for their application. Space shall be enclosed and weather-tight.
- F. The installer shall apply framing materials to the sheetrock surfaces scheduled to receive the Fabric-Wrapped Panel system. Framing shall be plumb and straight, flush, and in proper alignment. Mounting channel details and core coloration shall not be visible through facing fabric.
- G. Core materials shall be installed in a continuous manner, flush and level with framing materials. Core materials shall not "telegraph" through the face fabric.
- H. The installer shall cut fabric from each roll maintaining a regular sequence of drops and matching direction of weave for sequential and uniform installation.
- I. Fabric shall be tensioned securely to track system using appropriate tools. Spray adhesives or stapling of fabric to core or frame members shall not be permitted.
- J. The installer shall submit complete, unedited test reports for stretched fabric panel system prepared by an independent testing laboratory that is IAS Certified indicating full compliance with fire resistance performance requirements under ASTM E84, and specifically;

1. Fire ratings shall be for a complete assembly, including perimeter and longitudinal butt joint framing extrusions, core material, and fabric covering as required by ASTM E2573-07 Specimen Preparation and Mounting of Site Fabricated Stretch Systems to Assess Surface Burning Characteristics.
 2. Systems must be certified under ASTM E84 and Class must be compliant with placement in the building:
Class A with a Flame Spread Index (0-25) Smoke Developed Index (0-450) –
Required in exhibit spaces and means of egress
Class B with a Flame Spread Index (26 - 75) Smoke Developed Index (0-450) –
Required in exhibit spaces protected by automatic sprinkler system
Class C with a Flame Spread Index (76 – 200) Smoke Developed Index (0-450)
- K. Stretched fabric panel system installation shall be warranted by the Authorized Distributor or Certified Installer for the period defined in contract documents.

099xxx – Painting and Coatings

099113 Painting

- A. The General Contractor shall only engage a Painting Contractor that has a minimum of five (5) years proven satisfactory experience and shall maintain a qualified crew of painters throughout the duration of the work.
- B. The General Contractor shall make sure that only qualified journeypersons, as defined by local jurisdiction be engaged in painting and decorating work.
- C. Apprentices may be employed provided they work under the direct supervision of a qualified journeyperson in accordance with trade regulations.
- D. The Architect/Designer shall only select paint from manufacturers and products that are listed under the Approved Products List section of the MPI Painting Manual.
- E. Use only materials complying with the Ozone Transport Commission (OTC) air quality regulations rating based on VOC (EPA Method 24) content levels. Where indoor air quality (odour) is an issue, use only MPI-listed materials having a minimum E3 rating.
- F. The Painting Contractor shall conform to work place safety regulations and requirements of those authorities having jurisdiction for storage, mixing, application and disposal of all paint and related hazardous materials.
- G. The Painting Contractor may apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.
- H. Ensure adequate continuous ventilation and sufficient heating and lighting are in place.
- I. Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be regarded as hazardous products.

Recycle and dispose of these materials according to regulations of applicable authorities having jurisdiction.

- J. In order to meet LEED (Leadership in Energy and Environmental Design) program requirements, the Architect/Designer shall specify only MPI-listed materials having an “L” rating designation.
- K. The condition and preparation requirements for all surfaces shall be in accordance with MPI Painting Manual requirements.
- L. The Painting Contractor shall not paint unless substrates are acceptable and/or until all environmental conditions (heating, ventilation, lighting and completion of other sub-trade work) are acceptable for applications of products.

099300 Staining and Transparent Finishing

- A. Finish must comply with the South Coast Air Quality Management District (SCAQMD) rules for VOC levels to meet U.S. Green Building Council IEQc4.2 standards:
 - 1. Interior Stains 250 g/L
 - 2. Sanding Sealers 350 g/L
 - 3. Varnish 350 g/L
- B. All staining and transparent finishes that are specified shall be water-based.

099600 High-Performance Coatings

- A. The High-Performance Coating is defined as a pro-industrial, precatalyzed, water-based epoxy.
- B. This coating is for interior use only.
- C. It can be used on the following surfaces:
 - 1. Drywall
 - 2. Plaster
 - 3. Masonry
 - 4. Block
 - 5. Steel, Aluminum, Galvanized
 - 6. Wood
- D. Adhesion: ASTM D 3359, 5B, 100% adhesion for light colors; darker colors require longer cure time for same level of adhesion.
- E. Abrasion Resistance: ASTM D 4060t, 74.4 mg loss; CS-10 wheels 1000 gram load: 1000 cycles.
- F. Direct Impact Resistance: ASTM D 2794, >100 inch – lbs.

- G. Pencil Hardness: ASTM D 3363.
- H. Scrub Resistance: ASTM D 2486, 500 – 600 cycles with stiff brush and pumice scrub media.
- I. Permeability Rating: AD/TS 2002.27A, dry cup 2.0 metric perms @ 1.3 – 1.5 mils DFT.
- J. Stain Resistance: ASTM D 3023.
- K. Chemical Resistance: ASTM D 1308.

Division 10 – Specialties

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 NFPA 909 Code for the Protection of Cultural Resources Properties – Museums, Libraries and Places of Worship
- 1.04 Smithsonian Guidelines for Accessible Design
- 1.05 ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
- 1.06 ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- 1.07 ASTM E413 Classification for Rating Sound Insulation
- 1.08 ASTM E1300 Standard Practice for Determining Load Resistance of Glass in Buildings
- 1.09 ANSI/BIFMA X5.6 American National Standard for Office Furnishings – Panels Systems
- 1.10 ANSI Z97.1 American National Standard for Safety Glazing Materials Used in Buildings
- 1.11 NFPA 70 National Electric Code
- 1.12 Scientific Certification Systems (SCS) Indoor Air Advantage
- 1.13 NFPA 101 Life Safety Code
- 1.14 SI Security Design Criteria
- 1.15 ASTM E72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction

II. Design Requirements

2.01 Signage

- A. Signage design shall comply with the Smithsonian Guidelines for Accessible Design.
- B. All egress signage shall comply with SI OSHM Fire Protection and Life Safety Design Manual, NFPA 101, and local fire codes. Refer to electrical section 265100 Interior Lighting for standards for exit signs.
- C. Design of exterior signage at all Smithsonian facilities (on and off the Mall) shall be coordinated with the signage design standards incorporated in the Smithsonian Mall Wide Signage Project, OFEO Project # 0069914. In addition, exterior signage design shall be coordinated with standards incorporated in the Improve Mall Wide Perimeter Security OFEO Project # 0269910. The designer may obtain a copy of the relevant signage project information from the OFEO Design Manager.
 - 1. Exterior signage at NASM shall conform to the requirements in Improve Mall Wide Perimeter Security NASM OFEO Project # 0269910 A.
 - 2. Exterior signage at NMNH shall conform to the requirements in Improve Mall Wide Perimeter Security NMNH OFEO Project # 0269910 B.
 - 3. Exterior signage at NMAH shall conform to the requirements in Improve Mall Wide Perimeter Security NMAH OFEO Project # 0269910 C.
- D. Comply with the May 2002 Concept Plan, which identified three (3) types of signs (building, information, and program) and their locations, when applicable. The signs specified in this plan are used beyond the Mall, for example at the Reynolds Center.
- E. Refer to as-built drawings for relocation or temporary removal of existing signage, for refinishing and maintenance, and for new fabrication.
- F. Exterior signage must be legible and easy to clean, and it should coordinate with existing site and landscape features.

2.02 Restrooms

- A. The design of restrooms and fixtures shall comply with the Smithsonian Guidelines for Accessible Design. The size of accessible toilet compartments and fixture/ accessory mounting heights and clearances are among the requirements that must be addressed in the design.
- B. Provide a baby-changing station with its own sink in all public restrooms (men and women).
- C. Sinks in restrooms shall be an integral or an under mount sink in the counter.
- D. All restroom floors shall be sealed.

- E. Refer to General Requirements Division, Section 7.08 Restrooms for additional requirements for restrooms.

2.03 Demountable Partitions

- A. Demountable partitions may be used in exhibition gallery spaces and in office/administration areas.

2.04 Mobile Storage

- A. Coordinate the design of mobile storage shelving with building systems.
 - 1. Ensure there is adequate protection from the sprinkler system design. The shelving and automatic sprinkler design must always be considered together, as a change in shelving design will change the sprinkler system requirements. Refer to the SI OSHEM Fire Protection and Life Safety Design Manual and comply with any local jurisdiction code when determining the required sprinkler system.
 - 2. Coordinate the mobile storage design with the floor slab design, including required floor flatness and inserts for recessed tracks.
 - 3. Coordinate the mobile storage design with the ceiling height, lighting layout, and fire protection and mechanical distribution above the shelving.
- B. The design of mobile shelving (compact storage) for collections and archives shall be in accordance with the requirements of NFPA 909.
- C. All mobile storage shelving requires SI OSHEM review as soon as possible to evaluate the fire sprinkler density and design issues.
- D. The design of mobile storage shall comply with the Smithsonian Guidelines for Accessible Design.
- E. The decision to use manual versus motorized controls for the mobile shelving will be based on project-specific requirements.

III. Specifications

101xxx – Display Cases

101200 Display Cases

- A. Coordinate any required additional structural framing inside the partition for the support of display cases and shelving in SI retail design.

102xxx – Toilet Compartments, Demountable and Operable Partitions**102113 Stainless Steel Toilet Compartments**

- A. Toilet Compartments shall be floor-mounted overhead-braced construction.
- B. Doors, Panels and Pilasters shall be constructed of two sheets of panel flatness Type 304 #4 brushed stainless steel, laminated under pressure to a "Vertical" 12.5 mm (1/2 in.) honeycomb core for impact resistance, rigidity and sound deadening. The Honeycomb is to be of virgin, long fiber paper with a maximum 12.5 mm (1/2 in.) cell size. In the highest traffic areas, the Architect/Designer may elect to use reinforced Masonite core in lieu of the honeycomb. Formed edges are to be welded together and interlocked, under tension, with a roll-formed oval crown locking bar, mitered, welded and ground smooth at the corners.
- C. Doors shall be 25 mm (1 in.) thick with cover sheets not less than 0.8 mm (.030 in.). The surface of the doors shall be Type 304, #4 brushed satin finish stainless steel.
- D. Panels shall be 25 mm (1 in.) thick with cover sheets not less than 0.8 mm (.030 in.). The surface of the doors shall be Type 304, #4 brushed satin finish stainless steel.
- E. Pilasters shall be 32 mm (1.25 in.) thick with cover sheets not less than 0.9 mm (.036 in.). The surface of the doors shall be Type 304, #4 brushed satin finish stainless steel.
- F. Where needed, the panels shall be reinforced with wood to accept the mounting of grab bars. The load bearing quality is subject to the grab bar itself, the fasteners used, and the blocking in the wall that supports the panel.
- G. The Headrail shall be 25 mm (1 in.) by 41 mm (1.625 in.) extruded anodized aluminum with anti-grip design. The wall thickness of the Headrail is to be 1.5 mm (.060 in.) and shall be securely attached to wall and pilasters with the manufacturer's fittings in such a way as to make a strong and rigid installation. All of the joints in the Headrail shall be made at a pilaster.
- H. The Pilasters shall be securely and rigidly fastened to the floor and fitted with a jack leveling screw for vertical adjustment. The floor fastening shall be concealed and protected by a 102 mm (4 in.) high, die-formed #4 brushed finish stainless steel pilaster shoe.
- I. Full height continuous stainless steel channels shall be used for all panel to pilaster, panel to wall, and pilaster to wall connections. Slide latch and keeper shall be cast stainless steel and allow for emergency access. Fasteners are to be #4 brush finished stainless steel 305 mm x 44 mm (12 in. x 1-3/4 in.) and 305 mm x 16 mm (12 in. x 5/8 in.) TR-27 6-lobe security screws. Doors shall be equipped with a full-height continuous 16-gauge stainless steel hinge with a stainless steel hinge pin. Each door shall be fitted with a combined coat hook and bumper of Zamak, finished to match hardware items. Pilaster shoes shall be stainless steel with a #4 brushed finish.

- J. Urinal screens shall be 25 mm (1 in.) thick with cover sheets not less than 22 gauge. Supporting pilasters shall be 127 mm (5 in.) wide and 32 mm (1.25 in.) thick with cover sheets not less than 18 gauge.

102114 Solid Plastic Toilet Compartments

- A. Toilet Compartments shall be floor-mounted overhead-braced construction.
- B. Partition materials shall comply with the following requirements, when tested in accordance with the ASTM E 84:
 - 1. Smoke Developed Index: Not to exceed 450
 - 2. Flame Spread Index: Not to exceed 75
 - 3. Material Fire Ratings:
 - a. National Fire Protection Association (NFPA): Class B
 - b. International Code Council (ICC): Class B
- C. The Toilet Compartment manufacturer must be a company regularly engaged in manufacture of this specific type of product and whose products have been in satisfactory use under similar service conditions for not less than five (5) years.
- D. The Toilet Compartment installer must be a company or individual, regularly engaged in installation of this specific type of product with a minimum of five (5) years experience.
- E. The Toilet Compartment manufacturer must provide a warranty of its solid plastic against breakage, corrosion and delamination under normal conditions for a minimum of ten (10) years from the date of receipt by the Smithsonian.
- F. Doors, panels and pilasters shall be 25 mm (1 in.) thick constructed from High Density Polyethylene (HDPE) resins. Partitions shall be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. All plastic components shall be covered with a protective plastic masking.
- G. Doors, panels, and pilasters shall be 25 mm (1 in.) thick with all edges rounded to a radius.
- H. Doors and dividing panels shall be 1397 mm (55 in.) high and mounted at 356 mm (14 in.) above the finished floor. An aluminum heat sink may be fastened to the bottom edges.
- I. Pilasters shall be 2083 mm (82 in.) high (standard) and fastened into a 76 mm (3 in.) high pilaster shoe with a stainless steel tamper resistant torx head sex bolt.
- J. Hinges shall be 203 mm (8 in.) and fabricated from heavy-duty extruded aluminum (6463-T5 alloy) with bright -dip anodized finish with wrap-around flanges, through bolted to doors and pilasters with stainless steel, torx head sex bolts. Hinges operate with field adjustable

nylon cams. Cams can be field set in 30-degree increments. A third hinge shall be added to all accessible doors over 762 mm (30 in.) wide.

- K. Door strike/keeper shall be 152 mm (6 in.) long and made of heavy-duty extruded aluminum (6436-T5 alloy) with a bright dip anodized finish and secured to the pilasters with stainless steel, torx head sex bolts. The bumper shall be made of extruded, black vinyl.
- L. The latch and housing shall be made of heavy-duty extruded aluminum (6463-T5 alloy). The latch housing shall have a bright dip anodized finish, and the slide bolt and button shall have a black anodized finish.
- M. Each door shall be supplied with one coat hook/bumper and door pull made of chrome-plated Zamak. Accessible doors shall be supplied with a second door pull and out-swing doors with one door stop made of chrome-plated Zamak.
- N. Pilaster shoes shall be 76 mm (3 in.) high (type 304, 20 gauge) stainless steel. Pilaster shoes shall be secured to the pilaster with a stainless steel tamper resistant torx head sex bolt.
- O. Wall brackets shall be 1372 mm (54 in.) long and made of heavy duty extruded aluminum (6463-T5 alloy) with a bright-dipped anodized finish. The aluminum brackets are fastened to the pilaster with stainless steel tamper resistant torx head sex bolts.
- P. The headrail shall be made of heavy-duty extruded aluminum (6463-T5 alloy) with anti-grip design and integrated curtain track. The headrail shall have a clear anodized finish and shall be fastened at the top of the pilaster with stainless steel tamper resistant torx head screws.
- Q. Headrail brackets shall be 20 gauge stainless steel with a satin finish and secured to the wall with stainless steel tamper resistant torx head screws.

102219 Demountable Partitions

- A. The specified Demountable Partitions shall be non-progressive, moveable and reconfigurable system of unitized panels, from a single manufacturer.
- B. For the required acoustic performance the Demountable Partition's solid panels, when tested in accordance with ASTM E90, shall achieve the following acoustic performance ratings in accordance with ASTM E413, without site alteration:
 - 1. Steel faced panels: Minimum STC 44
 - 2. Gypsum board panels: Minimum STC 42
 - 3. Wood composite panels: Minimum STC 42
- C. Provide butt hinged doors where acoustic performance of the wall system is paramount.

- D. The Surface Burning Performance of the Painted steel panels is to be as follows:
Maximum Flame Spread of 25 when tested in accordance with ASTM E84.
- E. The Surface Burning Performance of the Wall covering faced panels is to be as follows:
Maximum Flame Spread of 25 when tested in accordance with ASTM E84.
- F. The design and size of the Demountable Partitions and components must be designed to withstand dead and live loads as calculated in accordance with the International Building Code.
- G. The design and size of the Demountable Partitions and components must be designed to withstand seismic loads as calculated in accordance with International Building Code.
- H. The load bearing capacity of the Demountable Partitions is to be: Tested to not less than the requirements for panel systems as defined by ANSI/BIFMA X5.6, latest edition. Specifically, a load of 136 kg (300 lbs.) on either side of each panel at both overhead and desktop elevations with a CG of no greater than 203 mm (8 in.) from the panel face.
- I. Panels or panel framing members of the Demountable Partitions shall exhibit lateral deflection not greater than 1/240 of span when subjected to a uniformly distributed load of 0.24 kPa (5 psf).
- J. At a minimum, glass thickness shall conform to the requirements of ASTM E1300.
- K. Glass framing members shall be sized to limit glass edge deflection not greater than 1/175 or 19 mm (3/4 in.), whichever is less, when subjected to a uniformly distributed load of 0.24 kPa (5 psf).
- L. Glazing materials shall comply with the requirements of 16 CFR Part 1201 and/or ANSI Z97.1, and shall bear markings as required by Chapter 24 of the International Building Code.
- M. Assembled panels shall be UL Classified to comply with NFPA 70 National Electric Code.
- N. Modular Wiring System Components shall be UL Listed to comply with NFPA 70 National Electric Code and Article 604 – Manufactured Wiring Systems.
- O. The indoor Air Quality Performance of the Demountable Partitions shall be as follows:
Product shall be Indoor Air Advantage GOLD certified by Scientific Certification Systems, for conformance to the requirements of California 01350 Specification (Ca-DHS-EHLB-R-174 addendum 2004-1), and the Collaborative of High Performance Schools.
- P. The combustibility Performance of the Demountable Partitions shall be as follows:
Product shall have finishes and construction acceptable for use in Non-Combustible buildings, in accordance with Chapters 6 and 8 of the International Building Code.
- Q. The Demountable Partition System shall be rectilinear in design and expression with crisp corners and well defined horizontal and vertical elements.

- R. The system shall be 102 mm (4 in.) thick minimum, and designed and sized in horizontal and vertical modules to accommodate the partition layout indicated.
 - 1. Panel heights shall be available in 1.6 mm (1/16 in.) increments from a minimum of 203 mm (8 in.) to maximum of 3658 mm (144 in.) as required. Actual floor to ceiling heights shall be verified in field.
 - 2. Solid panel widths shall be available in 1.6 mm (1/16 in.) increments from a minimum of 203 mm (8 in.) to maximum of 1219 mm (48 in.) for solid panels and 1524 mm (60 in.) for glass panels.
- S. Gypsum board, glass and steel panels shall be constructed of materials acceptable for use in non-combustible construction. Painted metal and wallcovering finishes shall exhibit Class 1 or Class A Surface Burning Performance.
- T. The system shall be non-progressive, allowing for removal and re-installation of panels, including door frames, at any position, without disturbing adjacent panels.
- U. Solid panels shall have monolithic or horizontally segmented panel faces on each side. Panel faces shall be removable and reusable, attached to the panel frame without the use of screws or other mechanical fasteners.
- V. Each unitized panel shall be able to be removed, relocated and re-installed in different layouts, with all parts reusable. Scribing and fitting of panels on site to individual locations is not acceptable.
- W. The panel/floor interface shall have a reveal, recessed 19 mm (3/4 in.) from the face of the panel on both sides and adjustable in height from 32 mm (1-1/4 in.) to 64 mm (2-1/2 in.). Surface mounted base trim is not permitted.
- X. The panel/ceiling interface shall have a reveal, recessed 19 mm (3/4 in.) from the face of the panel on both sides and adjustable in height from 16 mm (5/8 in.) to 35 mm (1-3/8 in.). Surface mounted top trim is not permitted.
- Y. The system shall provide a vertical adjustment of not less than 50 mm (2 in.) in overall height to accommodate floor and ceiling irregularities.
- Z. The system shall include a freestanding option that does not require a connection or attachment to the ceiling.
- AA. The system must be erected and removed in a manner to prevent damage to adjacent building surfaces and elements, including floors, walls, ceilings, columns and window mullions. All system connectors to fixed-in-place building components shall be non-marking, removable and reusable.
- BB. The system shall be capable of extending in multiple directions using 2-way, 3-way, 4-way and variable angle corner posts.

- CC. Doors shall be single, double, sliding, or butt hinged doors utilizing adjustable metal frames. All door panels shall utilize standard panel connection methods and be reversible in field without additional modifications or materials.
- DD. Provide cut-able panels in order to address irregularities in the interface between the panel system and fixed-in-place construction (i.e. sills, columns, bulkheads).
- EE. Solid panels shall be capable of providing integrated, factory installed modular power & voice/data distribution utilizing plug-and-play technology for ease of panel reconfiguration.
- FF. The system shall include an integrated, factory installed, modular power option. Power distribution shall be consistent and compatible with power system used in furniture system and below raised access floor.
- GG. Components shall be free of distortion and uniform in dimension, construction and appearance.
- HH. Total recycled content shall be greater than 10% combining both post-consumer and pre-consumer recycled content.
- II. Steel, aluminum and glass components shall be 100% recyclable.
- JJ. Polyethylene film, corrugated cardboard and wood packaging materials shall be readily recyclable.
- KK. Product shall be free of hexavalent chrome, CFCs, PDBEs, persistent organic pollutants (POPs) and heavy metals.
- LL. Fiberglass insulation materials shall be formaldehyde-free and have a minimum of 25% recycled content.
- MM. Product shall be SCS IndoorAdvantage™ Gold certified as a low emitting product.
- NN. No ozone depleting substances (ODSs) shall be used in the manufacturing process.
- OO. Warranty period shall be ten (10) years from date of substantial completion.

102238 Operable Panel Partitions

- A. Operable panel partitions shall be unitized, movable, non-progressive steel partitions.
- B. All panels shall be readily removable and easily opened and closed by one individual.
- C. Flush panels shall be designed for maximum sound control and shall provide a minimum STC of 40 when tested in accordance with ASTM E90 by an approved testing laboratory.
- D. The panels shall be Class A noncombustible rated. Wall panel flame spread rating shall be 25 or less and smoke developed rating shall be 100 or less as per ASTM E84.

- E. Partition shall be laboratory tested according to ASTM E72 to prove that deflection will not exceed L/120 with a 24 kg/m² (5 lb/ft²) uniform load applied uniformly over the surface of the panel.
- F. Specify steel suspension track, designed for type of operation, size and weight of operable panel partition. Coordinate suspension of track with required overhead structural support.
- G. All electrical components of electrically operated panel partition system shall comply with NFPA 70, be listed and labeled by UL or other qualified testing agency, be marked for intended use, and be tested as a system.

102600 Wall and Door Protection

- A. Provide wall and corner guards in service corridors and other areas where service carts and other similar equipment will typically be used.
- B. Wall guards shall be designed to protect door frames wherever possible by returning the ends into the frame.

102800 Toilet Accessories

- A. Accessories shall be the products of a single manufacturer. Accessories with tumbler locks shall be keyed alike with the exception of coin boxes in vending equipment.
- B. Operation of accessories shall comply with guidelines set forth by the American Disabilities Act, Title III. Documentation and samples shall be provided to architect upon request.
- C. The Contractor shall furnish a one (1) year guarantee against defects in material and workmanship on all accessories. In addition to the above, the following shall apply:
 - 1. Hand and hair dryers shall have a ten-year limited warranty.
 - 2. Welded stainless steel framed mirrors shall have a fifteen-year guarantee against silver spoilage.
- D. All cabinets shall be constructed of 18-8, type-304 stainless steel.
- E. All waste receptacles shall be constructed of 18-8, type-304 stainless steel or rigid molded leak-proof plastic.
- F. All tumbler locks shall be fastened to accessories with lock nuts. Fastening locks to units with spring clips is not acceptable.
- G. The Contractor shall install items with non-corrosive anchoring devices.
- H. Installation methods shall conform to manufacturer's recommendations for backing and proper support.

- I. All hands-free fixtures shall be specified hard-wired, not battery operated.
- J. Do not use hands-free soap dispensers as they do not function well consistently.

104xxx – Fire Extinguisher Cabinets**104400 Fire Extinguishers, Cabinets, and Accessories**

- A. The Smithsonian master specification section is available on the OFEO A/E Center Website.
- B. Specify fully recessed or semi-recessed fire extinguisher cabinets in public areas of Smithsonian buildings.

105xxx – Mobile Storage Shelving**105626 Mobile Storage Shelving**

- A. Refer to Division 10 Design Requirements Section 2.04.
- B. The Contractor shall submit the qualifications for the mobile storage shelving system manufacturer and installer.
 - 1. The manufacturer must have a minimum of 25 years of experience in the continuous manufacture of mobile systems. Manufacturer certification is required.
 - 2. The manufacturer must be ISO 9001 certified for a minimum of three (3) years. Certification from ISO is required.
 - 3. The installer must have a minimum of ten (10) years of experience installing systems similar to those required for the specific project and must be certified by the manufacturer.
- C. All major storage shelving system components, finishes, and lubricants must be chemically tested for emissions and volatiles. The system shall be inert. The results of the tests performed by an independent test lab must be submitted.
- D. The Contractor shall take field measurements before fabrication and indicate dimensions on shop drawings. The Contractor shall be responsible for the accurate fit of the storage shelving system.
- E. The Contractor shall monitor the condition and levelness of the flooring and coordinate preparatory work performed by other subcontractors that may impact installation of the storage shelving system.
- F. The Contractor shall sequence storage shelving system installation with other work to minimize possibility of damage and soiling during the remainder of the construction period.
- G. The Contractor shall 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.

1. The entire installation shall be warranted against defects in material and workmanship for a period of five (5) years from date of acceptance by the Smithsonian.
 2. All structural beam elements of mobile and shelving system must carry a lifetime warranty.
- H. The manufacturer must provide a prototype storage unit complete with all components for Smithsonian review and approval. If applicable in specific projects, the manufacturer must certify that components are compatible and interchangeable with the Smithsonian's existing storage system.
- I. The Contractor shall submit shop drawings indicating construction details, material, description, dimensions, profiles and installation of each type of storage equipment. Include details of layout and installation including clearances, spacing 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 during construction. Furnish templates if required for accurate placement.
- J. The manufacturer shall retain an independent licensed structural engineer to certify mobile storage units and all shelving are structurally compliant. Engineer shall provide full structural calculations for overturning, system structure and anchorage based on specified rated load and local seismic zones. Calculations shall be submitted with the shop drawings.
- K. The storage system carriages, rack/tracks and associated components shall comply with the following requirements:
1. Where there are stringent temperature and humidity requirements, the carriages and associated parts must maintain peak performance under the stated conditions in the rooms indicated. The temperature and humidity specifications are 13°C (55°F) with 30% Relative Humidity (RH) and -20°C (-4°F)..
 2. Other performance considerations include floor loading, deflection tolerances

and specialty environmental conditions.

3. Carriages shall be minimum 454 kg (1,000 lbs.) per linear carriage meter capacity, fixture unit welded (preferred), uniframe assemblies constructed of minimum 12 gauge steel with main supporting structural face section 146 mm (5-3/4 in.) high with two reinforcing flanges running the full length of the carriage. Main supporting structural face sections shall provide a 19 mm (3/4 in.) minimum shelf mounting recess for positive shelving alignment and attachment. Wheel support section shall be minimum 12 gauge 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.
4. Bumper location shall be determined by the manufacturer. Bumper design and profile shall be rounded to minimize abrupt protrusion into the aisle. Bumper must leave a minimum 102 mm (4 in.) space between units unless otherwise required by the fire protection design.
5. All carriage splices shall be tongue and groove, offset angle, tension bolted type, and designed to maintain proper unit alignment and weight load distribution.
6. Unless otherwise required by the fire protection design, carriages shall have solid metal canopy tops, solid metal longitudinal dividers that span the length and height of the shelving, solid metal transverse dividers that span the width and height of the shelving located every 1219 mm (4 ft.) along the length, and solid metal endcaps.

107xxx — Flagpoles

107513 Automatic Flagpoles

- A. Use maintenance-free finishes.

107516 Ground-Set Flagpoles

- A. Use maintenance-free finishes.

107523 Wall-Mounted Flagpoles

- A. Use maintenance-free finishes.

Division 11 – Equipment

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 State and Local Jurisdiction Code Regulations
- 1.04 NSF/ANSI Standards for Food Service Equipment and Commercial Cooking
- 1.05 NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals
- 1.06 Smithsonian Guidelines for Accessible Design
- 1.07 SI Security Design Criteria
- 1.08 SI Collections Space Security Standards
- 1.09 ANSI Z358 American National Standard for Emergency Eyewash and Shower Equipment

II. Design Requirements

- 2.01 Loading Dock
 - A. Provide a coiling overhead door at the loading dock. In addition to the overhead door, provide a personnel door at the loading dock.
- 2.02 Food Service
 - A. The design of food service areas shall comply with the Smithsonian Guidelines for Accessible Design, such as the allowable counter height in food service lines.
 - B. All counter top surfaces shall be 14 gauge stainless steel.
 - C. Backsplashes at counter tops shall be integral and therefore 14 gauge stainless steel. Provide a full-height backsplash in any food preparation area.
 - D. Stainless steel shelves shall be 16 gauge.

- E. Stainless steel cabinets shall be 18 gauge.
- F. Stainless steel sinks shall be 14 gauge.
- G. Stainless steel type 304 shall be used. This type is the most stain resistant for food surfaces.
- H. Ceilings shall consist of non-corrosive ceiling grid with vinyl-faced, washable lay-in tiles.
- I. Lights shall be recessed, fluorescent fixtures with shatter-proof shield/lens.
- J. Walls shall have a minimum of FRP (Fiberglass) finish and, in public view, shall be covered with ceramic tile.
- K. Quarry tile floor shall consist of 152 mm (6 in.) x 152 mm (6 in.) quarry tile with 15% carbide abrasive (for slip resistance) and dark color epoxy grout. Provide integral coved base and corners. For new construction, slope floors at 3 mm (1/8 in.) per 304 mm (12 in.) in a 1219 mm (4 ft.) radius towards the drain.
- L. Use seamless flooring in wet areas.
- M. Specify high density plastic for trash receptacles in public areas of the cafeteria.

2.03 Library Stacks

- A. Coordinate the design of library stacks with building systems.
 - 1. Ensure there is adequate protection from the sprinkler system design. Refer to the SI OSHM Fire Protection and Life Safety Design Manual and comply with any local jurisdiction code when determining the required sprinkler system.
 - 2. Coordinate the library stack design with the ceiling height, lighting layout, and mechanical distribution above the shelving.
- B. The design of library stacks shall comply with SI Guidelines for Accessible Design, such as the requirement for turning space.

2.04 Audio Visual

- A. Refer to the SI OSHM Fire Protection and Life Safety Design Manual for all applicable requirements for rooms housing Audio Visual equipment.
- B. Provide a smoke detector on the interior and a power cut-off switch on the exterior of any Audio Visual room per the SI OSHM Fire Protection and Life Safety Design Manual.

2.05 Laboratory

- A. The design of laboratories shall be in accordance with the requirements of the IBC, NFPA 45 and the SI OSHM Fire Protection and Life Safety Design Manual.

- B. The design of laboratories shall comply with SI Guidelines for Accessible Design.
- C. Provide solid heat seam-welded or seamless flooring with integral base in laboratories.
- D. Coordinate safety features, such as eyewash/shower stations, with the mechanical section 239xxx Fume Hoods in these design standards. Refer also to ANSI Z358, latest edition.
- E. The designer shall obtain a copy of the OSHEM design guidelines for radiation/ laser facilities, "Additional Requirements for Radioactive Material Laboratories," from the OFEO design manager.

2.06 Collection Storage

- A. Refer to the SI OSHEM Fire Protection and Life Safety Design Manual for all applicable requirements for Collection Storage rooms, such as the required fire separation between the storage room and other areas of the building.
- B. Refer to the SI OSHEM Fire Protection and Life Safety Design Manual for the maximum allowable size of a collection storage space.
- C. The design of collection storage shall comply with the Smithsonian Guidelines for Accessible Design.
- D. The design of collection storage areas and facilities shall be in accordance with the SI Security Design Criteria and the SI Collections Space Security Standards.

III. Specifications

111xxx – Loading Dock Equipment

111300 Loading Dock Equipment

- A. At least one loading berth must be equipped with a powered dock leveler.
- B. Provide protective metal dock plates at the edge of the loading dock.
- C. Commercial grade dock bumpers shall be mounted under the load leveler.
- D. Provide dock seals at each loading dock platform to conserve energy.
- E. Provide a minimum of two trash compactors at the loading dock for compaction of recycled cardboard and for general trash.

114xxx – Food Service Equipment

114000 Food Service Equipment

- A. Provide equipment that bears NSF mark certifying compliance with applicable NSF

standards.

- B. Provide equipment and components that are certified for UL compliance and labeled for intended use.
- C. All food service equipment shall be commercial grade and shall comply with all Federal, state and local code regulations.

115xxx – Library, Audio Visual and Laboratory Equipment

115123 Library Stack Systems

- A. Refer to the SI OSHM Fire Protection and Life Safety Design Manual for all applicable requirements for library stacks, such as the required minimum width of aisles between stacks.
- B. Refer to the SI OSHM Fire Protection and Life Safety Design Manual for the required clearance of stacks below sprinkler heads.

115200 Audio Visual Equipment

- A. Refer to the SI OSHM Fire Protection and Life Safety Design Manual for all applicable requirements related to Audio Visual equipment.

115313 Laboratory Fume Hoods

- A. Coordinate fume hood design requirements, including ventilation, with the mechanical section 239xxx Fume Hoods in these design standards.

119xxx – Collections Storage Equipment

119000 Collections Storage Equipment

- A. The Smithsonian Collections Space Plan, a study currently in progress, will develop design standards for collections storage equipment to be used at SI facilities.

Division 12 – Furnishings

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 NFPA 101 Life Safety Code
- 1.04 NFPA 701 Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
- 1.05 California Technical Bulletin 133 Flammability Test Procedure for Seating Furniture for Use in Public Occupancies
- 1.06 California Technical Bulletin 117 Requirements, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture
- 1.07 Smithsonian Guidelines for Accessible Design
- 1.08 ASTM C1028 Static Coefficient of Friction
- 1.09 ASTM B117 Product Corrosion to Salt
- 1.10 ANSI/BIFMA X5.4 American National Standard for Office Furnishings – Lounge Seating
- 1.11 ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
- 1.12 NEMA Standard for High-Pressure Decorative Laminates
- 1.13 ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- 1.14 NFPA 70 National Electrical Code
- 1.15 SI Security Design Criteria

II. Design Requirements

2.01 Window Treatment

- A. All fabrics or other materials used in curtains, draperies, or other window treatments must be certified as flame resistant in accordance with the criteria contained in NFPA 701.
- B. Coordinate window treatments (i.e., supports, clearances, pocket detail) with surrounding construction.

2.02 Casework

- A. The design of casework shall comply with the Smithsonian Guidelines for Accessible Design, such as the clear floor area and the height for built-in work surfaces.
- B. Casework shall comply with the requirements of the SI Fire Protection Guidelines.

2.03 Entrance Floor Mats and Grilles

- A. The design of entrance floor mats/grilles shall comply with the Smithsonian Guidelines for Accessible Design.
- B. Coordinate the size and location of the required depression in the concrete floor slab with the installation of any recessed floor mat/grille.
- C. Provide walk-off mats at all Mall-side entrances to capture dust from Mall walkways.
- D. The entrance floor mat/grille frame shall be anchored securely to the subfloor.
- E. Provide access under the floor mat/grille for cleaning and maintenance.

2.04 Fixed Seating

- A. Design of fixed auditorium seating shall comply with the requirements for new assembly occupancies identified in the NFPA 101 Life Safety Code.
- B. The design of accessible spaces within fixed seating areas shall comply with the Smithsonian Guidelines for Accessible Design.
- C. Theater and bench seating materials shall comply with California Technical Bulletins 133 and 117.

2.05 Site Furnishings

- A. Projects on the National Mall must comply with Mall Streetscape Manual, National Park Service (NPS) Streetscape Manual- Interagency Initiative for National Mall Road Improvement Program.
- B. Projects at the National Zoo shall follow NZP existing standards or typical details.

1. This includes but is not limited to site benches, Olmsted Walk railing, Olmsted pavers, Olmsted Walk light posts, and other existing exhibit details.

III. Specifications

122xxx – Window Treatment

122413 Roller Window Shades

- A. Roller window shades shall comply with the following standards:
 1. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
 2. NFPA 70 National Electrical Code
 3. NFPA 701 Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
- B. Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.
- C. Installer shall be trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.
- D. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- E. Electrical Components: NFPA 70 Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.
- F. Anti-Microbial Characteristics: 'No Growth' per ASTM G21 results for fungi ATCC9642, ATCC 9644, ATCC9645.
- G. When a woven shade is selected for use, the transparency will be determined by both the density of the weave as well as the color of the fiber.
- H. The Architect/Designer should obtain several large samples of woven shade densities and colors to properly specify the level of transparency required.

123xxx – Casework

123553 Laboratory Casework

- A. Laboratory casework shall be easily cleanable and have smooth, non-sharp corners.
- B. For most laboratory conditions, the casework shall be made of painted enamel steel.

- C. In laboratory applications that do not involve heavy usage of corrosive chemicals, the casework may be made of a hard wood, such as maple.
- D. Metal shelving shall be provided, unless otherwise required by user's specialized laboratory requirements.
- E. Three types of countertop materials are recommended for most biology laboratory applications. These materials are solid-surface epoxy resin, solid-surface phenolic resin and stainless steel.
- F. Chemical resistant plastic laminate countertops may be appropriate for laboratory applications that do not involve heavy water usage or corrosive chemicals. If laminates are used, all top and bottom surfaces shall be laminated and all edges shall be banded.

124xxx – Entrance Floor Mats and Grilles

124813 Entrance Floor Mats and Grilles

- A. Provide a modular, recessed aluminum entrance floor mat system with modules weighing less than 23 kg (50 lbs.) and prefabricated welded frames that are installed to maintain performance criteria stated by manufacturer without defects, damage or failure.
- B. The Contractor shall submit product data, including manufacturer's specification sheet and installation instructions for specified products. Include methods of installation and substrate preparation for each type of substrate.
- C. The Contractor shall submit shop drawings showing layout, traffic direction, profiles and product components, including anchorage, fibered insert colors, patterns and textures.
- D. The Contractor shall submit samples for each type of exposed foot grille, entrance mat, and frame assembly required.
- E. The Contractor shall submit all Quality Assurance submittals provided by the manufacturer including the following:
 - 1. Certified test reports showing compliance with specified performance characteristics and physical properties
 - 2. Manufacturer's installation instructions
- F. The Contractor shall submit all Closeout submittals provided by the manufacturer including the following:
 - 1. Cleaning & Maintenance Data (include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance)
 - 2. Warranty

- G. The Contractor shall insure that the installer is highly experienced in the installation of entrance floor mats and grilles and has previously done work similar to that required for this project.
- H. In order to assure a consistent level of quality, there shall be a single source manufacturer for all specified foot grilles, assembly frames and fibered entrance mats.
- I. The Contractor shall comply with the manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- J. The Contractor shall store materials received by the manufacturer at temperature and in humidity conditions recommended by the manufacturer and protect them from exposure to harmful weather conditions.
- K. The Contractor shall maintain the temperature where products will be installed before, during and after installation as recommended by the manufacturer.
- L. The Contractor shall verify actual measurements by field measuring before fabrication and include measurements in shop drawings.
- M. The Contractor shall examine the substrates and conditions where floor mats will be installed and determine that there are proper conditions to accept the floor mat/grilles. If the conditions are unsatisfactory, the installation shall not proceed until the conditions are corrected. The sub floor shall be clean and dry and within industry acceptable tolerances.
- N. The construction of the foot grilles shall be cross bolt-thru design. Swedge, welded and key lock fastening are not acceptable.
- O. The material content of the foot grilles shall be Aluminum Alloy Type 6061-T6. Soft aluminum alloy such as 6063-T52 is not acceptable.
- P. The blades of the foot grilles shall be T-shaped blades; 33 mm (1-5/16 in.) x 3 mm (1/8 in.) x 38 mm (1-1/2 in.) size combined with T shaped blades 17 mm (11/16 in.) x 3 mm (1/8 in.) with anti-slip polymer insert. Spacing between blades shall not exceed 5 mm (3/16 in.).
- Q. The foot grille depth shall be 38 mm (1-1/2 in.) with a frame of 41 mm (1-5/8 in.).
- R. The foot grille shall be supplied in panels that do not exceed 1219 mm (48 in.) x 1067 mm (42 in.). A one piece design will not be acceptable. The load capacity for the Foot grille shall be 1738 kg (3,831 lbs.) per each 610 mm (2 ft.) span.
- S. The Contractor shall coordinate with the manufacturer to order the correct frame for each foot grille, taking into consideration the substrate of the area that is receiving the foot grille.
- T. The Contractor shall examine every substrate and all conditions where the foot grilles and/or floor mats will be installed. The Contractor shall not proceed with an installation until any and all unsatisfactory conditions are corrected. The sub floor shall be clean and dry and within industry acceptable tolerances.

- U. The Contractor shall strictly comply with the manufacturer's installation instructions and recommendations. Coordinate the installation with adjacent work to ensure proper clearances and to prevent tripping hazards.

126xxx – Seating

126100 Fixed Auditorium Seating

- A. The contractor shall take field measurements to verify or supplement dimensions indicated. The contractor shall be responsible for accurate fit of the work.
- B. The contractor shall submit a complete seating plan developed from the contract drawings, showing all chairs, sizes, and aisle widths. The contractor shall be responsible for the accuracy of all chair measurements shown on the seating plan.
- C. Varying lateral sizes of backs shall be used in accordance with the approved seating plans, with standards in each row spaced laterally so that the end standards shall be in alignment from first to last row whether aisles are of constant or converging width.
- D. The seating plan is to be reproduced on the floor and/or risers, all dimensions checked against the plan, and necessary adjustments made in the layout for all discrepancies. The contractor shall cover all products for backs and seats in clear plastic bags in order to protect the products prior to use.
- E. The bidder shall submit, as part of his bid, certified copies of test reports by a recognized independent test laboratory establishing conformance to the performance tests. Failure to supply these test reports shall result in disqualification of the bidder.
- F. Seating shall be designed and manufactured in compliance with the intent of ANSI/BIFMA X5.4, latest edition. Seating shall exceed all applicable BIFMA performance test criteria or the fabricator must perform the following tests and provide the test results.
 - 1. Test 1 – Vertical Impact Test to Seat:
 - a. Test Description: This test consists of repeated impacts of an 18 kg (40 lbs.) 254 mm (10 in.) diameter sand bag dropped on the seat at an approximate rate of 20 impacts per minute. The center of impact is to be at the center of the seat. The chair tested shall be the middle chair of a three chair assembly.
 - b. Tolerances: Bag weight plus or minus 0.5 kg (1 lb.).
Bag diameter plus or minus 25 mm (1 in.).
 - c. Test Criteria: The bag shall be dropped as follows:
25,000 times from a height of 152 mm (6 in.)
25,000 times from a height of 203 mm (8 in.)
25,000 times from a height of 254 mm (10 in.)
25,000 times from a height of 305 mm (12 in.)

- d. Acceptance Criteria: Measurements of the seat height are to be taken at the completion of the first 100 impacts and then at the completion of the test. The height of the seat measured at the front edge shall not drop more than 19 mm (3/4 in.). There shall be no loosening of the floor fastenings or of the pivots which retain the seat to standards. The seat must be able to return to normal fold position.
2. Test 2 – Swinging Impact Test:
- a. Test Description: This test consists of repeated impacts to the chair back of two 18 kg (40 lbs.), 254 mm (10 in.) diameter sand bags. The bags mounted at 330 mm (13 in.) centers are to be pivotally hung from a horizontally reciprocating actuating bar cycling at approximately 35 strokes per minute. The sand bags are to be filled with dry sand and hung with the bottom of the bag 813 mm (32 in.) below the pivot suspension point and 254 mm (10 in.) below the top of the chair back. The chair back is to be centered between the bags when the bags are in the center of the stroke.
 - b. Tolerances: Bag weight plus or minus 0.5 kg (1 lb.).
 Bag diameter plus or minus 25 mm (1 in.).
 - c. Test Criteria: The number of impacts and the horizontal stroke of the actuating bar shall be as follows:
30,000 impacts (cycles) through a distance of 121 mm (4-3/4 in.)
20,000 impacts (cycles) through a distance of 152 mm (6 in.)
10,000 impacts (cycles) through a distance of 203 mm (8 in.)
 - d. Acceptance Criteria: At the completion of the test, the middle standards shall have demonstrated sufficient strength and durability to withstand the test without failure or irregularities that would impair the unit's usefulness. Also, no visible evidence of failure or irregularities shall have occurred in the seat or back of the unit.
3. Test 3 – Static Load Test to Seat:
- a. Description: A vertical static load is to be applied to the top of the seat with the center of the load approximately 76 mm (3 in.) from the front edge and equal distance from the sides. A beam 51 mm (2 in.) x 102 mm (4 in.) is to be used to distribute the load transversely across the seat.
 - b. Test Criteria: The test load of 272 kg (600 lbs.) is to be applied at the rate of approximately 51 mm (2 in.) per minute.
 - c. Acceptance Criteria: Chair must withstand a minimum load of 272 kg (600 lbs.) with a permanent distortion not to exceed 16 mm (5/8 in.). Deflections and permanent distortions are to be measured at the front center edge of the seat.

4. Test 4 - Self-Lifting Seat Oscillating Test:
 - a. Test Description: The seat shall be lowered mechanically against the down stop, and then released at a rate of 20 times per minute by means of 2 hard rubber rollers attached dually to the end of an actuating bar. The rollers shall be 102 mm (4 in.) in diameter and contact the center of the seat approximately 127 mm (5 in.) to 140 mm (5-1/2 in.) from the rear edge. The mechanism shall allow the seat to cycle freely through its full operation.
 - b. Test Criteria: 300,000 Cycles
 - c. Acceptance Criteria: At the completion of the test the seat will have demonstrated sufficient strength and durability to withstand this test without any appreciable loss of the seat's self-rising action or excessive loosening of components.
- G. The contractor shall provide a manufacturer's warranty covering the material and workmanship for a period of five (5) years from the date of final acceptance.
 1. Repair or replace any part which becomes defective during the warranty period, excepting where the product has been subject to accident, alterations, abuse, misuse or neglect.
 2. Provide a manufacturer's warranty covering the gravity lift seat return for the period of lifetime from the date of final acceptance.
- H. Materials for the fixed seating shall conform to the following requirements:
 1. STEEL: All steel shall have smooth surfaces and be of sufficient gauge thickness and designed to withstand strains of normal use and abuse.
 2. PADDING MATERIAL: Seat and back padding material shall be of cold molded polyurethane foam. Padding material shall comply with the flammability requirements outlined in California Technical Information Bulletin #117, Resilient Cellular Materials, Section A & D, dated March 2002, when tested in accordance with Federal Test Method Standard 191, Method 5903.2.
 3. WOOD: Plywood, exposed or concealed, shall be hard wood. All plywood shall be hot press laminated using high frequency process. Interior plys shall be Class 3 or better. Exposed exterior plys shall be Class 1. Particle core shall be 25 kg (55 lbs.) density.
 4. PLASTIC: Plastic shall be injection molded, high density polypropylene with ultra-violet light inhibitors to retard fading. Plastic shall have a burn rate of 25 mm (1 in.) per minute when tested in accordance with ASTM D635 or the Department of Transportation of Motor Vehicle Safety Standard No. 302.
 5. PLASTIC LAMINATE: Plastic laminate shall be composed of a core of kraft papers impregnated with phenolic resins, a decorative surface sheet, and overlay

sheet containing melamine. Layers are fused together under pressures in excess of 6.9 MPa (1,000 psi), and temperatures over 275 degrees. Plastic laminate shall meet or exceed performance standard as established by N.E.M.A. Thickness: Horizontal Surfaces 1.3 mm (.050 in.) thick. Vertical Surfaces 0.8 mm (.030 in.) thick.

I. Finishes for the fixed seating shall conform to the following requirements:

1. METAL PARTS: Prior to the application of epoxy powder finish, all metal parts shall be cleaned by use of a three step process consisting of an iron phosphate, hot water rinse and a chromic acid rinse. All metal parts, both exposed and non-exposed, shall be coated with an epoxy powder which shall be electrostatically applied. All metal shall have a Minimum Dry Film Thickness of at least two millimeters and shall pass the 2H hardness test. All coated metal parts shall be oven baked at not less than 360 degrees.
2. WOOD PARTS: All exposed surfaces shall be stained to color selected and coated with lacquer of sufficient film depth to afford wear resistance of institutional quality and oven baked.
3. PLASTIC PARTS: Color of plastic shall be selected from manufacturers standard color range.
4. HARDWARE: All assembly hardware shall be rust resistant, black plated.
5. FABRIC: Fabric and color shall be selected from manufacturer's standard fabric selection.

J. Construction of the fixed seating shall conform to the following standards:

1. The seating shall be pedestal design made with a rectangular tube with 16 gauge steel 25 mm (1 in.) x 76 mm (3 in.). The tube shall be attached by a concealed weld to a 83 mm (3-1/4 in.) x 203 mm (8 in.) 14 gauge deep formed steel foot. The foot shall have four holes for attachment of the standard to a concrete floor with lead shielded expansion bolts. Two bolts shall be used for attachment of the fixed chair or lounge chair and four screws shall be used to attach to a wood floor surface (see wood floor surface thickness requirements). A reinforced 6 mm (1/4 in.) steel bracket for seat pan attachment shall be integrated into the standard which has an inlay at mid point for resistance upon force. The seat pan shall be anchored to the standard by use of a hexagon 8 mm (5/16 in.) fusion nut and a hexagon bolt of 8 mm (5/16 in.) x 19 mm (3/4 in.) through a threaded insert on the steel seat bracket. A lug support for attachment of the back shall be made of 14 gauge sheet metal. Welded to the top of the column shall be a 16 gauge plate for armrest attachment.
2. The aisle standards shall be oval, fabricated in the same manner as the center standards with a required formed frame of 20 gauge steel welded to the column to accept a decorator panel finished with laminated plastic, upholstery or with the finish to be selected by architect. End panels to be furnished pursuant to the plan of seating.

3. Riser mounted standards shall take into account the curvature of the riser. The standards shall be a rectangular tube, 25 mm (1 in.) x 76 mm (3 in.) with a break to ensure that the seat height is 445 mm (17-1/2 in.) from the floor. A 102 mm (4 in.) x 102 mm (4 in.) steel plate shall be continuously welded to the tube for attachment to the riser. The riser height must be at least 203 mm (8 in.) high and 90 degrees, plus or minus 3 mm (1/8 in.). Four expansion bolts are required to attach the standard to the surface.
4. Seat cushion shall be of arch-spring type. The seat cushion frame shall be of one piece reinforced injection molded polypropylene. Serpentine springs of normalized steel of 10 gauge, painted in epoxy paint to prevent corrosion, shall span the frame and be secured to the injection molded frame so as to eliminate noise. The spring assembly shall be covered by a tough and durable inter-liner to provide a chafing barrier to protect the cold molded polyurethane seat cushion. The seat cushion shall be cold molded to the contour of the springs to provide raised outer edge so that the overall seat foam is contoured for exceptional body support in the hip area. The foam shall have a density of 3.4 +/- point two. The seat frame shall have two steel bars that span the width of the cushion and which provide additional strength and support. The seat frame shall rotate on one 14 gauge 22 mm (7/8 in.) diameter cold rolled steel hinge rod securely attached to the seat frame. The additional hollow steel tube is attached to the rear of the frame for additional strength, support and stability. The steel flanges for attachment to the standards are made of 7 gauge steel. Stops that limit rotation are stamped-died from 9 gauge steel and are filled with high impact resistance neoprene rubber. High resistant nylon bushings are used at the pivot points to prevent metal to metal contact. The specified fabric, carefully tailored, shall be of panel side construction and manufactured as a slip cover with a draw string application. The slip cover fits over the entire assembly in order to allow ease in replacement.
5. The self lifting mechanism shall be a counter balance system integrated within the seat frame and which utilizes a weight inserted into the interior of the seat frame which allows the seat pan to return to a 75 or 90 degree vertical position by means of gravity. There shall be two 13 mm (1/2 in.) square tube stops, two counter-stops and two 25 mm (1 in.) cold rolled steel bushings, all reinforced.
6. The seat frame and return mechanism shall be enclosed with an Injection molded polypropylene cover with a decorative embossment and attaches to the frame without screws or other fasteners but which can be removed with the use of a specially supplied tool. The rear of the seat pan shall be vented to allow the foam to breathe.
7. Chair back shall be padded with cold molded polyurethane foam of 51 mm (2 in.) thickness at the top increasing to 76 mm (3 in.) at the bottom of the back and designed for lumbar support. The foam shall be cemented to 5 ply 11 mm (7/16 in.) plywood base with four 6 mm (1/4 in.) threaded inserts for the attachment of two die formed metal supports (back wings), 14 gauge, with four cold-rolled galvanized flat head steel screws 6 mm (1/4 in.) by 19 mm (3/4 in.). This shall be mounted onto a high impact, injection molded polypropylene outer back. All

attachment screws shall be fully concealed. Back wings shall have provision for 16 degree, 20 degree or 24 degree pitch. The height of the back to the floor shall be 864 mm (34 in.) as measured in the 20 degree back pitch.

8. The armrests shall be of solid hardwood, stained to a finish, all as specified or surfaced with laminate as selected by the architect, injection molded or upholstered. They are designed to have a perfect fit with the standards of the chair, which have exuberance in the lower section, perfectly distributed to hold four lag screws of cold-rolled galvanized steel 3 mm (1/8 in.) x 15 mm (19/32 in.). The armrest for the center standards shall be substantially similar in size to the aisle standard armrests.

129300 — Site Furnishings

129313 Bicycle Racks

- A. Bike Racks shall be in compliance with local jurisdiction requirements, for example DDOT Bicycle Facility Design Guide.
 1. Use SI Standard or approved equal. SI Standard: 'Bike Hitch Innovative Bike Rack' or approved equal.
 2. Installation shall be embedded or surface mount.
 3. Color and finish shall be approved by Smithsonian project manager.

129323 Trash and Litter Receptacles

- A. Trash receptacles shall match the facility standard or local jurisdiction or existing on site, and shall have a rodent-proof design.
- B. Recycling bins shall be provided where there are trash receptacles.

129343 Site Seating and Tables

- A. Benches shall match facility standard or existing on site.

Division 13 – Special Construction

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Building Code (IBC)
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 Metal Buildings Manufacturers Association (MBMA) Metal Buildings Systems Manual
- 1.04 SI Security Design Criteria

II. Design Requirements

(No specific notes this section)

III. Specifications

133xxx – Metal Buildings

133419 Metal Building Systems

- A. Metal buildings shall be designed to accommodate the loads of the material to be stored, the associated handling equipment, and the needs of the operating personnel.
- B. The design of the metal building shall be planned to best accommodate the physical dimensions of the material to be stored and/or the operations to be housed.
- C. Design of metal building is to be based on the dead and live load requirements of the structure as it will be built. Snow, wind, and seismic loads shall be considered where they are applicable.
- D. Columns supporting the outer edge of the roof shall be so spaced as not to interfere with the spacing of exterior loading dock doors or truck berths. Dock widths shall be wide enough to allow efficient maneuvering of forklift trucks and other expected types of material handling equipment. Minimum width shall be 3 m (10 ft). Forklift bumpers shall be placed at both sides of all door jambs where forklift traffic will occur to prevent damage to the walls, door track and the door frame.

- E. General warehouse or storage space shall be floored with a concrete slab of proper design to carry the wheel loads and withstand the abrasion generated by the continual use of forklift trucks where required. Concrete hardeners and dust proofers are recommended to minimize the wear of forklifts or other heavy equipment on the concrete floor. Surfaces that are subject to wetting, such as outdoor docks, shall not have a smooth finish to minimize safety hazards. Office space may be covered with resilient tile or carpet to upgrade the floor slab to office conditions where required.

133423 Fabricated Structures

- A. Fabricated structures, i.e. guard booths, shall be self-contained with all necessary systems as a package unit.
- B. Fabricated structures that are to be located adjacent to a major building shall complement the architectural character of the building through building proportions, lighting and finishes.
- C. Design of fabricated structure shall take into account number of personnel assigned during normal operations, space required for electronic and electrical equipment, mechanical equipment, and counter or work space.
- D. Due to the fact that fabricated structures, especially guard booths, are typically located away from larger building structures, consider the corrosion resistance and maintenance requirements of these facilities as a result of constant environmental exposure.
- E. Finished floor elevation shall be 152mm (6 in.) or more above grade or adjacent walkways, unless the facility is located on a raised island. If the facility is on an island, the minimum finished floor elevation shall be the elevation of the island.
- F. Provide floors and walkways with anti-skid surfaces. Anti-fatigue mats shall be provided at all security personnel posts to relieve fatigue and discomfort if standing for long periods of time is required.
- G. Provide heating and cooling appropriate for personnel, the electronic and electrical systems or fixtures, and the security support equipment.
- H. Provide adequate interior and exterior lighting for the specific use of the fabricated structure. If structure is to be used for clearing of personnel or verification of identification, provide lighting that will support identification and inspection tasks such as seeing hair, eye, clothing, complexion, and vehicle colors.
- I. Electrical design shall consider current power demands as well as the communication and power requirements for future traffic control devices (where applicable), identification equipment, and other devices associated with potential automation devices.

Division 14 – Conveying Systems

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.1).
- 1.02 SI OSHM Fire Protection and Life Safety Design Manual
- 1.03 SI Safety Manual
- 1.04 International Building Code (IBC)
- 1.05 American National Standard Specification for Making Buildings and Facilities Accessible to and Usable By Physically Handicapped People (ANSI A117.1).
- 1.06 GSA "Facilities Standards for the Public Buildings Service – PBS P-100. Latest edition as accepted by GSA.
- 1.07 National Elevator Industry, Incorporated (NEII) Building Transportation Standards and Guidelines
- 1.08 National Electric Code (NFPA 70).
- 1.09 United States Department of Labor – Occupational Safety & Health Administration (OSHA).
- 1.10 Local codes.

II. Design Requirements

- A. It is the intent of these standards to provide guidelines in developing vertical transportation systems that: Provide acceptable levels of elevator service as related to the Average Interval and Handling Capacity as defined in GSA "Facilities Standards for the Public Buildings Service – PBS P-100 (<http://www.gsa.gov/portal/content/104821>) for staff areas, latest edition accepted by GSA, and have a traffic analysis performed by a qualified elevator consultant.
 - 1. *Peak Loads:* Assume that 10 percent of the population will not require service during the peak time frame. Calculate average interval as the time between departures of elevators from the main lobby during the a.m. peak period. Average intervals shall not exceed 30 seconds. Calculate handling capacity as the number of persons the elevator system must move in any given 5-minute period of up peak traffic used to measure average interval. Design buildings for 16 percent handling capacity.
 - 2. *Other Service:* Provide separate calculations for passenger and for freight or service (combination of passenger and freight) traffic. If the building provides

parking levels, prepare a separate analysis for shuttle elevators connecting parking levels to the lobby.

3. The traffic analysis shall determine the quantity, capacity, and speed requirements of the elevators. Absent formal program populations, calculate population at the rate of one person per every 150 sq.ft. of gross building area. Elevator waiting times shall not exceed 30 seconds during peak time periods in a typical bank. Passenger elevators shall have a minimum capacity of 3,500 pounds, with cars sized to ANSI A17.1 standards and ambulance stretcher requirements.
 4. *Exhibit Space (Public Space).* Separate traffic calculations shall be made for the vertical transportation needs of the public, incorporating elevator, escalator, and stair traffic, based on actual formal population data. It should be assumed that the system be designed for the following:
 - a. Design total system for complete entry or exit from building in one hour.
 - b. Maximum of 20% stair usage.
 - c. Adequate queuing areas must be provided at both the entry and exit of each escalator and special consideration be paid if escalators feed into another set of escalators so that adequate space is provided for safe access.
 - d. Both pedestrian stairs and public elevators shall be located within close proximity and within line of sight to escalators to insure that baby strollers and like devices are directed towards the correct conveyance type.
- B. Provide safe and convenient transport of passengers and material.
 - C. Provide systems that meet the highest level of accessibility for people with disabilities.
 - D. Incorporate standardized parts for easy maintenance and repair.
 - E. Provide reliability and achieve desired lifecycle service and cost.
 - F. Prohibit installation of manufacturer standard proprietary control equipment that requires adjustment or troubleshooting with proprietary diagnostic instruments.

1.11 Design Criteria

- A. To ensure that elevators comply with specifications and installation procedures in the standards, the A/E shall retain the services of an elevator consulting firm to provide design, specification and construction/inspection services.
- B. For a modernization project, the Smithsonian shall retain the rights to salvage existing elevator and escalator components.
- C. Hydraulic passenger elevators shall be used for applications limited to a maximum travel of 35 feet or four landings.

- D. The maximum speed for hydraulic elevators shall be 150 feet per minute.
- E. Hydraulic freight elevators shall be limited to a maximum travel of 35 feet or four landings.
- F. Telescopic multi-staged cylinder-plunger units will not be acceptable.
- G. Traction elevators shall be used for all applications that exceed 35 feet of travel or four landings.
- H. When escalators are provided there shall be redundant service in case of equipment shutdowns and auxiliary means shall be provided for pedestrian traffic via adjacent stairways within line of sight to escalators.
- I. The use of machine room less (MRL) elevators shall not be utilized unless express approval is received from the OEDC/OFMR department through the project COTR.
- J. Exposure of elevator and escalator equipment to the elements/weather shall not be allowed.
- K. If the building is determined to require special loading of large or heavy materials and then the minimum standard shall be C-1 rating.
- L. The use of single speed side slide or single center parting doors is required. Exceptions may be made in case of service elevators with capacity of greater than 4,500 lbs for the use of two speed doors.
- M. Escalators shall be provided with solid "high deck" balustrades in lieu of "low deck" or glass balustrades.
- N. Escalators shall be designed to operate at a standard speed of 90 feet per minute and be provided with a 40" step width under all applications.
- O. All fire service key switches shall utilize a FEOK1 key switch and all other keying for equipment shall utilize a "J Series" key switch to match Smithsonian standards.
- P. The use of wheelchair lifts, LU/LA, or platform lifts shall not be utilized in new buildings.

- Q. It is the intent that when emergency power is provided it should provide means for the following systems to be supplied by both normal power and Type 60/Class 2/Level 1 standby power.
1. Lighting of elevator machinery spaces, machine rooms, control spaces, and control rooms.
 2. Elevator/escalator equipment.
 3. Hoistway lighting.
 4. Machine room ventilation and cooling equipment.
 5. Sump pump.
- R. Operational Performance (Passenger Door Open Time Selection Chart):

Door Width	Side Opening		Center Opening	
	Open (seconds)	Close (seconds)	Open (seconds)	Close (seconds)
36"	2.1	3.4	1.5	2.2
42"	2.3	4.0	1.6	2.4
48"	2.5	4.4	1.7	2.7
54"	2.7	5.0	1.8	2.8
60"	2.8	6.1	1.8	2.8

III. Specifications

14XXX – Conveying Systems

14210 Electric Traction Elevators

- A. Designers shall develop project specific specification using the Smithsonian master specification found in the appendix.
- B. Machine room less (MRL) elevators shall not be utilized unless express approval is received from the OEDC/OFMR department through the project COTR.

- C. Traction elevators shall be used for all applications that exceed 35 feet of travel or four landings.
- D. Provide a solid state microprocessor system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands, manufactured by Motion Control Engineering. Control system shall be non-proprietary in all respects. System shall incorporate on-board diagnostics as part of the standard control design. Use of portable or removal diagnostic equipment is unacceptable.
- E. Exposure of elevator equipment to the elements/weather shall not be allowed.
- F. All fire service key switches shall utilize a FEOK1 key switch and all other keying for equipment shall utilize a "J Series" key switch to match Smithsonian standards.
- G. Provide "Vandal Resistant" custom signal fixtures. The intent is not to furnish the new state-of-the-art plastic bezel mounting design. Provide vandal resistant type pushbutton modules manufactured by Innovation Industries push button style PB-23. Provide LED type illumination in all pushbuttons.
- H. The use of single speed side slide or single center parting doors is required. Exceptions may be made in case of service elevators with capacity of greater than 4,500 lbs for the use of two speed doors.
- I. Passenger elevators shall have a minimum capacity of 3,500 pounds, with cars sized to ANSI A17.1 standards and ambulance stretcher requirements.

14215 Electric Traction Freight Elevators

- A. Designers shall develop project specific specification using the Smithsonian master specification found in the appendix.
- B. Machine room less (MRL) elevators shall not be utilized unless express approval is received from the OEDC/OFMR department through the project COTR.
- C. Traction elevators shall be used for all applications that exceed 35 feet of travel or four landings.
- D. Provide a solid state microprocessor system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands, manufactured by Motion Control Engineering. Control system

shall be non-proprietary in all respects. System shall incorporate on-board diagnostics as part of the standard control design. Use of portable or removal diagnostic equipment is unacceptable.

- E. Exposure of elevator equipment to the elements/weather shall not be allowed.
- F. All fire service key switches shall utilize a FEOK1 key switch and all other keying for equipment shall utilize a "J Series" key switch to match Smithsonian standards.
- G. Provide "Vandal Resistant" custom signal fixtures. The intent is not to furnish the new state-of-the-art plastic bezel mounting design. Provide vandal resistant type pushbutton modules manufactured by Innovation Industries push button style PB-23. Provide LED type illumination in all pushbuttons.
- H. If the building is determined to require special loading of large or heavy materials, then the minimum standard shall be C-1 rating.

14240 Hydraulic Elevators

- A. Designers shall develop project specific specification using the Smithsonian master specification found in the appendix.
- B. Machine room less (MRL) elevators shall not be utilized unless express approval is received from the OEDC/OFMR department through the project COTR.
- C. Hydraulic passenger elevators shall be used for applications limited to a maximum travel of 35 feet or four landings.
- D. The maximum speed for hydraulic elevators shall be 150 feet per minute.
- E. Telescopic multi-staged cylinder-plunger units will not be acceptable.
- F. Provide a solid state microprocessor system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands, manufactured by Motion Control Engineering. Control system shall be non-proprietary in all respects. System shall incorporate on-board diagnostics as part of the standard control design. Use of portable or removal diagnostic equipment is unacceptable.
- G. Exposure of elevator equipment to the elements/weather shall not be allowed.

- H. All fire service key switches shall utilize a FEOK1 key switch and all other keying for equipment shall utilize a "J Series" key switch to match Smithsonian standards.
- I. Provide "Vandal Resistant" custom signal fixtures. The intent is not to furnish the new state-of-the-art plastic bezel mounting design. Provide vandal resistant type pushbutton modules manufactured by Innovation Industries push button style PB-23. Provide LED type illumination in all pushbuttons.
- J. The use of single speed side slide or single center parting doors is required. Exceptions may be made in case of service elevators with capacity of greater than 4,500 lbs for the use of two speed doors.
- K. Passenger elevators shall have a minimum capacity of 3,500 pounds, with cars sized to ANSI A17.1 standards and ambulance stretcher requirements.

14245 Hydraulic Freight Elevators

- A. Designers shall develop project specific specification using the Smithsonian master specification found in the appendix.
- B. Machine room less (MRL) elevators shall not be utilized unless express approval is received from the OEDC/OFMR department through the project COTR.
- C. Hydraulic passenger elevators shall be used for applications limited to a maximum travel of 35 feet or four landings.
- D. The maximum speed for hydraulic elevators shall be 150 feet per minute.
- E. Telescopic multi-staged cylinder-plunger units will not be acceptable.
- F. Provide a solid state microprocessor system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands, manufactured by Motion Control Engineering. Control system shall be non-proprietary in all respects. System shall incorporate on-board diagnostics as part of the standard control design. Use of portable or removal diagnostic equipment is unacceptable.
- G. Exposure of elevator equipment to the elements/weather shall not be allowed.

- H. All fire service key switches shall utilize a FEOK1 key switch and all other keying for equipment shall utilize a "J Series" key switch to match Smithsonian standards.
- I. Provide "Vandal Resistant" custom signal fixtures. The intent is not to furnish the new state-of-the-art plastic bezel mounting design. Provide vandal resistant type pushbutton modules manufactured by Innovation Industries push button style PB-23. Provide LED type illumination in all pushbuttons.
- J. If the building is determined to require special loading of large or heavy materials, then the minimum standard shall be C-1 rating.

14310 Escalators

- A. Designers shall develop project specific specification using the Smithsonian master specification found in the appendix.
- B. When escalators are provided there shall be redundant service in case of equipment shutdowns and auxiliary means shall be provided for pedestrian traffic via adjacent stairways within line of sight to escalators.
- C. Exposure of escalator equipment to the elements/weather shall not be allowed.
- D. Escalators shall be provided with solid "high deck" balustrades in lieu of "low deck" or glass balustrades.
- E. Escalators shall be designed to operate at a standard speed of 90 feet per minute and be provided with a 40" step width under all applications.
- F. All key switches shall utilize a "Yale style" key switch to match Smithsonian standards.
- G. The use of "intermittent operation" shall not be utilized on any escalators.

Division 22 – Plumbing

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Plumbing Code (IPC) – Latest edition
- 1.02 International Energy Conservation Code (IECC) – Latest edition
- 1.03 ASHRAE Standard 90.1- Energy Standard for Buildings Except Low-Rise Residential Buildings – Latest edition
- 1.04 Local Jurisdiction Requirements
 - A. DC Water and Sewer Authority (DCWASA) Requirements
 - B. Washington Suburban Sanitary Commission (WSSC) Requirements
 - C. District of Columbia Construction Codes Supplement of 2008 – DCMR 12F Plumbing Code Supplement
- 1.05 Smithsonian Sustainability Plans – Latest edition
- 1.06 Smithsonian Institution, Office of Facilities and Operations, Codes, Standards and Guidelines – Latest edition
- 1.07 Energy Policy Act (EPA) 2005
- 1.08 Executive Orders 13423, 13512, 13221 and 13514
- 1.09 Energy Independence and Security Act of 2007 (EISA 2007)
- 1.10 Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding
- 1.11 10 CFR 435 – Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal Buildings
- 1.12 10 CFR 436 – Federal Energy Management and Planning Programs
- 1.13 42 USC Chapter 91 – National Energy Conservation Policy
- 1.14 10 CFR 434 – Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings.

II. Design Requirements

- 2.01 Any deviation from these standards requires the approval of the Smithsonian Associate Director for Engineering and Technical Services.
- 2.02 The design shall be in accordance with the A/E Special Conditions. Where a conflict occurs for any item between the A/E Special Conditions and the Smithsonian Institution Design Standards, the most stringent will apply.
- 2.03 The designer must provide a Plumbing Systems Design Narrative and the calculations specified in the A/E Special Conditions at each submission as part of the Design Analysis Book. This includes but is not limited to the roof areas used in determining the storm drainage pipe sizes, any tables/charts used as a design basis, water demand calculations, domestic hot water heater sizing calculations, plumbing pipe sizing charts/calculations, compressed air/lab gas equipment and pipe sizing, pump sizing calculations, and all plumbing equipment and plumbing fixture cut sheets with model numbers highlighted.
- 2.04 All plumbing fixture accessibility clearances, installation, and accessories shall be compliant with the Americans with Disabilities Act and the Americans with Disabilities Act Accessibility Guidelines.
- 2.05 All water serving food preparation areas shall be heated to 60 degrees C (140 degrees F). Hot water temperature shall be boosted to 82 degrees C (180 degrees F) for final sanitizing rinse for commercial dishwashers. Commercial type laundries shall be heated to 82 degrees C (180 degrees F). General Service, that is - showers, sinks, family housing, administration facilities, etc. shall be heated to 49 degrees C (120 degrees F). Other areas shall be supplied with water heated or tempered to IPC requirements.
- 2.06 Hot water recirculation shall be provided so that hot water is available at each hot water outlet within 15 seconds of activation.
- 2.07 All supply and drainage piping shall be removed back to the main(s) and/or riser(s) for renovation projects in which plumbing fixtures are being replaced. No piping is permitted to be "abandoned in place" unless directed otherwise by the Smithsonian. All piping that is no longer needed to serve, drain, or vent a fixture shall be removed back to the main and/or riser and capped water tight.
- 2.08 Any piping that is direct buried shall have an appropriate means of corrosion protection.
- 2.09 Do not route any plumbing piping through electrical/telecommunications rooms and closets unless it directly serves equipment in those areas. Minimize routing directly over electrical equipment.
- 2.10 All plumbing equipment shall have a minimum of 0.9 m (3 ft) clearance around it for access and maintenance.
- 2.11 Piping corrosion is a common occurrence in Smithsonian buildings. Methods for limiting or preventing these occurrences shall be explored during design.
- 2.12 At a minimum, the following systems shall be considered during design if applicable: solar water heating, heat recovery from steam condensate for preheating domestic water, siphonic roof

drainage, rain water harvesting, domestic water leak detection and sustainable storm water management practices.

- 2.13 Irrigation systems must be supplied from harvested rainwater or other sustainable water source if at all possible. Direct supply from the domestic water system for irrigation is not preferred. In the design of major renovations of the museums or SI facilities, no potable water shall be used for irrigations systems unless approved by the Smithsonian OEDC Engineering and Design Division Associate Director.
- 2.14 Plumbing systems shall support the needs of the building occupants; be easily maintained and operated, have reliable and redundant components; and be efficient to operate. Typically each facility will have numerous piping connections which shall be concisely detailed and engineered in the contract documents to suit the applications intended to be supported or serviced.
- 2.15 All design projects are required to complete a check list for each discipline's services (i.e. Architectural Services, Mechanical Services, Plumbing Services, Electrical Services, etc.) at each submission of the Design Development as part of the SD-410 review. Refer to the A/E Special Conditions portion of the OFEO website at www.ofeo.si.edu.
- 2.16 The designer shall place a note on the applicable drawing that provides a basis (minimum working pressure of ____ [kPa (psig)] at a flow rate of ____ [L/s (gpm)] for sizing the main water service entering the building.
- 2.17 A non-potable water supply, when used in an entirely separate system and when approved by the local health department, may be used for flushing water closets and urinals, and for other approved purposes where potable water is not required. Piping containing non-potable water, that is – water not meeting accepted potable water standards, will be labeled "NONPOTABLE WATER, DO NOT DRINK."
- 2.18 When the pressure of water supply to the building exceeds the required water pressure by 69 kPa (10psig), a pressure reducing valve shall be provided. Consider increasing pipe sizes based on the anticipated future installation of fixtures when performing design calculations. Building potable water pressure shall not exceed 552 kPa (80 psig).
- 2.19 Division One (Supplementary Conditions for Construction) is available on the OFEO web site. This information includes specific building operations and when certain types of construction, demolition, welding times, deliveries, etc. can be accomplished.
- 2.20 Special Cases – Zoo
- A. PEX Piping shall be used where applicable.
 - B. Appropriately size animal drinking troughs and make-up water lines for drinking troughs per individual animal requirements.
 - C. Pressure boosters may be required for animal washing areas.
 - D. Provide hose bibbs in all animal washing areas. Provide floor drains with hair interceptors.

- E. Provide two-way cleanouts outside of areas containing animals where possible as opposed to cleanouts located integral with the drain. Drain covers shall be lockable stainless steel.
- F. Comply with Animal Welfare Act of 1966
- G. Comply with applicable standards and guidelines from the Association of Zoos and Aquariums.
- H. Comply with Section 8-1: Plumbing Design Considerations: National Institutes of Health Office of Research Facilities Biomedical and Animal Research Facilities Design Policies and Guidelines.
- I. Comply with the Guide for the Care and Use of Laboratory Animals: U.S. Department of Health and Human Services, Bethesda, MD: National Institutes of Health, Pub. No.86-23

III. Specifications

220xxx – General Plumbing Items

220513 Common Motor Requirements for Plumbing Equipment

- A. All motors for plumbing equipment shall be premium efficiency motors.

220516 Expansion Fittings and Loops for Plumbing Piping

- A. Expansion fittings and loops shall be provided for plumbing piping as necessary.

220517 Sleeves and Sleeve Seals for Plumbing Piping

- A. Wall and floor sleeves for plumbing piping shall be provided at each penetration.
- B. Sleeve seals for plumbing piping shall be provided at each exterior or foundation wall penetration.

220518 Escutcheons for Plumbing Piping

- A. Escutcheons for plumbing piping shall be chrome finish unless directed otherwise. Escutcheons shall be provided for plumbing piping where penetrations are exposed in finished areas.

220519 Meters and Gages for Plumbing Piping

- A. Provide direct mounted, metal case, liquid filled, industrial style dual unit temperature gages. Provide temperature gages on all inlets and outlets of plumbing heating equipment.
- B. Provide direct mounted, metal case, industrial style dual unit pressure gages. Provide pressure gages on all inlets and outlets of booster pumps. Provide a pressure gage and/or accessible fitting at the most hydraulically remote plumbing fixture to measure pressure reading in the future.
- C. Mercury gages are prohibited.

220523 General Duty Valves for Plumbing Piping

- A. Shutoff valves shall be provided at each toilet room and at each piping branch. Full port, two-piece ball valves are preferred for plumbing piping shutoff.

220529 Hangers and Supports for Plumbing Piping and Equipment

- A. Hangers and supports for plumbing piping and equipment shall be provided per the latest edition of Manufacturers Standardization Society Standard MSS SP-58 and MSS SP-69.

220533 Heat Tracing for Plumbing Piping

- A. Electric self-regulating heat tracing shall be provided for all domestic water piping, pump discharge piping, trap primer piping, and traps exposed to freezing conditions. Heat tracing shall be connected to emergency power if available, and must be properly insulated.
- B. Use the formula and method described in ASHRAE Applications Handbook for determining the capacity of heat tracing.
- C. Install the following types of electric heating cable for the applications described:
 - 1. Snow and Ice Melting on Roofs and in Gutters and Downspouts: Self-regulating, parallel-resistance heating cable.
 - 2. Temperature Maintenance for Domestic Hot Water: Self-regulating, parallel-resistance heating cable.
- D. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.
- E. Electric Heating-Cable Installation for Snow and Ice Melting on Roofs and in Gutters and Downspouts: Install on roof and in gutters and downspouts with clips furnished by manufacturer that are compatible with roof, gutters, and downspouts.
- F. Electric Heating-Cable Installation for Freeze Protection for Piping:
 - 1. Install electric heating cables after piping has been tested and before insulation is installed.
 - 2. Install electric heating cables according to IEEE 515.1.
 - 3. Install insulation over piping with electric cables according to Section 220719 "Plumbing Piping Insulation."
 - 4. Install warning tape on piping insulation where piping is equipped with electric heating cables.
- G. Electric Heating-Cable Installation for Temperature Maintenance for Domestic Hot Water:
 - 1. Install electric heating cables after piping has been tested and before insulation is installed.

2. Install insulation over piping with electric heating cables according to Section 220719 "Plumbing Piping Insulation."
3. Install warning tape on piping insulation where piping is equipped with electric heating cables.

H. Set field-adjustable switches and circuit-breaker trip ranges.

220548 Vibration and Seismic Controls for Plumbing Piping and Equipment

- A. Provide required seismic controls for plumbing piping and equipment for the appropriate site class as defined by the IBC.
- B. Floor mounted water heaters shall be provided with neoprene pads. Floor mounted plumbing pumps shall be provided with floor spring isolators and/or inertia bases, dependant on the size of the pump per the latest edition of American Society of Heating, Refrigeration, and Air-Conditioning Engineers HVAC Applications Handbook. Air compressors shall be provided with floor spring isolators.

220553 Identification for Plumbing Piping and Equipment

- A. All plumbing piping and equipment shall be identified. Piping shall be provided with adhesive pipe labels with flow direction arrows. All labeling color schemes shall be per the latest edition of American National Standards Institute/American Society of Mechanical Engineers Standard ANSI/ASME A13.1.

CLASSIFICATION	BACKGROUND COLOR	STRIPES
Domestic Cold Water	Green	1 – Black
Domestic Hot Water	Green	2 – Black
Domestic Hot Water Recirc	Green	3 – Black
Natural Gas Piping	Yellow	
Fuel Oil Piping	Yellow	

Table 1 - Schedule of Piping Identification
ANSI A 13.1

- B. All plumbing equipment shall be identified with a plastic equipment tag listing equipment designation.
- C. Plumbing valves shall be provided with metal valve tags that indicate service type and valve number. A valve tag schedule that includes valve service type, number, location, and normal operating position (normally open/closed) shall be provided with Operation and Maintenance data.

220716 Plumbing Equipment Insulation

- A. Foam plastic insulation is prohibited. Insulation shall have a smoke developed index of 50 or less and flame spread index of 25 or less. Canvas covering shall be provided over all insulation in exposed areas.

220719 Plumbing Piping Insulation

- A. Foam plastic insulation is prohibited. Insulation shall have a smoke developed index of 50 or less and flame spread index of 25 or less. Canvas covering shall be provided over all insulation in exposed areas.
- B. Provide insulation on all domestic hot water, cold water, and hot water recirculation piping. Provide insulation on all piping with heat tracing and all piping where condensation may occur, such as drain piping from a floor drain receiving cooling coil condensate. Insulation shall be a minimum thickness of 25mm (1").
- C. Insulation that can wick and hold condensation, such as mineral fiber, shall not be used on piping containing fluids below 27 degrees C (80 degrees F).

221xxx – Domestic Water/Dual Service Water/DWV/Compressed Air Piping, Plumbing Pumps**221113 Facility Water Distribution Piping**

- A. Below grade facility water distribution piping, both domestic and dual service, shall be Type K copper up to 65mm (2-1/2") and ductile iron for sizes 80mm (3") and larger. Above grade shall be Type L copper for sizes up to and including 50mm (2") and galvanized steel for sizes larger than 50mm (2").
- B. Water meters shall be provided for each incoming domestic water service. Provide water meter with a manual bypass. Each water meter shall be tied to the building automation system for remote readout. Location of water meter shall be coordinated with preferences of the local jurisdiction. Where combined domestic water and fire protection lines are used, the water meter shall be located downstream of the line split as to not meter fire protection water. Provide strainer with blowdown valve upstream of all water meters. Mechanical make-up water for hot water, chilled water, and cooling tower make-up shall be metered separately. Refer to Division 32 for irrigation system requirements.

221116 Domestic Water Piping

- A. Below grade domestic water piping shall be Type K copper up to 65mm (2-1/2") and ductile iron for sizes 80mm (3") and larger. Above grade shall be Type L copper for sizes up to and including 50mm (2") and galvanized steel for sizes larger than 50mm (2").
- B. Domestic water piping riser diagrams shall be included in the contract documents. Complete sizing of the riser diagrams is required.
- C. Provide pressure gage at the domestic water and fire water service entrance to the museum buildings.

- D. Piping shall conform to NSF-61.
- E. Domestic piping water velocities shall not exceed 3.28 m/s (10 feet/s). In hospitals and similar facilities, velocities shall not exceed 2.13 m/s (7 feet/s).
- F. PEX distribution system for indoor domestic water distribution may be considered with Smithsonian Design Manager and OSHM approval.

221119 Domestic Water Piping Specialties

- A. Non-freeze wall hydrants shall be provided on the building exterior every 61 m (200 ft) for new buildings. Provide vacuum breakers.
- B. Air vents shall be provided at high points in closed water systems to allow purging of trapped air.
- C. Drain valves shall be provided at low points in closed water systems to allow draining of system.
- D. Provide dielectric fittings when connecting piping of dissimilar metals.
- E. Provide water hammer arrestors on domestic water piping upstream of quick closing valves. Water hammer arrestors shall be compliant with Plumbing and Drainage Institute Standard PDI-WH201.
- F. Reduced pressure zone backflow preventers (RPZ) shall be provided for all incoming non-fire protection domestic water services. If incoming domestic water service is combined with fire protection service, services shall split interior to the building, a double check backflow preventer shall be provided for the fire protection line after the split, and a reduced pressure zone backflow preventer shall be provided for domestic water after the split. Indoor RPZ installations shall comply with DC WASA standards and guidelines, while outdoor RPZ installations shall comply with WSSC standards and guidelines. Outdoor vaults housing RPZs and/or meters shall be freeze protected (maintain a minimum of 4.4 degrees C (40 degrees F)) with a unit heater tied to the BAS and FAS. Indoor installations shall have a floor drain to receive discharge from relief valve and a means to drain water out of the building. Coordinate with building user for confirmation of requirement for a redundant, parallel RPZ for continuous supply of domestic water should one RPZ fail or be under service or repair.

Provide pressure gages at upstream and downstream of the RPZ and double-check assemblies for domestic and fire protection services backflow preventers.

221123 Domestic Water Pumps

- A. The quantity (duplex versus triplex), size and arrangement of the booster pumps operating to meet the building demand shall be selected by the designer to suit the specific project needs. Short cycling of the pumps shall be avoided.
- B. A water flow test shall be conducted to determine the street pressure and flow capacity at peak conditions.

- C. Thorough calculations are required to be performed to determine if a booster pump is necessary. Determine the required capacity of the booster pump system by evaluating the building demand in terms of peak flow.
- D. A hot water recirculation pump and piping shall be provided where any fixture requiring hot water is 23 m (75 ft) or more away from the source of domestic hot water.
- E. Variable frequency drives may be used if energy and life cycle cost effective. The pressure sensor shall be located at the top of the riser.
- F. A hydropneumatic tank may be used to meet low-flow demands without operating the booster pumps.

221216 Facility Elevated, Potable-water Storage Tanks

- A. Section not applicable.

221219 Facility Ground-mounted, Potable-water Storage Tanks

- A. Ground mounted potable water storage tanks shall be of nontoxic welded steel construction with cathodic protection. Provide roof hatch, roof manhole, side manhole, and vent as necessary. Tank shall be equipped with level indicators and remote read capability. Tank shall be disinfected per American Water Works Association Standard AWWA C652. Tank shall conform to NSF-61.
- B. Provide either a hydraulically or electronically operated altitude control valve for storage tanks to control the water level.

221223 Facility Indoor Potable-water Storage Tanks

- A. Indoor potable water storage tanks shall be of nontoxic welded steel construction. Tank shall be insulated where condensation may occur.

221313 Facility Sanitary Sewers

- A. Piping shall be cast iron hub and spigot. PVC piping is not permitted for sanitary waste and vent piping. Hubless fittings are permitted for above grade installations only.

221316 Sanitary Waste and Vent Piping

- A. Piping shall be cast iron hub and spigot. PVC piping is not permitted for sanitary waste and vent piping. Hubless fittings are permitted for above grade installations only.
- B. Sanitary waste and vent piping riser diagrams shall be included in the contract documents. Complete sizing of the riser diagrams is required.

221319 Sanitary Waste Piping Specialties

- A. Cleanouts shall be provided per the IPC.

- B. Provide at least one floor drain in each new or renovated toilet room. Floor drains shall be cast iron bodied with bronze tops.
- C. Provide floor drains as necessary in utility spaces such as mechanical rooms. Floor drains shall be cast iron bodied with cast iron strainers.
- D. Electronic, timed trap primers shall be provided for all floor drains in toilet rooms and other utility spaces, such as mechanical rooms.
- E. Air admittance valves are prohibited.

221323 Sanitary Waste Interceptors

- A. Provide grease interceptors for any food preparation areas. Locate grease interceptor for serviceability. Avoid routing piping near any collection storage or collection receiving/storage areas. Food waste grinders shall not discharge into grease interceptor. Oil/water separators shall be provided for any maintenance areas in which oil may be washed into the sanitary system. All separators shall be accessible for regular cleaning and maintenance. Separators shall be located on the building exterior in a concrete vault where possible.
- B. Grease interceptors shall be compliant with Plumbing and Drainage Institute Standard PDI-G101.

221329 Sanitary Sewerage Pumps

- A. Provide submersible, quick disconnect, double seal duplex sewage pumps for discharge of any sanitary waste that cannot be evacuated from the building via gravity alone. Provide with high water alarm connected to BAS and guide-rail supports. Pumps shall be connected to emergency power if available.

221343 Facility Packaged Sewage Pumping Stations

- A. Section not applicable.

221353 Facility Septic Tanks

- A. Provide facility septic tanks where applicable, such as at SERC Edgewater. Septic tanks and septic fields shall be provided in conjunction with waste water treatment plants/facilities.

221413 Storm Drainage Piping

- A. Piping shall be cast iron hub and spigot. PVC piping is not permitted for storm water piping. Hubless fittings are permitted for above grade installations only.
- B. Storm water drainage systems for new buildings shall be designed and sized per the IPC to provide sufficient drainage for a "100 year storm" scenario.
- C. Overflow and secondary drainage shall be provided per the IPC.
- D. Storm drainage piping is prohibited in and over collections spaces and galleries.

- E. Storm drainage piping riser diagrams shall be included in the contract documents. Complete sizing of the riser diagrams is required.

221423 Storm Drainage Piping Specialties

- A. Cleanouts shall be provided per the IPC.
- B. Plastic roof drains are prohibited.

221429 Sump Pumps

- A. Elevator sump pumps shall be sized for a flow rate of 3.15 L/s (50 gpm). Sump pumps serving hydraulic elevator sump pits shall be equipped with a hydrocarbon sensing and isolation system or oil separator. Hydrocarbon sensing alarm shall be connected to BAS.
- B. Submersible sump pumps may be used.

221513 General Service Compressed Air Piping

- A. Compressed air piping shall be Type L copper for sizes 100mm (4") and smaller. Schedule 40 black steel piping shall be used for sizes larger than 100mm (4").

221519 General Service Packaged Air Compressors and Receivers

- A. General service air compressors shall be oil-free reciprocating type. Compressor shall be simplex single stage and tank mounted on horizontal receiver tank. Vertical receiver tanks may be used if space does not allow for a horizontal tank. System shall be provided with a refrigerated air dryer and air-cooled after cooler.

223xxx – Water Softening/Heating Equipment

223000 General

Sustainable practices shall be used for heating domestic water when possible. These include but are not limited to preheating of domestic water using solar collectors, chiller condenser water, and/or steam condensate.

Hot water shall be provided at the following temperatures:

Service	Degrees C (Degrees F)
General use such as showers, sinks, family housing, administration facilities, etc.	49 (120)
Commercial type dishwashers with internal boosters	60 (140)
Commercial type dishwashers without internal boosters	82 (180)
Commercial type laundries	82 (180)

223100 Domestic Water Softeners

- A. Water softeners shall be regenerating tank type. Water softeners shall be provided for any kitchen areas and for any steam generating humidification equipment. Domestic water leak detectors shall be installed and tied into BAS for monitoring and alarms.

223200 Domestic Water Filtration Equipment

- A. Domestic water used for consumption (i.e. at drinking fountains and water coolers) shall be filtered by a centralized filtration system or point of use filters. Filters shall be 98% efficient for particles 10 micrometers and larger. Domestic water leak detectors shall be installed and tied into BAS for monitoring and alarms.

223300 Electric Domestic Water Heaters

- A. Electric tank type water heaters are not preferred. Instantaneous water heaters shall be used as much as possible. Provide an appropriately sized expansion tank for domestic hot water system. Domestic water leak detectors shall be installed and tied into BAS for monitoring and alarms.

223400 Fuel-fired Domestic Water Heaters

- A. Tank type water heaters shall be natural gas where tank type heaters are deemed more cost and energy efficient and natural gas is available. Tanks shall be glass lined and be direct vented where possible. Provide an appropriately sized expansion tank for domestic hot water system.

223500 Domestic Water Heat Exchangers

- A. Domestic water heat exchangers shall be shell and tube type where steam or high temperature hot water is available for heating of domestic water. Steam is not the preferred method of heating domestic water if other methods are available.

224xxx – Plumbing Fixtures**224000 General**

- A. Provide the appropriate number of plumbing fixtures per the A/E Special Conditions, as determined by the project architect.

224100 Residential Plumbing Fixtures

- A. Section not applicable.

224213 Commercial Water Closet and Urinal Fixtures

- A. All commercial water closet and urinal fixtures shall have hands free activation unless directed otherwise. All hands free devices shall be hard wired. Battery powered devices are prohibited unless specifically authorized by the Smithsonian on an individual project basis.

- B. Water closets shall be flush valve type. Tank type water closets are prohibited.
- C. All commercial water closet and urinal fixtures shall be low-flow type. Water closet flush valves shall be dual-flush type or 4.85 L/flush (1.28 gal/flush). Urinals shall be 0.5 L/flush (1/8 gal/flush).
- D. Waterless urinals are prohibited in public spaces. Waterless urinals may be considered for private/staff bathrooms with Smithsonian Design Manager and tenant approval.

224216 Commercial Lavatories and Sinks

- A. All commercial lavatory and sink fixtures (except kitchens) shall have hands free activation unless directed otherwise. All hands free devices shall be hard wired. Battery powered devices are prohibited unless specifically authorized by the Smithsonian on an individual project basis.
- B. All commercial lavatory and sink fixtures (except kitchens) shall be low-flow type with a maximum flow of 1.9 L/min (0.5 gal/min).

224223 Commercial Showers, Receptors, and Basins

- A. All commercial showers, receptors, and basins shall be low-flow type with a maximum flow of 6.8 L/min (1.8 gal/min).
- B. Provide showers with anti-scald thermostatic mixing valve.

224233 Wash Fountains

- A. All wash fountain fixtures shall have individual hands free activation unless directed otherwise. All hands free devices shall be hard wired. Battery powered devices are prohibited. Provide with thermostatic mixing valve.
- B. All wash fountain fixtures shall be low-flow type with a maximum flow of 1.9 L/min (1/2 gal/min).

224300 Medical Plumbing Fixtures

- A. Section not applicable.

224500 Emergency Plumbing Fixtures

- A. All emergency fixtures shall be hard plumbed where possible. Self-contained fixtures are not preferred. All emergency fixtures shall be designed and installed per the latest edition of American National Standards Institute Standard ANSI Z358.1. Emergency shower minimum flushing fluid performance shall be 1.26 L/s (20 gal/min) at 207 kPa (30 PSI) for 15 minutes. Eyewash minimum flushing fluid performance shall be 0.025 L/s (0.4 gal/min) at 207 kPa (30 PSI) for 15 minutes. The tempered water range shall be 16-38 degrees C (60-100 degrees F).
- B. Provide thermostatic mixing valve, tank type water heater, or instantaneous water heater to supply emergency fixtures with tempered water.

224600 Security Plumbing Fixtures

- A. The latest Smithsonian Institution security requirements shall be obtained from the Office of Facilities and Engineering Operations (OFEO) website at www.ofeo.si.edu.

224713 Drinking Fountains

- A. Drinking fountains shall have bar activation. Provide with grid drain.
- B. Drinking fountains in outdoor locations shall be of frost-free design in climates where freezing occurs. Provide capability for winter shut-off.

224716 Pressure Water Coolers

- A. Water coolers shall be local condenser type with tri-bar activation. Provide with grid drain.

224723 Remote Water Coolers

- A. Section not applicable.

226xxx – Laboratory and Health Care Plumbing Specialties**226000 General**

- A. Please see Mechanical section for coordination with fume hoods.

226113 Compressed Air Piping for Laboratory and Health Care Facilities

- A. Compressed air piping shall be provided for laboratory applications where required. Health care applications do not apply. Compressed air piping shall be similar to that found in section 221513 of this standard.
- B. Compressed air riser diagrams shall be included in the contract documents. Complete sizing of the riser diagrams is required.

226119 Compressed Air Equipment for Laboratory and Health Care Facilities

- A. Compressed air equipment shall be provided for laboratory applications where required. Health care applications do not apply. Compressed air equipment shall be similar to that found in section 221519 of this standard. Compressed air systems shall be tied into the BAS for monitoring and alarms.

226213 Vacuum Piping for Laboratory and Health Care Facilities

- A. Vacuum piping shall be provided for laboratory applications where required. Health care applications do not apply. Piping shall be Type L copper water tubing with wrought copper fittings and soldered joints.

226219 Vacuum Equipment for Laboratory and Health Care Facilities

- A. Vacuum equipment shall be provided for laboratory applications where required. Health care applications do not apply. Vacuum pump shall be packaged, oil-free, rotary, sliding-vane type pumps unless directed otherwise. Minimum laboratory vacuum pressure shall be 68 kPa (20 inches of mercury).

226313 Gas Piping for Laboratory and Health Care Facilities

- A. Laboratory gases shall be provided as necessary. Gas cylinder storage racks with manifolds is the desired storage and distribution method for laboratory gases. Laboratory gases include but are not limited to nitrogen, oxygen, nitrous oxide, and carbon dioxide.
- B. Medical gas riser diagrams shall be included in the contract documents. Complete sizing of the riser diagrams is required.

226400 Medical Gas Alarms

- A. Provide master alarm panel that utilizes a separate trouble alarm and indicator for all laboratory systems including but not limited to compressed air, vacuum, natural gas, oxygen, nitrogen, nitrous oxide, and carbon dioxide. Master alarm shall be tied to building automation system.

226600 Chemical Waste Systems for Laboratory and Health Care Facilities

- A. Provide chemical waste systems for laboratories as required. Health care applications do not apply. Provide double wall containment and appropriate piping materials as dictated by laboratory functions and contaminants to be discharged to the waste system.
- B. Provide neutralization systems and containment as necessary for the laboratory function. Provide leak detection systems as necessary.

226700 Processed Water Systems for Laboratory and Health Care Facilities

- A. Provide central reagent, deionized (DI), distilled, or reverse osmosis (RO) distribution system(s) as dictated by laboratory function. Provide piping material appropriate for use with the type of water to be distributed.
- B. Processed water riser diagrams shall be included in the contract documents. Complete sizing of the riser diagrams is required.
- C. Deionized water (DI) piping riser diagrams shall be included in the contract documents. Complete sizing of the riser diagrams is required.

Division 23 – Heating, Ventilation, and Air Conditioning

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Mechanical Code (IMC) – Latest edition
- 1.02 ASHRAE Standard 62.1- Ventilation for Acceptable Indoor Air Quality- Latest edition
- 1.03 ASHRAE Standard 90.1- Energy Standard for Buildings Except Low-Rise Residential Buildings – Latest edition
- 1.04 Smithsonian Institution, Office of Facilities and Operations, Codes, Standards and Guidelines – Latest edition
- 1.05 Smithsonian Sustainability Plans – Latest version
- 1.06 Energy Policy Act (EPAct) 2005
- 1.07 Energy Independence and Security Act 2007
- 1.08 Executive Orders 13423, 13512, and 13514
- 1.09 High Performance and Sustainability Building Memorandum of Understanding 2006
- 1.10 29 CFR 1910 Occupational Safety and Health Standards –Latest edition
- 1.11 Prudent Practices in the Laboratory – Latest edition
- 1.12 10 CFR 434 – Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings.
- 1.13 10 CFR 435 – Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal Buildings.
- 1.14 10 CFR 436 – Federal Energy Management and Planning Programs.
- 1.15 42 USC Chapter 91 – National Energy Conservation Policy.

II. Design Requirements

2.01 Policy Directives

- A. Commissioning is required for all projects. This should be completed through an independent third party commissioning agent unless directed otherwise.
- B. Power and utility usage shall be monitored and budgeted on a yearly basis for comparison. As a result of this requirement, additional sub-metering and control is required. Reference and use Enhanced Metering Credit under LEED and Federal Advanced Metering Guidelines.
- C. Work safety plans shall address the design requirement for sufficient MER and shaft space(s) including adjacent clearances for maintenance and accessibility. Establishing necessary space for MER very early in the design process is crucial for a successful project.

2.02 General Requirements

- A. Any deviation from these standards requires the approval of the Smithsonian Associate Director for Engineering and Technical Services.
- B. Division One (Supplementary Conditions for Construction) is available on the OFEO web site. This information includes specific building operations and when certain types of construction, demolition, welding times, deliveries, etc. can be accomplished.
- C. The design shall be accordance with the A/E special Conditions. Where a conflict occurs for any item between the AE Special Conditions and the Smithsonian Institution Design Standards, the most stringent will apply.
- D. The designer must provide an HVAC Systems Design Narrative and the calculations specified in the A/E Special Conditions at each submission as part of the Design Analysis Book.
- E. Provide both Metric and English units for all measurements, sizing, air flow, pressure requirements and dimensioning.
- F. Smithsonian National Zoo - These Design Standards apply to administrative buildings and offices located at the National Zoo. Other facilities at The Smithsonian National Zoo are excluded from these standards due to unique requirements that differ from the rest of the SI facilities.

2.03 Design Requirements

- A. Quoting Dr Marion Mecklenburg's article titled "Preserving Legacy Buildings", written for ASHRAE: "Preserving cultural and national history collections and buildings that contain them requires an integrated approach to indoor temperature and RH requirements. Adopting an integrated approach that considers the needs of the building shell along with the needs of the collection can reduce degradation of the collections and in the buildings. It also establishes the importance of monitoring the reliability and effectiveness of the building systems that maintain the environmental conditions."

- B. It is imperative that each new facility or existing facility be designed so that all components comprise an integrated solution that works in conjunction with specific building programs, so that operation of the facility, energy usage and other criteria may be optimized.
- C. Building Quality Level should have a direct correspondence to type of building, it's primary purpose and function, the anticipated life expectancy of the components and what those components are.

Building Class	Description	Years to Component Replacement
A. Principal	Major, monumental buildings of historic.	25-50
B. Support	Building of long service life of 50-100 years that supports staff and related activities.	25-50
C. Service	Building with a service life of 25 to 50 years that supports maintenance.	20
D. Research	Special conditions based on usage.	25-50

Table 1 – Building Quality Level

- D. The mechanical system will be considered an essential element of each building with adequate space allocated for it and in a manner that will permit installation of a well designed mechanical system capable of being operated and maintained.
 - 1. Provide minimum 18% of the building square footage for building support spaces and allow at least 8% for equipment expansion.
 - 2. Plan space around each piece of equipment based on manufacturer's published recommendation, 0.9 m (3 ft) on all sides, minimum per code, or space required and shown for tube, coil, or filter pull, whichever is the greatest.
 - 3. Allow for access to service and operate valves; allow space in front of electrical equipment and panels per electrical codes. Do not install pipes or mechanical equipment above electrical panels, switch gears, transformers or starters.
- E. Review redundancy and maintainability of main systems and provide standby and back-up power for critical equipment.
- F. Review redundancy requirements of water-cooled food service equipment (or any other critical equipment). If necessary, provide a once-through domestic water bypass system in the event of a chilled water outage. Provide floor drains as necessary. Moreover, consider the impact of the bypass system requirements on the domestic water system.

G. Equipment:

1. All equipment shall be new, of the latest design and the best quality available for the application, and be inspected prior to delivery to the job site to assure freedom from defects in workmanship and materials.
2. All equipment and products specified and installed shall be standard items of production having not less than three years proven successful field experience which involved operation or usage under conditions equivalent to those of the project on which they are applied.
3. All equipment shall be applied and installed strictly in accordance with manufacturer's recommendations.

2.04 System Requirements

A. Facility Requirements: 24 hour operation or 16 hour with night setback.

B. Ambient Design Conditions

1. The values provided in ASHRAE Handbook - Fundamentals, latest edition, shall be used for the location closest to the project site. SI may impose more stringent requirements for design points in some cases.
2. Utilize the 1% data for cooling and 99% data for heating.

C. Standard outside air requirements shall be compliant with ASHRAE Standard 62.

D. Steam and chilled water from the central distribution system, if available, shall be used for the primary heating and cooling sources in any new or major renovation of a building.

E. Minimum Utility Supply Criteria

1. Chilled water supply temperature from central plant to building at 6.7°C (44°F).
2. Air supply at apparatus: 11.1 to 12.2°C (52 to 54°F).
3. Steam supply pressure from GSA pressure reducing station to building: 207 kPa (30 psig).
4. Building operation steam pressure: 69 kPa (10 psig).

F. Independent systems using primary energy sources are strongly discouraged. Plans for the expansion of the steam and chilled water distribution system into undeveloped areas of the campus have been prepared and should be consulted for new buildings.

G. Process cooling requirements are those space conditions which require specific temperature and/or humidification to be rigidly maintained. Examples are computer rooms and clean rooms or other rigid temperature requirements that must be maintained 100% of the time. Consider waterside economizers as an alternative scenario for all 24/7 operational spaces.

H. Approved Air Conditioning Systems:

1. Low velocity, constant volume, single zone.
2. Low velocity variable volume, constant/variable volume secondary air, terminal reheat.

3. Medium velocity, variable volume primary air, constant/variable volume secondary air, terminal reheat.
4. Air handling units (4 pipe system). Chilled water cooling; hot water heating.
5. Fan coil units, self-contained, temporary.
6. Fan coil units (2 pipe system). Chilled water cooling; hot water heating, fan cycling controls.
7. No building wide electrical heating systems will be allowed.

- I. Air Filtration: ASHRAE Handbook - HVAC Systems and Equipment.

2.05 Space Requirements

- A. Special areas require specific design requirements including but not limited to:

1. Temperature and relative humidity ranges in dedicated zones:
 - a. OEDC building standards current environmental guideline for buildings housing museums and galleries - 45% RH +/- 8% RH and 21°C (70°F) +/- 3°C (4°F).
 - b. Determine specific requirements of exhibition and storage spaces from the user. The building envelope shall have insulation to meet recommendations per ASHRAE 90.1, and vapor and air barriers required to satisfy the indoor room design requirements.
 - c. Rehabilitation of federally owned historical buildings shall utilize best practices and technologies in retrofitting to promote long term viability of the buildings and reduce deterioration of the building structure.

- B. The conditioning equipment selection for computer rooms and other similar spaces shall be based on 100% of sensible load. Total Cooling = (100% sensible + 15% sensible (for dehumidification)) x 125% (for future load). Other process cooling or heating equipment must be designed for 125% of known loads.

1. Equipment designed to maintain conditions in such spaces shall be independent of the main building HVAC system. Each space with its independent conditioning equipment shall have an electronic digital recorder.

- C. Conditioning Requirements:

1. Air Conditioning: Offices, telecommunications rooms and laundry rooms.
2. Mechanical Ventilation: Sanitary facilities, kitchens, vending machine alcoves and rooms, storage rooms, and mechanical rooms containing heat generating equipment.
3. Convection Ventilation: Unassigned spaces.
4. Heating: All spaces having exterior building surfaces.
5. Humidification: Low limit for occupied areas.

- D. Internal Loads:

1. Exhibit Areas: Lights off after hours.

2. Special Equipment: Computer rooms and server 24 hours per day.

E. Air Motion Air Conditioned:

1. Classrooms: per ASHRAE 62 and Section 239XXX Fume Hoods.
2. Laboratory Areas: per ASHRAE 62 and Section 239XXX Fume Hoods.

F. Temperature Control:

1. Exhibit Areas: averaging
 - a. Provide motion sensors in gallery spaces to switch terminal units from occupied to unoccupied setpoints to conserve energy. Internal design temperature and humidity requirements must continue to be met.
2. Office Areas: Zone maximum shall be three offices per thermostat zone.
3. Laboratory Areas: Separate zone per lab.
4. Other Air Conditioned Spaces: Individual room.
5. Service Areas: Low limit.

G. Humidity Control:

1. Humidity sensors are required throughout each project space and are to be connected into the building management system. Individual, area, or zone humidifiers shall be incorporated into the system to control space relative humidity levels. Trending software shall be used to record any fluctuation in humidity.
2. Humidification shall be provided to maintain a minimum of 38% relative humidity in all occupied buildings or higher level stipulated elsewhere in this standard.
3. All new air handlers shall be designed with the expectation of controlling humidity at some point in their operating life.
4. Provide humidity sensors in all gallery spaces.

H. Specific Rooms Temperature and RH Requirements

1. Elevator rooms shall be maintained between 10°C (50°F) and 32°C (90°F). Some rooms may require conditioning depending on the elevator manufacturer.
2. Fire Control Room is required in each building.
3. Food Service areas have special make-up air and exhaust requirements other than refrigerator allowances. Individual requirements are dependent on size and location of equipment and occupancy.
4. Criteria for Individual Spaces based on ASHRAE. The Design shall comply with ASHRAE Applications, maximum fluctuations and gradients in controlled spaces: See Table 2.

	DESIGN				OPERATION		Pressure Relationship To Adjacent Space	Noise Criteria
	SUMMER		WINTER		SUMMER	WINTER		
	DB	%RH	DB	%RH	DB	DB		
*General Museums	21.1°C (70°F)	45	21.1°C (70°F)	45	21.1°C (70°F)	21.1°C (70°F)		40
*Art Galleries	21.1°C (70°F)	45	21.1°C (70°F)	45	21.1°C (70°F)	21.1°C (70°F)		40
*Archives	21.1°C (70°F)	45	21.1°C (70°F)	45	70	21.1°C (70°F)		30
Libraries	22.2°C (72°F)	50	22.2°C (72°F)	40	23.3°C (74°F)	21.1°C (70°F)		30
Meeting Rooms	22.2°C (72°F)	60	22.2°C (72°F)	30	23.3°C (74°F)	21.1°C (70°F)		30
Offices	22.2°C (72°F)	60	22.2°C (72°F)	30	23.3°C (74°F)	21.1°C (70°F)		30
Toilet Rooms			22.2°C (72°F)			22.2°C (72°F)	Negative	
Janitor Rooms			22.2°C (72°F)			18.3°C (65°F)	Negative	
Storage Rooms			22.2°C (72°F)			18.3°C (65°F)		
Main Entrances	26.7°C (80°F)		22.2°C (72°F)		23.3°C (74°F)	21.1°C (70°F)		45
Corridors and Passages	23.9°C (75°F)		22.2°C (72°F)		25.6°C (78°F)	21.1°C (70°F)		45
Stairwells			22.2°C (72°F)			15.6°C (60°F)		
Basements (unoccupied)			22.2°C (72°F)			15.6°C (60°F)		
Mechanical Rooms			15.6°C (60°F)			15.6°C (60°F)		
Classrooms	22.2°C (72°F)	58	22.2°C (72°F)	38	23.3°C (74°F)	21.1°C (70°F)		30
*Laboratories	22.2°C (72°F)	50	22.2°C (72°F)	40	23.3°C (74°F)	21.1°C (70°F)	Negative	45
Elevator Machine Rooms	32.2°C (90°F)	60	10.0°C (50°F)		33.3°C (92°F)	50°C (10°F)		
Telecommunications Rooms	22.2°C (72°F)	58	22.2°C (72°F)	30	23.3°C (74°F)	21.1°C (70°F)		

Table 2 – Indoor Design Conditions for Individual Spaces

* - Temperature and relative humidity subject to change based on specific requirements for exhibits or equipment.

I. Energy Analysis and Management

1. Energy efficient products: provide motors, commercial packaged AC units, chillers and lighting products that are either Energy-Star qualified or FEMP designed products.
2. Load and expected energy usage calculations required in meeting the Guidelines and Policy Directives, including LEED, shall be submitted to the SI for review as part of design.
3. System evaluation, including total owning and operating cost (life cycle cost analysis), shall be submitted to the SI for evaluation. System, and large component, design should be evaluated on the total owning and operating cost based on at least a 20 year design analysis. The significance of the area served may be included allowing for standby and backup systems.
4. Energy analysis of annual energy usage of the standard and/or a proposed alternative building and system design shall be performed to permit the evaluation of:
 - a. Climate Data: Coincident hourly data for temperatures, solar radiation, wind, and humidity of typical days in the year representing seasonal variation.
 - b. Building Data: Orientation, size, shape, mass, air moisture, and heat transfer characteristics.
 - c. Operational Data: Temperature, humidity, ventilation, illumination, and control mode of spaces during occupied and unoccupied hours.
 - d. Energy Consumption: Maximum demand and annual usage of all energy sources used at the project site.
 - e. Mechanical Equipment: Design capacity, past load data.
 - f. Building Loads: Internal heat generation, lighting, equipment, and number of people during occupied and unoccupied periods.
5. The calculation procedure shall simulate the operations of the building and its services through a full year of operation and shall permit the evaluation of the effect of system design, climatic factors, operational characteristics, and mechanical equipment on annual energy usage. Manufacturers' data or comparable field test data shall be used when available in the simulation of all systems and equipment. The calculation procedure shall be based upon 8760 hours of operation and shall utilize design methods specified in the ASHRAE Handbooks. Only approved computerized energy analysis software such as DOE2.2, Energy Plus, Trace 700, or Carrier HAP will be acceptable.
6. Energy consumption devices shall be tied into the building automation system for monitoring and harvesting data for billing reports.
7. Special design considerations for Zoo design

- a. Zoo design shall comply with the following standards and guidelines,
 - i. 2007 ASHRAE HVAC Applications, Chapter 14: Laboratories.
 - ii. 2007 ASHRAE HVAC Applications, Chapter 22: Environmental Control for
 - iii. Animals and Plants.
 - iv. Guide for the Care and Use of Laboratory Animals
 - v. Association of Zoos & Aquariums
 - vi. Animal Welfare Act 1966
 - vii. Animal spaces and visitor/keeper spaces shall be zoned separately.

III. Specifications

230xxx – General HVAC Items

230130 HVAC Air Duct Cleaning

- A. Protect and cover all openings before start of demolition and throughout construction. Clean all air handling units inside surfaces and interior duct work before startup.

230513 Common Motor Requirements for HVAC Equipment

- A. Only provide High Efficiency inverted duty motors.

230516 Expansion Fittings and Loops for HVAC Equipment

- A. Provide expansions fittings and loops as necessary. Provide accompanying calculations.

230517 Sleeves and Sleeve Seals for HVAC Piping

- A. Provide a modular mechanical seal for penetrating and sealing at underground wall penetrations. Provide sleeves at all wall and floor piping penetrations.

230518 Escutcheons for HVAC Piping

- A. Provide chrome plated escutcheons at any exposed piping penetration in finished areas.

230519 Meters and Gages for HVAC Piping

- A. Individual building systems shall be sub metered where possible and practical. Kilowatt-hour (BTU) meters shall be provided to measure energy usage for LEED and billing purposes.
- B. Chilled water and hot water plants shall use ultrasonic or Doppler to measure the water flow.

- C. Steam flow meters shall be in-line variable area orifice type. If condensate meters are required, use a turbine type located so no uncondensed steam will pass through.
- D. Taps shall be provided to measure flow at each pump and heat exchanger.
- E. Wells for thermometers shall be provided at each heat exchanger.
- F. Gauges shall be provided on supply and return of pumps, boilers, cooling towers, chillers, converters, and where lines enter and exit mechanical rooms.
- G. Thermometers shall be specified on supply/return water chillers, boilers, cooling towers, air-handling units, fan coil units, and at other points as necessary.
- H. Where non-digital readout gauges are used, the following shall apply:
 - 1. Gauges for general use shall be screw-type recalibration, bronze bushed movements and single unit construction.
 - 2. In main mechanical rooms, provide 115 mm (4.5 inch) diameter gauges for all steam pressures, mounted a maximum of 2.5 m (8 feet) above the operating floor.
 - 3. Gauges shall be calibrated for static head.
 - 4. All gauges shall be non-pulsating.
- I. Gauges and thermometers shall display a minimum of twice the operating pressure or temperature for line/service in which they are installed.

230523 General Duty Valves for HVAC Piping

- A. Provide shut off valves at the entrance of the building and on each floor on riser takeoffs.
- B. Butterfly valves are to be high performance type, designed for dead end service at full pressure and rated for a minimum of 1724 kPa (250 psi). Seat material must be designed for the fluid passing through the valve.
- C. Recommended manufacturers for quality: Milwaukee, Jamesbury, Bray and Victaulic.
- D. For new buildings with diverse loading and long distances between the first AHU and the last, consideration should be given to pressure independent flow control valves similar to the Griswold PIC valves.

230529 Hangers and Supports for HVAC Piping and Equipment

- A. Hangers and Supports for HVAC piping and equipment shall be provided per the latest edition of MSS SP-58 and MSS SP-69.

230533 Heat Tracing for HVAC Piping

- A. Heat tracing is required for all piping subject to freezing temperatures.
- B. Provide snow melting system and floor radiant heating system as needed and if life cycle cost effective and energy efficient.

230548 Vibration and Seismic Controls for HVAC Piping and Equipment

- A. Provide vibration baseline data in accordance with the Smithsonian RCM-related Specifications and Reference, developed under OFMR and available through design managers.
- B. Mechanical and electrical equipment associated piping and ductwork shall be mounted on vibration isolators to minimize transmission of vibration and noise to the building structure or spaces. All motors over 3.7 kilowatt (five horsepower) must be solidly attached to a base common with the driven unit to minimize alignment problems. Solid sheaves and band belts shall be used to minimize vibration in multiple V-belt driven equipment.
- C. All rotating equipment shall be balanced, both statically and dynamically. The structure supporting the equipment shall not have any natural frequencies within plus or minus 20 percent of the normal operating speeds.
- D. The equipment, while operating, shall not exceed a self-excited radial vibration velocity of 2.5 mm per second (0.10 inch per second), or an axial vibration velocity of 1.3 mm per second (0.05 inch per second), and measured with a vibration meter.
- E. Vibration test pickup shall be placed on bearing caps in the horizontal, vertical and axial directions or on equipment mounting feet if the bearing caps are concealed.
- F. Walls and floors enclosing mechanical rooms adjoining occupied spaces shall have a sound transmission factor of at least 10 decibels above the determined or probable airborne noise level of operating equipment. In no such applications shall the rating be less than a 55-decibel STC.
- G. Coupled Machines – alignment tolerances:
 - 1. 3600 rpm – 2.0 mils, 0.5 mils/inch
 - 2. 1800 rpm – 4.0 mils, 0.7 mils/inch
 - 3. 1200 rpm – 6.0 mils, 1.0 mils/inch
 - 4. 900 rpm – 8.0 mils, 1.5 mils/inch
- H. Precut, purpose-built, S/S alignment shims are required. Site cut shim stock is not acceptable.

230553 Identification for HVAC Piping and Equipment

- A. This includes naming or tagging valves actuators and dampers
- B. Use ANSI A 13.1 for identification of piping systems.
- C. Materials for Color Identification: Plastic tape shall be 3M "Scotch" brand No. 471 vinyl tape, 5 mil thickness, of colors specified. Equal Texcel or Permacel tape is acceptable.

- D. All exposed piping shall be painted continuously in the background colors listed in Table 3.
- E. Identification stripes specified hereinafter shall be 20mm (3/4") wide plastic tape, unless noted otherwise.
- F. The space between stripes shall be equal to the width of the stripes.
- G. Provide color identification at the following locations and according to Table 3:
 - 1. All exposed piping:
 - a. All exposed piping within 0.5 meter (1 ½ ft) of each gate, glove, angle, or plug.
 - b. All exposed piping within 75 mm (3 inches) of each 90 degree elbow, connection to equipment or vessel, point where pipe enters shaft to upper floors, and point where pipe pierces outside wall.
 - c. Additional stripes as required to provide color identification at not over 6 meter (20 foot) intervals, measured along center line of pipe.
 - d. Omit identification on piping 40 mm (1 1/2 inch) size and smaller exposed at connections to equipment or plumbing fixtures.
 - 2. Above suspended ceilings:
 - a. Within 0.5 m (1 ½ ft) of each valve or valve assembly.
 - b. At tees, both main and branch shall be identified within 7.6 m (300") of tee.
 - c. Within 0.9 m (3 ft) of each 90 degree elbow.
 - 3. Piping concealed in cases or shafts:
 - a. Identify each pipe visible through access door panel.
- H. Flow markings: Arrows showing the direction of flow should be painted on the piping near the location of each piping identification label.

CLASSIFICATION	BACKGROUND COLOR	STRIPES
Ice Water	Green	1 – Black 1 – White
Equipment Drains	Green	None
High Pressure Steam	Yellow	1 – Red
High Pressure Condensate	Yellow	2 – Red
Medium Pressure Steam		
Medium Pressure Condensate		
Low Pressure Steam		
Low Pressure Condensate		
Pump Condensate Return	Yellow	3 – Black
Hot Water Supply From Converter or Boiler (Heating)		1 – Blue
Hot Water Return To Converter or Boiler (Heating)	Yellow	2 – Blue
Steam Vent, Steam Relief, Valve Discharge, etc.	Yellow	None
Reduced Pressure Steam	Yellow	1 – Red 1 – White
Chilled Water Supply	Blue	1 – White
Chilled Water Return	Blue	2 – White
Condenser Water Supply	XXX	XXX
Condenser Water Return	XXX	XXX
Glycol Supply		
Glycol Return		

Table 3 - Schedule of Piping Identification
ANSI A 13.1

230593 Testing, Adjusting, and Balancing for HVAC

- A. Testing, adjusting, and balancing is required for all HVAC systems. TAB must be performed using NEBB, AABC, or TABB procedures.
- B. TAB companies must be certified by NEBB, AABC or TABB.

230713 Duct Insulation

- A. Exposed sound lining downstream of the filter shall not be used. Exterior duct insulation shall be non-asbestiform mineral fiber and sized per ASHRAE 90.1.

230716 HVAC Equipment Insulation

- A. All exposed insulation shall be canvas wrapped.

230719 HVAC Piping Insulation

- A. Plastic foam insulation is prohibited.
- B. Provide package removable formed covers for valves 50 mm (2 inch) and larger.
- C. Do not use a PVC outer jacket on steam piping insulation.
- D. Use "0.00" perm cellular glass insulation with a flame spread of 5, smoke developed 0, conforming to ASTM C-552 with thermal properties of 0.29 K @ 24°C (0.29 K @ 75°F). The manufacturer shall be ISO 9000 certified and offer a 20 year thermal performance warranty on all chilled water applications. Cellular glass insulation shall be used on chilled water piping in un-conditioning areas where the piping insulation is susceptible to surface moisture.
- E. All exposed insulation shall be canvas wrapped.

230800 Commissioning of HVAC

- A. Projects shall meet the requirements to achieve LEED credit EA 3: Enhanced Commissioning. An independent commissioning agent is to be used on each project and shall follow ASHRAE Guideline 0 and shall be designated prior to the commencement of construction documents. The contractor shall provide personnel and equipment to set up, start up, and test all equipment.
- B. Classroom and field training shall be provided on all pieces of mechanical equipment. O&M and warranty information shall be submitted to the facility manager.
- C. Provide audio narrative of the observations made during the inspection for project closeout.
- D. Training videos for operation, maintenance and repair procedures shall be provided to the facility manager on each piece of mechanical equipment.
- E. All large equipment shall be pre-tested and accepted at the factory. In some cases, this will need to be witnessed by the SI engineering team. The design shall require the contractor to include in their bid the cost for up to four SI personnel to witness tests. An equipment asset inventory shall be provided in a format compatible with SI CMMS – FC9.

230900 Instrumentation and Control for HVAC

- A. The Smithsonian Institution (SI) has a standard for DDC Control Systems. The primary purpose of this system is to provide dynamic control, economical operation and operational information of the equipment. When this system is installed, it will aid the engineer in certifying that the contractor has installed and set up the equipment to engineer's specifications. This standard is mandatory before SI will accept the mechanical portion of the project. Contact the SI Systems Engineering Division – Controls Branch for the vendor contacts. It is intended that the DDC vendor work with the project engineers to develop the most efficient system and to aid the engineers with developing control specifications to achieve such a system.
- B. DDC building controls system shall be manufactured and installed by Siemens Industry. The system shall be an extension of the existing SI Wide Siemens Facility Management and Control System (FMCS). The new DDC system shall be connected to the FMCS Database Server within the National Museum of Natural History (NMNH) for full database management via the Siemens Apogee Software. Siemens Industry contact information shall be obtained through SI DM.
- C. SI requires all building automation controls (DDC) to be of the type that are of the same manufacturer as and connect to the existing SI Wide Siemens FMCS. The DDC vendor shall be part of the project during design.
- D. The contractor (renovation or new building mechanical contractor) shall hire the Division 230900 (or 15900) contractor to connect the new controls with the existing Siemens FMCS. It shall be the responsibility of the Division 230900 contractor to coordinate all work associated with the FMCS connection. The new DDC controls shall be connected/integrated to the FMCS over the SI.EDU WAN via Ethernet connections.
- E. All damper and valve actuation must be electric/electronic.
- F. Include any temperature and/or pressure sensors that will provide enough information to complete the thermodynamic picture of the engineer's project; for example, if you are connecting to the central chilled water distribution system, the engineer should include: temperature sensor, pressure sensors on the supply and return. Also include a flow transducer. Specify KW-hour (BTU) calculations on the water extracted from the distribution system. See meter section. Flow metering sensor shall be an ultrasonic Doppler effect sensor that does not penetrate the piping.
- G. All control valves shall be two-way valves. Replace any existing three-way control valves with two-way modulating valves.
- H. Fail settings:
 - 1. Reheat and steam coils shall be normally open fail open if they are conditioning the outside air.
 - 2. Reheat coils shall be normally closed if they service interior loads.
 - 3. Steam pressure reducing station shall fail close position.
 - 4. Hot water heat exchanger valve shall fail open normally open.
 - 5. Chilled water coils shall be normally closed.

- I. Install CO2 sensors in high occupancy areas to help reduce the amount of outside air being brought into the building and reduce the energy to pre-heat or pre-cool the air to ensure requirements outlined in ASHRAE 62 are met.
- J. Design for night set back in acceptable spaces, allowing the resetting of the supply air or shut down of the AHUs.
- K. Include an economizer control to bring in free outside air (cooling air) when the enthalpy differences are optimal for such operation.
- L. In instances at coils when most of the chilled water is bypassed or the temperature difference between the chilled water supply and return is too low and the flow is too high, a pressure independent control valve shall be used for the coil for modulating 1.9 L/s (5 gpm) and greater. Automatic flow limiter with characterized control shall be use in applications 1.9 L/s (5 gpm) or less.
- M. DDC panels and the DDC FMCS Database Server shall be connected through the SI.EDU network, using TCP/IP over an Ethernet, routed network. Provide all equipment, materials and software necessary to connect DDC panels via the Owner-provided network drops. It shall be possible to access any DDC panel through the network. Such access shall include full read-write capability from an operational as well as programming standpoint. Total system information shall be available to the FMCS Database Server at all new or existing operators' workstations.
- N. DDC panels shall be provided with emergency power so that conditions can be monitored during a power outage.
- O. All energy monitoring systems are required to be tied into the BAS for monitoring and usage reports.

230993 Sequence of Operations for HVAC Controls

- A. The control sequences shall be specified by the design project engineer for all airside and waterside systems and equipment.
- B. The DDC contractor shall program the building controllers and all operator central computers to locally log trend data. The FMCS Database Server shall maintain communications with the building controllers and retrieve the trend data. The FMCS Database Server shall store all historical trend data over the period of trend capture.
- C. The DDC contractor shall install all graphic displays for all systems and controlled devices in the FMCS Database Server located in NMNH. The graphic displays shall illustrate the depiction of the device, sensor and control point locations. The graphic displays shall display dynamic sensor readings in engineering units.
- D. The DDC contractor shall update the SI Siemens FMCS Apogee Database with all set points, analog and digital input points and analog and digital output points, programs, application specific controllers, schedules, alarm parameters and user rights.

- E. The FMCS Database Server shall contain an exact copy of all DDC control sequences in the project.
- F. The DDC contractor shall provide a complete set of DDC Drawings as part of shop drawings; these shop drawings shall show all logic, set points and control schedules. A complete points list with range and scale for electrical and engineering units shall be provided as part of the submittal as well.
- G. All new air handlers, exhaust fans and fume hoods shall be programmed for an emergency shutdown sequence mode.
- H. Provide freeze protection controls for hydronic side such as Glycol loop, circulating pump, waterside economizer, etc.
- I. Provide controls for specialty systems such as stairwell pressurization controls, atrium smoke removal controls, airside economizer controls.

231xxx – Fuel/Gas Piping

Provide facility fuel/gas piping systems complete with storage tank and monitoring systems.

231113 Facility Fuel-oil Piping

- A. Provide duplex fuel-oil pumps.
- B. Provide shutoff valves on the inlet and outlet of each piece of fuel-oil equipment, including but not limited to pumps and storage tanks.
- C. Fuel-oil piping shall be schedule 40 black steel with welded joints and be double wall containment type.
- D. All fuel-oil systems shall be compliant with National Fire Protection Association Standard 31.
- E. Provide any fuel-oil storage tanks with appropriate manholes and ladders for access. Provide all tanks with leak detection and monitoring systems and underground tanks with overfill protection devices. Provide appropriate venting for underground tanks.
- F. Fuel-oil monitoring systems shall have auxiliary contacts to be tied into the BAS for monitoring and alarms.

231123 Facility Natural Gas Piping

- A. Provide gas main meter and regulator on building exterior at building entrance. Gas meter shall be tied to the building automation system for remote readout.
- B. Provide solenoid valve for gas shutoff in all kitchens and food preparation areas.
- C. In general, natural gas shall be reduced to a pressure of 13.8 kPa (2 psi) at main building regulator. Gas at this pressure shall then be routed to individual appliance regulators that are

set to reduce gas pressure to specific gas pressure requirements for that particular appliance or piece of equipment.

- D. Provide shutoff valves for all natural gas piping branches and at each piece of natural gas equipment. Shutoff valves shall be plug valve type.
- E. Natural gas piping shall be schedule 40 black steel with welded joints. Flexible stainless steel piping may be used on a case-by-case basis with the permission of the Smithsonian design manager for direct buried piping and piping located in tunnels.
- F. All natural gas systems shall be compliant with National Fire Protection Association Standard 54.

231126 Facility Liquid Petroleum (LP) Gas Piping

- A. All LP systems shall be compliant with National Fire Protection Association Standard 58.
- B. Provide shutoff valves for all LP piping branches and at each piece of LP equipment.
- C. Provide pressure regulators as necessary for proper operation of equipment.
- D. Provide direct-type direct fired LP vaporizer.
- E. LP piping shall be schedule 40 black steel with welded joints.

232xxx – Hydronic Water/Steam Piping

232113 Hydronic Piping

- A. Use only welded connections inside the shaft for supply and return main riser from the plant. For sizes 150 mm (6") and above, flanges connections or welded connections are to be used for both vertical and horizontal piping. Victaulic fittings valves are acceptable at equipment connections and in the chiller plant to facilitate servicing.
- B. Tees and test plugs for pressure gages and thermometers shall be schedule 80 pipe. All piping and specialties related to any plant shall be rated at Class 150 minimum. All others shall be rated Class 125 or greater
- C. Copper piping (minimum type L) may be used for piping 75 mm (3") and smaller. Use type K piping for below grade installations.
- D. Schedule 40 black steel shall be used for sizes above 75mm (3"). Standard weight steel piping may be used for pipe sizes 0.3 m (12") and larger.
- E. Use ball valves for piping 50 mm (2") and smaller. Ball valves must meet MSS SP-110 and be Class 150 at a minimum. Piping larger than 50mm (2") may be butterfly valves.

232113.13 Underground Hydronic Piping

- A. Snow melt systems shall be utilized at loading docks, ramps and stairs. The systems shall be designed using polyethylene (PEX) tubing or electric resistance cable suitable for direct burial in concrete or asphalt

232113.33 Ground-Loop Heat-Pump Piping

- A. A geothermal heat pump system should be considered if feasible. A life cycle cost analysis shall be performed to determine if a geothermal system should be implemented.

232123 Hydronic Pumps

- A. Chilled water, hot water, and condenser water pumps used on building systems shall be long coupled, horizontal direct drive, end suction and double suction centrifugal type. The pump shall be mounted on either a cast iron or steel base and driven by an electric motor.
- B. The pump shall be constructed of the following materials:

1. Case wearing rings	Bronze ASTM B144-3B
2. Casing	Cast iron ASTM A48-56
3. Ball Bearings	Steel
4. Seal	Mechanical (carbon/ceramic)
5. Shaft sleeve	Stainless steel
6. Impeller	Bronze ASTM B144-3B
7. Shaft	Carbon steel
8. Coupling guard	Formed sheet steel
- C. Constant or variable speed of pumps shall not exceed 1800 nominal rpm.
- D. Pump case and components shall be designed and manufactured to withstand hydrostatic pressure equal to a minimum of two times the greatest pressure imposed on the system.
- E. Where a specific project has more than one chilled water pump, all chilled water pumps must be of the same manufacturer.
- F. All pump sets shall have the provision to measure the pressure drop across the pump and the temperature of the water. Pumps shall have a flange pressure port on the inlet and outlet.
- G. An auto/manual air vent shall be provided on all pump sets to eliminate trapped air in the pump.
- H. Provide standby pump for chilled water systems.
- I. Butterfly valves shall not be used for balancing valves. Provide circuit setters for all pumps on pipe sizes 100 mm (4") and smaller.
- J. Provide isolation valves on both sides of the pump. Circuit setter valves shall not be used as isolation valves.

- K. The condenser and chilled water systems shall have a standby pump. A differential pressure switch across each pump shall provide a feedback signal to the building automation system which controls the lead/lag and standby pumps selection.

232213 Steam and Condensate Heating Piping

- A. Notify facility manager a minimum of two days before any connection or shutdown to the main high pressure steam system.
- B. Pressure reducing station shall use DDC sensors if the steam system is dirty. GSA steam is considered dirty.
- C. Provide pressure relief valve on the discharge side of the station relieving to the outside in a safe location.
- D. Provide a separator on incoming steam pipe when connecting to GSA steam.
- E. Use schedule 80 pipe for all steam condensate piping.
- F. Use schedule 40 black steel for steam piping 65 mm (2 ½") and larger.
- G. Steam piping utilizing de-ionized water shall use stainless steel piping.
- H. Gate valves 75 mm (3") and larger shall meet MSS SP-70 and be Class 150 at a minimum.
- I. Ball valves 65 mm (2 1/2") and smaller shall meet MSS SP-110 and be Class 150, 4137 kPa (600 psi), ASTM B 584 rated at a minimum.

232223 Steam Condensate Pumps

- A. Low pressure systems may use dual electric pumps to eliminate heat burning up the motors; the sequence should allow for alternating lead/lag pumps. For medium pressure steam condensate, consider elevating the condensate receiver/pump, especially if the condensate temperature is high. For high pressure condensate, recommend the use of a steam powered pump. A flash tank is required.

232300 Refrigerant Piping

- A. Refrigerant piping material and sizing shall be per manufacturer's recommendations.

232500 HVAC Water Treatment

- A. Water treatment should be provided with a bi-monthly contract to sample and test the water.
- B. Where there is evidence of corrosion or bactericidal degrading of the interior wall of the piping, consider the use of sand filter/strainers, Chlorine Dioxide Generation or additional treatment.
- C. Provide a condenser water filtration system.

- D. Vessels shall be 304 Stainless Steel made to ASME Div. I Section VIII and rated for 689.5 kPa (100 psi) service.
- E. Filtration media shall be nominal 0.45 sub micron multimedia.
- F. Water treatment equipment shall be equipped with an Omron PLC controller.

233xxx – Ductwork, Fans

233113 Metal Ducts

- A. Use double wall ductwork for collection areas.
- B. Interior sound lining is not recommended. If interior sound lining is required for sound attenuation, it shall be impervious to moisture, shall not collect dirt, nor release fibers into the airstream.
- C. Use metal ductwork as recommended by SMACNA.
- D. Exhaust duct/piping for emergency generators shall comply with NFPA 110, NFPA 37 and the International Mechanical Code. The exhaust shall have an integral muffler/silencer with a spark arrestor provided or approved by the generator manufacturer. Generator rooms shall be exhaust at 7.62 L/s per square meter (1.5 CFM/Sq.Ft). or as required by the generator manufacturer which ever rate is higher. The generator room shall maintain as a negative pressure in relation to the adjacent space.

233116 Non-metal Ducts

- A. Residential fiberglass type ductwork is not acceptable.

233119 HVAC Casings

- A. Double wall insulated casings are required for all air handling units. Provide with stainless steel drain pans.

233300 Air Duct Accessories

- A. Provide two hour rated fire dampers for collections areas. Install per SMACNA and UL direction.

233413 Axial HVAC Fans

- A. Provide any axial plug fans with an AMCA stamp.

233416 Centrifugal HVAC Fans

- A. Do not use forward curved fans on high flow and low pressure applications. They are less efficient than plenum or plug type fans.

233423 HVAC Power Ventilators

- A. Propeller type power ventilators may be used to exhaust mechanical, electrical, and other utility spaces located on the building exterior.
- B. Roof fans shall be dome type fans.

233433 Air Curtains

- A. Electric air curtains shall be used at building entrances and/or loading docks to help alleviate infiltration as necessary.

233600 Air Terminal Units

- A. Terminal units shall be single duct type. Fan powered air terminal units may be used along building perimeters. All terminal units located in areas with collections/artifacts shall be provided with electric heating coils.
- B. Terminal units shall have temperature discharge sensors tied to the BAS for monitoring and troubleshooting.

233713 Diffusers, Registers, and Grilles

- A. Diffusers, registers, and grilles shall be selected and sized to be aesthetically pleasing and effectively diffuse/exhaust air from the space. NC levels should be considered when selecting air devices for any occupied space.

233723 HVAC Gravity Ventilators

- A. Gravity ventilators shall not be used unless absolutely necessary.

233813 Commercial Kitchen Hoods

- A. Ductwork construction shall comply with NFPA 96 and shall be reinforced and supported per SMACNA duct construction standards and installed per SMACNA (tested in conformance with UL tests and certified for grease fire for two hours, with zero clearance to combustible).
- B. Installation requirements for commercial kitchen hood exhaust duct
 1. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2% to drain grease back to the hood.
 2. Install fired rated access panel assemblies at each change in direction and at maximum intervals of [6 m (20 feet)] [3.7 m (12 feet)] in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 38 mm (1-1/2 inches) from bottom of duct.
 3. Do not penetrate fire-rated assemblies except as allowed by applicable codes and authorities having jurisdiction.

4. Kitchen hood ductwork shall have liquid tight continuous external welds at seams, joints, penetrations, and duct-to-hood collar connections.

234xxx – Air Filtration

234100 Particulate Air Filtration

- A. Provide MERV 7 particulate air filtration per ASHRAE Standard 52 as necessary.

234133 High Efficiency Particulate Air Filtration

- A. AHUs shall use MERV 14 filters of 95% minimum efficiency with 30-40% pre filters.

234200 Gas-phase Air Filtration

- A. Carbon and Purafil chemical air filtration should be considered depending on the items exhibited and in storage and the outside environment. Outdoor air sampling and testing is suggested.
- B. Building requirements and available budget shall be closely examined before selecting filters.

235xxx – Hot Water/Steam Generation

235100 Breechings, Chimneys, and Stacks

- A. All breechings, chimneys, and stacks shall be double wall construction.

235113 Draft Control Devices

- A. Section not applicable.

235213 Electric Boilers

- A. Electric boilers are prohibited unless project circumstances dictate the use of them. This is due to the high cost of electricity and availability of steam and natural gas.

235216 Condensing Boilers

- A. Condensing type boilers shall be used when possible. They have higher efficiency and allow more flexibility for water temperature options. Higher efficiency may allow project to obtain additional LEED points.
- B. Condensing boilers shall supply 54.4°C (130°F) heating hot water.
- C. Provide stainless steel tubes.

235223 Cast-iron Boilers

- A. Section not applicable.

235233 Water-tube Boilers

- A. Design for low Nox if oil is used. Study is required to determine if water-tube boilers are appropriate for the project.

235239 Fire-tube Boilers

- A. Design for low Nox if oil is used. Study is required to determine if fire-tube boilers are appropriate for the project.

235313 Boiler Feed water Pumps

- A. Provide boiler feedwater pumps as necessary for boiler water make up.

235316 Deaerators

- A. Provide deaerators as necessary for steam boilers.

235400 Furnaces

- A. Furnaces shall be used for small projects and where central steam is not available.

235513 Fuel-fired Duct Heaters

- A. Fuel fired duct heaters are prohibited. Duct heaters shall be electric, hot water, or steam as applicable.

235523 Gas-fired Radiant Heaters

- A. Gas fired radiant heaters may be used to heat warehouse and loading dock spaces. Proper venting of combustion air and exhaust flue must be considered.

235700 Heat Exchangers for HVAC

- A. Heat exchangers for HVAC hot water generation shall be shell and tube type. Plate and frame type for water side economizers may be used.

236xxx – Chilled Water Generation

Modular chillers and heat recovery chillers may be used if life cycle cost and energy efficient.

Thermal storage systems shall be considered if feasible, a life cycle analysis shall be used for determination of use.

236200 Packaged Compressor and Condenser Units

- A. Consider digitally controlled compressors

236313 Air-cooled Refrigerant Condensers

- A. Section not applicable.

236333 Evaporative Refrigerant Condensers

- A. Consider on a case by case basis. This is not an open system and may have a higher energy usage than a cooling tower/condenser water system.

236413 Absorption Water Chillers

- A. Absorption chillers are prohibited. In Washington DC, steam costs are too high. These chillers are not efficient with a COP of around 1.

236416 Centrifugal Water Chillers

- A. Centrifugal water chilling machines shall be used on projects. All chillers shall be based on HFC refrigerants R-134a. A refrigerant monitoring system shall be provided. This shall apply to all refrigeration equipment.
- B. Electric motor driven machines will be constant or variable speed type with motor shaft speed not exceeding 3600 rpm.
- C. Compressors may be single or multiple stage. Evaporators may be flooded or direct expansion type.
- D. Machines shall be specified to deliver water at a temperature of 6.7°C (44°F) assuming a condenser fouling factor of 0.0001 and an evaporator fouling factor of 0.0005 with an entering water temperature of 11°C (52°F). They shall have a 4.5°C (8°F) temperature drop. The condenser shall be configured for EWT 29.5°C (85°F), LWT 35°C (95°F).
- E. A factory performance test shall be run and a certified test report is required to verify the design operating conditions.
- F. Machine control systems shall be electric. Safety controls shall include a flow switch or differential pressure switch, and low temperature cut-off thermostat in the chilled water circuit.
- G. Provide discharge and liquid line refrigerant isolation valves to allow isolation of the entire charge in the condenser while servicing the compressor. Check valves shall not be accepted.
- H. The chiller control interface shall be a high speed RS-232 serial or Ethernet interface. The chiller on-board controls shall provide total remote operations to start, stop, change all set points, obtain all chiller on-board monitored sensors and read all alarms. All other chillers shall have a DDC interface.
- I. Machines shall be installed in ground level or basement mechanical rooms with sufficient clearance provided to perform all necessary routine maintenance, repairs and replacement of components.
- J. Where a project utilizes more than one chiller, all chillers will be of the same manufacturer.

- K. Equipment performance shall be in accordance with ASHRAE 90.1, latest edition. The chiller shall have a kilowatt per ton rating below 0.62 kw/ton at full load. The designer should request NPLV ratings for the selected chiller, with the BIN weather data.
- L. If removing or replacing an existing chiller, recycle per ASHRAE Standard 15 and local codes.
- M. Modular Chillers may be used.

236419 Reciprocating Water Chillers

- A. Use for high lift or low temperature requirements as applicable.

236423 Scroll Water Chillers

- A. R-410A hydrofluorocarbon may be used.
- B. Modular chillers may be used.

236426 Rotary-Screw Water Chillers

- A. The new R-134A refrigerant screw machines have the advantage of being positive displacement compressors, and can be used for heat recovery. This may help obtain additional LEED points.

236500 Cooling Towers

- A. Cooling towers or closed coolers shall be installed for all refrigeration systems using water for refrigerant condensing. Cooling towers shall be pretested or comply with ETI ATC-105.
- B. All cooling towers will be mechanical draft and may be of metallic or non-metallic construction. Return water distribution may be deck or spray type. System shall be designed for EWT 35°C (95°F), LWT 29.5°C (85°F), entering air wet bulb 25.5°C (78°F). Consider lowering the leaving water temperature to increase the chiller efficiency however, this may increase the tower size.
- C. The tower's walls, panels and structure shall be stainless steel, type 304. A standard guardrail meeting OSHA requirements is required for work surfaces with an unprotected side or edge which is 1.2 m (4 ft) or more above a lower level. Ladders over 3.6 m (12 ft) in length shall have safety cage.
- D. The elevation of tower basins, storage tank operating levels, and pump suctions shall be indicated on contract drawings to assure pump operation free of cavitations. Horizontal shaft pumps shall be installed inside buildings.
- E. All cooling towers operating with wet basins shall be provided with sump heaters to allow draining during sub-freezing weather.
- F. Chemical treatment equipment shall be provided for all cooling towers.

- G. All make-up water for cooling towers shall be metered.
- H. All cooling towers shall have sound abatement accessories to control the noise of the condenser fan(s).
- I. Cooling towers may have VFD fans and tower modulated bypass to help control the cooling tower water temperature at low ambient temperatures. Do not use two speed fans on cooling towers.
- J. Provide spring isolation rails, flexible connections, and isolation valves on the equalizing line to allow draining of one tower when an additional tower is in operation.

237xxx – Air Handling Equipment

237200 Air-to-air Energy Recovery Equipment

- A. Provide energy study for system comparisons are required to be provided with energy study. Heat wheels and run-around-coils are recommended if they are determined to be energy efficient. Verify the increased fan energy with these devices does not offset their energy savings.
- B. Refrigerant heat pipes and heat plates may be used if energy efficient and life cycle cost effective.
- C. Energy recovery systems that may produce cross contamination shall not be used within areas with hazardous exhaust in accordance with Section 510 of the International Mechanical Code. A system which will not permit cross-contamination may be used based on energy savings and life cycle cost analysis.

237313 Modular Indoor Central Station Air-handling Units

- A. Field assembled or factory fabricated air units may be used for systems.
- B. Sheet metal walls and casing tops shall be constructed in accordance with details based on the recommendations of SMACNA. Curb anchoring shall be detailed for plenums pressurized by Class II and Class III fans.
- C. Air filtration shall be provided in every air handling system. Air-handling units shall have a disposable pre-filter and final filter. The filter media shall be rated in accordance with AHSRAE Systems Handbook 2004 Chapter 24. Filter racks shall be designed to minimize the bypass of air around the filter media with a maximum bypass leakage of 0.5 percent. Filters shall be sized at 2.5 m/s (500 fpm) maximum face velocity. Filter media shall be fabricated so that fibrous shedding does not exceed levels prescribed by ASHRAE 52. The filter housing and all air-handling components downstream shall not be internally lined with fibrous insulation. Double-wall construction or externally insulated sheet metal housing is acceptable. The filter change-out pressure drop and the initial clean filter rating must be used in determining fan pressure requirements. Differential pressure gauges and sensors shall be placed across each filter bank to allow quick and accurate assessment of filter dust loading as reflected by air-pressure loss through the filter and sensors shall be connected to building automation system.

- D. Plenum chambers shall rest on 100 mm (4") high concrete bases and be sized and arranged to permit servicing and repair of fans and filters, and replacement of finned tube coils. Each chamber shall be lighted and have an access door not smaller than 600 mm (24") by 1220 mm (48"). Access doors shall be provided with safety latches and be hinged to swing into the area of highest static pressure. Fan shutdown switches shall be provided inside casings pressurized by Class II and Class III fans. The minimum elevation of the cooling coil shall be calculated to allow for the condensate trap height requirement.
- E. Cooling coils shall be mounted vertically in a straight line with tubes perpendicular to air flow.
- F. Coils shall be independently supported on galvanized structural frames. Individual finned tube coils should generally be between six and eight rows with at least 2.1 mm between fins (12 fins per inch) to ensure that the coils can be effectively and efficiently cleaned. Dehumidifying coils shall be selected for no more than negligible water droplet carryover beyond the drain pan at design conditions. All hot water heating and chilled water cooling coils shall be copper tube and finned materials. Equipment and other obstructions in the air stream shall be located sufficiently downstream of the coil so that it will not come into contact with the water droplet carryover. Cooling coils shall be selected at or below 2.5 m/s face velocity (500 fpm) to minimize moisture carryover. Heating coils shall be selected at or below 3.8 m/s face velocity (750 fpm).
- G. Intermediate condensate drain pans shall project no less than 300 mm (12") downstream of coil frames, constructed of stainless steel or Monel, and shall be installed between each coiled section with vertical copper drain lines to carry condensate to floor pan.
- H. Block off sheets of 24 gauge galvanized steel shall be installed with caulking to prevent air bypass and leakage. Condensate drains shall be trapped.
- I. Ultraviolet light band emitters/lamps may be incorporated downstream of all cooling coils and above all drain pans to control airborne and surface microbial growth and transfer. Emitters and fixtures are to be installed in sufficient quantity and in such an arrangement so as to provide an equal distribution of UVC energy on the coil and in the drain pan. To maintain energy efficiency, the UVC energy produced shall be of the lowest possible reflected and shadowed losses. The minimal UVC energy striking the leading edge of all the coil fins shall not be less than 1500 W/cm³ (1423 BTU/in³). This sets the quantity of fixtures to be installed and their placement. The emitter tube shall be of the high output, hot cathode, T5 [15 mm (2")] diameter and medium bi-pin type. They shall produce 95% of their energy at 254 mm (10") and be capable of producing the specified output at airflow velocities to 5.08 m/s (1000 fpm) at temperatures of 1.6-76.6°C (35-170°F). When tested in accordance with the general provisions of IES Lighting Handbook, 1981 Applications Volume, total output per mm (inch) arc length shall not be less than 820 W/cm² (0.018 btuh/in²), at one meter, in a 2 m/s (400 fpm) airstream of 7.2°C (45°F). Applied fixtures/lamps must be specifically manufactured for this purpose. Safety interlocks/features shall be provided to limit hazard to operating staff.
- J. Access doors shall be provided at air handling units downstream of each coil, upstream of each filter section, and adjacent to each drain pan and fan section. Access doors shall be of sufficient size to allow personnel to enter the unit to inspect and service all portions of the equipment components.
- K. Coil face velocity shall not be greater than 2.5 m/s (500 fpm).

- L. Do not use wet coils in air handling units.
- M. Plenums containing cooling coils shall be wide enough to fully enclose coil end turns and heads and provide clearance between coil surfaces and plenum insulation.
- N. Piping risers shall be offset from coils and be provided with unions to facilitate removal of coils. Bottoms of risers shall have drain valves, tops, and manual vent valves.
- O. Use variable volume systems as much as possible in lieu of constant volume systems to save energy and better balance the air distribution. Three recommended VFD manufactures are Yaskawa, ABB and Danfos.
- P. Fans mounted on grade and those on above grade floors shall be isolation mounted. Fan motors greater than 5.6 kw (7.5 hp) should be premium high efficiency models. All fan motors with VFDs shall be high efficiency motors.
- Q. All heating and cooling coils shall have a pressure gauge and temperature gauge on the piping entering and leaving the coil.

237333 Indirect-fired H&V Units

- A. Provide indirect-fired H&V units for kitchen hood or process makeup air.

237339 Direct-fired H&V Units

- A. Section not applicable.

237413 Packed, Outdoor, Central Station Air-handling Units

- A. Consider custom units if possible. Due to shorter life span, increased maintenance concerns, and energy usage, this option should only be considered if space is not available inside the facility.

237433 Dedicated Outdoor Air Units

- A. This custom option should be considered when there is high ventilation or make up air demand and where the humidity levels are above what a normal AHU can condition.

238xxx – Unitary Air Conditioning/Humidity Control Equipment

238113 Self-contained Air Conditioners

- A. Provide self-contained air conditioners for small dedicated systems. Spot coolers and window units are prohibited.

238119 Computer Room Air Conditioners

- A. Computer Room space temperature and humidity requirements shall be tightly maintained and controlled.

238123 Split-system Air Conditioners

- A. Provide split-system air conditioners for small dedicated systems.

238146 Water-source Unitary Heat Pumps

- A. Water source heat pumps are prohibited in any location where noise is a concern or where dehumidification is required. Units may be used as part of a ground source geothermal system if considered.

238213 Valance Heating and Cooling Units

- A. Section not applicable.

238216 Air Coils

- A. Where possible provide drainable type.
- B. Provide with air vent connection.

238219 Fan Coil Units

- A. Allow sufficient space for maintenance and replacement

238223 Unit Ventilators

- A. Not recommended for any Smithsonian applications.

238233 Convectors

- A. Use extra heavy covers in high usage areas.

238239 Unit Heaters

- A. Provide unit heaters with minimum 0.18 kw (1/4 hp) motor on the fan. Provide calculations or chart to ensure air can reach the floor level.

238313 Radiant-heating Electric Cables

- A. Direction must be provided to assure the cable will not be cut during installation otherwise this product should not be used. Controls should be provided to best eliminate overheating. Coordinate with type of floor being used.

238316 Radiant-heating Hydronic Piping

- A. Direction must be provided to assure the poly piping will not be cut during installation otherwise this product should not be used. Controls should be provided to best eliminate overheating. Coordinate with type of floor being used.

238323 Radiant-heating Electric Panels

- A. Ideal for certain areas; design eliminates the problems of in floor radiation. Coordinate with type of floor being used. Carpet reduces the efficiency of such a system.

238413 Humidifiers

- A. Where humidification is required, use clean steam humidifiers to avoid contamination from “dirty” steam from GSA.
- B. Ultrasonic humidifiers cannot be used without special treatment of water. RO water may be required.
- C. Design duct mounted humidifiers with adequate space and accessibility to properly perform maintenance and repairs.

238416 Mechanical Dehumidification or Make up air Units.

- A. Custom air handling units are recommended for high percentages of outside air and areas with high ambient humidity requirements. Take the opportunity to recover a percentage of the energy by using a heat wheel or other energy saving feature that eliminate pre-heat. After hours, these units can close the OSA dampers and be used to dehumidify the building in certain high humidity locations such in the South.

239XXX Fume Hoods

- A. Regulations, Standards and References
 - 1. Regulations:
 - a. Virginia Code of Regulations (XXX), Title __, Section
Ventilation requirements for laboratory type hood operations
 - b. Virginia Code of Regulations, Title __, Section __, Carcinogens
 - c. Maryland Code of Regulations (XXX), Title __, Section
Ventilation requirements for laboratory type hood operations
 - d. Maryland Code of Regulations, Title __, Section __, Carcinogens
 - e. New York Code of Regulations (XXX), Title __, Section
Ventilation requirements for laboratory type hood operations
 - f. New York Code of Regulations, Title __, Section __, Carcinogens
 - g. CCR Title 8 Section 5154.1(e)(7)
 - h. SCCo Toxic Gas Ordinance No. NS-517.44
 - i. Code of Federal Regulations (CFR) 10, Parts 20 and 35

- j. Code of Federal Regulations (CFR) 1910.106 page 144,
- k. OSHA 2206, Nov 7, 1987 (OSHA, 1987)
- l. National Fire Protection Association ("NFPA") Handbook 45
Standard on Fire Protection for Laboratories Using Chemicals
- m. National Fire Protection Association ("NFPA") 56C
Standard for laboratories in health related institutions, Chapter 3-3.5: Fume
Hoods
- n. National Fire Protection Association (NFPA) Handbook 99
Standard for Health Care Facilities

2. Consensus Standards and References:

- a. American National Standards Institute (ANSI), Z358.1
Emergency Eyewash and Shower Equipment
- b. American National Standard for Laboratory Ventilation (ANSI/AIHA Z9.5)
- c. American National Standard for Thermal Environmental Conditions for
human Occupancy (ANSI/ASHRAE 55-2004)
- d. American Society of Heating and Refrigeration Engineers – ASHRAE
Handbook, Chapter 13
- e. American Society of Heating and Refrigeration Engineers – ASHRAE
Applications: Chapter 14, Laboratories: Part VIII; Laboratory Fume Hoods
- f. Virginia Disabled Accessibility Guidebook
- g. Maryland Disabled Accessibility Guidebook
- h. New York Disabled Accessibility Guidebook
- i. "CRC Handbook of Laboratory Safety, 4th ED." CRC Press 1995
- j. Guidelines for Construction and Equipment of Hospital and Medical Facilities
– U.S. Department of Health and Human Services; Chapter 7.29 Mechanical
Standards – Sections D(1)(n): Laboratory Hood Special Standards
- k. SAMA Fume Hood Standards – LF-10, latest edition
- l. USDA: Science and Educational Administration Manual for laboratory
Chemical Fume hoods – Standards – United States Department of
Agriculture
- m. ACGIH Industrial Ventilation Handbook (22nd edition)

- n. ACGIH, Industrial Ventilation: A Manual of Recommended Practice, 23rd edition or latest edition
- o. University of California EH&S Lab Safety Design Guide
- p. Prudent Practices in the Laboratory 8.C, 8.D
- q. Design and Construction of Inside Storage Rooms, General Industry Standard 29
- r. CDC-NIH Biosafety in Microbiological and Biomedical Laboratories
- s. NIH Design Policy and Guidelines, Research Laboratory, 1996, D7.7

B. General Ventilation Considerations

1. The room should have mechanical generated supply air and exhaust air. All lab rooms shall use 100% outside air and exhaust to the outside. There shall be no return of fume hood and laboratory exhaust back into the building. The air balance of the room cannot be adjusted unless the provision of mechanically generated supply and exhaust is made.
2. Mechanical climate control should be provided
3. Cabinetry or other structures or equipment must not block or reduce effectiveness of the supply or exhaust air.
4. Ventilation calculation shall be in accordance with ACGIH Industrial Ventilation Manual.
5. General laboratories shall have a minimum of 6 air changes per hour or 1 cfm/sf of exhaust, whichever provides the more stringent ventilation requirement.
6. Laboratories must be maintained under negative pressure in relation to the corridor or other less hazardous areas. Clean rooms requiring positive pressure should have entry vestibules provided with door-closing mechanisms so that both doors are not open at the same time. Consult with the local State Fire Marshal for additional design requirements.
7. The air velocity volume in each duct should be sufficient to prevent condensation or liquid or condensable solids on the walls of the ducts in compliance with ACGIH Industrial ventilation handbook and ASHRAE Laboratory Design Guide.
8. Fume hoods should not be the sole means of the room air exhaust. General room exhaust outlets shall be provided where necessary to maintain minimum air change rates and temperature control.
9. Operable windows should be prohibited in new lab buildings and should not be used on modifications to existing buildings.

10. Local exhaust ventilation (e.g. “snorkels”), other than fume hoods shall be designed to adequately control exposures to hazardous chemicals. An exhausted manifold or manifolds with connections to local exhaust may be provided as needed to collect potentially hazardous exhausts from gas chromatographs, vacuum pumps, excimer lasers, or other equipment which can produce potentially hazardous air pollutants. The contaminant source needs to be enclosed as much as possible, consistent with operational needs to maximize control effectiveness and minimize air handling challenges and cost. The development of enclosures to minimize the volume of airflow required to attain the desired degree of containment control will effectively reduce fan size, motor horsepower, make up air volume, and make up air conditioning costs.
11. Hoods shall be labeled to show which fan or ventilation system they are connected to.
12. No laboratory ventilation system ductwork shall be internally insulated. Sound baffles or external acoustical insulation at the source should be used for noise abatement.
13. Air exhausted from laboratory work areas shall not pass un-ducted through other areas.
14. Biological safety cabinets shall be designed and installed with exhaust systems or associated exhaust systems as specified by CDC NIOSH BMBL Appendix A and ANSI/AIHA Z9.5-2003 Part 5.3.2.5.

C. Negative Pressurization

1. Airflow shall be from low hazard to high hazard zones. Anterooms may be necessary for certain applications, such as clean rooms or tissue culture rooms. Potentially harmful aerosols can escape from the containment of the laboratory room unless the room air pressure is negative to the adjacent non-laboratory areas. It is recommended that laboratories should contain a fully integrated laboratory control system to control the temperature, ventilation rate and room pressurization. The control system should constantly monitor the amount of supply and exhaust air for the laboratory rooms and regulate the flow to maintain a net negative pressurization.
2. Provide an adequate supply of makeup air (90% of the exhaust) to the laboratory.
3. An air lock or vestibule may be necessary in certain high-hazard laboratories to minimize the volume of supply air required for negative pressurization control. These doors should be provided with interlocks so that both doors cannot open at the same time.
4. A corridor should not be used as a plenum.

D. Supply Air Arrangements

1. Room air currents at the fume hood should not exceed 20% of the average face velocity to ensure fume hood containment.

2. Make up air should be introduced to the opposite end of the laboratory room from the fume hood (s) and the flow paths for the room HVAC system shall be kept away from the hood locations.
3. Make up air shall be introduced such that negative pressurization is maintained in all laboratory spaces and does not create a disruptive air pattern
4. Cabinetry or other structures or equipment shall not block or reduce effectiveness of the supply or exhaust air.
5. Supply system air should meet the technical requirements of the laboratory work and the requirements of the latest version of ASHRAE, Standard 62, Ventilation for Acceptable Indoor Air Quality

E. Fume Hood Location

1. Fume hoods shall be located away from activities or facilities which produce air currents or turbulence. Locate away from high traffic areas, air supply diffusers, doors, and operable windows.
2. Fume hoods shall not be located adjacent to a single means of access to an exit. Recommend that hoods be located more than 3 m (10 ft) from any door or doorway.
3. Fume hood openings should not be located opposite workstations where personnel will spend much of their working day (i.e. desks or microscope benches).
4. An emergency, ADA eyewash/shower station shall be within 16 meters (55 feet) or 10 seconds of each fume hood.

F. Approved Equipment and Submittals

1. All fume hoods shall meet the requirements of
 - a. State Code of Regulations specific to project site, including:
 - i. Virginia Code of Regulations
 - ii. Maryland Code of Regulations
 - iii. New York Code of Regulations
 - iv. Florida Code of Regulations
 - v. Arizona Code of Regulations
 - vi. Hawaii Code of Regulations
 - vii. Massachusetts Code of Regulations
 - b. In addition to NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals
2. The following chemical fume hood manufacturers are currently approved for installation within the Smithsonian Institution facilities:
 - a. Fisher/Hamilton

- b. Kewaunee
 - c. Jamestown
 - d. Mott Manufacturing
 - e. LabConco
 - f. H.H. Hawkins, Ltd.
- 3. Only those fume hoods on the Smithsonian Institution's approved list may be used. Fume hood submittals must be reviewed and approved by the Smithsonian Institution OSHM prior to selection
 - 4. Fume hoods not on the Smithsonian Institution's approved list may be added to the approved list only after the Smithsonian Institution OSHM review and approval of the manufacturer's specifications.
 - 5. Manufacturer's product literature and data sheets are required
 - 6. Plastic laminate for color selection shall be provided.
 - 7. Submit specifications for size of fume hood, showing dimensions, required clearances, and finishes; and where necessary, size (especially height above the floor), and capacity and location of all mechanical and electrical services required

G. Fume Hood and Local Exhaust Ventilation Selection/Types

- 1. General laboratory design shall be based upon the following factors:
 - a. Room volume (length x width x height)
 - b. Number of room air changes
 - c. Laboratory Heat Load
 - d. Types of material used
 - e. Linear meter (feet) of hood needed based on
 - i. Number of users/hood
 - ii. Frequency of use
 - iii. % of time working at the hood
 - iv. Size of apparatus to be used in the hood, etc
 - v. Sash Position
 - f. A facility designed for intensive chemical use should have at least 0.8 linear meters (2.5 linear feet) of hood space per user.

- g. An extensive laboratory calculation that evaluates all laboratory equipment against heat load, recommended air change rates, minimal cooling requirements for the laboratory, variable volume venturi valve laboratory design or constant volume venturi valve laboratory design should be provided to Smithsonian Institution for review of laboratory development.
- h. Fume hoods are to be operated 24 hours a day. No user controlled shut-off switch is allowed unless necessary to the operation and approved by OSHM.

2. Constant Volume Fume Hoods

- a. Constant Volume fume hoods permit a stable air balance between the ventilation systems and exhaust by incorporating a full bypass feature within the hood. If the bypass is 100%, this allows a constant volume of air to be exhausted through the hood regardless of the sash position. Full by-pass hoods must be used for constant volume applications.

3. Variable Volume (VAV) Fume Hoods

- a. Variable Volume fume hoods (partial bypass) maintain constant face velocities by varying exhaust volumes in response to changes in sash position. Because only the amount of air needed to maintain the specified face velocity is pulled from the room, significant energy savings are possible when the sash is closed.

4. Supply or Auxiliary Air Hoods

- a. This type of hood is not permitted by the Smithsonian Institution, unless an exception is granted by Smithsonian Institution OSHM. It is very difficult to keep the air supply and exhaust of the supply hoods properly balanced. There also can be challenges with maintaining temperature conditions which will cause discomfort in the laboratory environment. Improper balancing and temperature conditions leads to the presence and movement of user bodies in the stream of the supply air which creates turbulence in the laboratory, degrades the performance of the hood, and can interfere with the tolerances of the calibration and measurement equipment in the lab.

5. Ductless Fume Hoods

- a. Portable, non-ducted fume hoods are not permitted by the Smithsonian Institution, unless an exception is granted by Smithsonian Institution OSEHM. Portable hoods do not typically meet the regulatory airflow requirements.

6. Perchloric / Hot Acid Hoods

- a. Heated perchloric acid shall only be used in a laboratory hood specifically designed for its use and identified as "For Perchloric Acid Operations". Perchloric acid and other hot acid digestion hoods must be on a dedicated

system and have an automatic wash down system. High use solvent extraction and solvent use hoods (ether, other flammable solvents, etc.) must be on a dedicated system.

- b. Perchloric acid hoods and exhaust duct work shall be constructed of materials that are acid resistant, nonreactive, and imperious to perchloric acid.
- c. The exhaust fan shall be acid resistant. The exhaust fan motor shall not be located within the duct work. Drive belts shall not be located within the ductwork.
- d. Ductwork for perchloric acid hoods and exhaust systems shall take the shortest and straightest path to the outside of the building and shall not be manifolded with other exhaust systems. Horizontal runs shall be as short as possible, with no sharp turns or bends. The ductwork shall provide a positive drainage slope back into the hood. Duct shall consist of sealed sections. Flexible connectors shall not be used.
- e. Sealants, gaskets, and lubricants used with perchloric acid hoods, ductwork, and exhaust systems shall be acid resistant and nonreactive with perchloric acid.
- f. A water spray system shall be provided for washing down the hood interior behind the baffle and the entire exhaust system. The hood work surface shall be watertight with a minimum depression of 15 mm (1/2") at the front and the sides. An integral trough shall be provided at the rear of the hood to collect wash-down water. The work surface shall have a raised lip on all four sides, and be constructed of materials compatible with usage. Union between work surface and counter shall be coved at a 20 mm (3/4") radius and sealed watertight.
- g. Spray wash-down nozzles shall be installed in the ducts not more than 1.5 m (5 ft) apart. The ductwork shall provide a positive drainage slope back into the hood. Ductwork shall consist of sealed sections and no flexible connectors shall be used.
- h. The hood surface should have an all-welded construction and have accessible rounded corners for cleaning ease.
- i. The hood baffle shall be removable for inspection and cleaning.
- j. Each perchloric acid hood must have an individually designated duct and exhaust system.

7. American with Disabilities Act (ADA) Hoods

- a. The designer shall consult with the Smithsonian Institution's ADA Compliance Office regarding the number of laboratory hoods that are required under each project design. These hoods must provide the

appropriate work surface heights, knee clearances, reach to controls, etc for individuals requiring use in wheelchairs.

Virginia Disabled Accessibility Guidebook
Maryland Disabled Accessibility Guidebook
New York Disabled Accessibility Guidebook
Florida Disabled Accessibility Guidebook
Arizona Disabled Accessibility Guidebook
Hawaii Disabled Accessibility Guidebook
Massachusetts Disabled Accessibility Guidebook

8. Glove Boxes

- a. Glove boxes (positive and negative) must meet the type, design, and construction requirements of ANSI/AIHA Z9.5-1992, 5.14.

9. Walk-In Fume Hoods

- a. Walk-In fume hoods must meet the type, design, and construction requirements of ANSI/AIHA Z9.5-1992, 5.13.

H. Fume Hood Construction, Installation and Performance

1. New hoods can be mounted above a chemical storage cabinet, provided that the cabinet meets the Uniform Fire Code requirements for construction. It is recommended that solvent storage not be located under the laboratory fume hoods as this is where fires are most likely to occur in laboratories.
2. All chemical fume hoods must meet the Smithsonian Institution's review for approval.
3. All fume hoods must be tested using the most current American National Standards Institute (ANSI)/ASHRAE 110 method.
4. Type 316 stainless steel should be used for all parts of the fume hood systems ventilation duct as long as compatibility is maintained.
5. Fume hood interior surfaces shall be constructed of corrosion resistant, non-porous, non-combustible materials such as type 316 stainless steel, and should be smooth and impermeable, with round corners. These materials shall have a flame spread index of 25 or less when tested in accordance with NFPA method 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.
6. Laboratory hoods shall be provided with a means of containing minor spills.
7. There must be a horizontal bottom airfoil inlet at the front of the hood.
8. Operator adjustable baffles are not permitted. Removable fixed slot or perforated baffles only are acceptable. Slots are to be continuous across the back of the fume hood.

9. Before a new fume hood can be placed into operation, an adequate supply of makeup air must be provided to the lab.

10. Face Velocity

Laboratory fume hoods shall be designed to provide a minimum average effective face velocity of 0.5 m/s (100 feet per minute (fpm)) with a minimum of 0.4 m/s (70 fpm) at any point, unless an exception is approved by OSHM. OSHM is to be consulted on all face velocity/exhaust rate design parameters for laboratory hood systems.

11. Where the required velocity can be obtained by partly closing the sash, the sash and/or jamb shall be marked to show the maximum opening at which the hood face velocity will meet the requirements.
12. An airflow indicator shall be provided and located so that it is visible from the front of the fume hood. The hood shall be prepared at the factory to receive the specified alarm/monitor. As a minimum, the alarm shall accommodate the following:
 - a. The Safety Monitor/Alarm System shall monitor face velocity and provide audible and visual alarm if face velocity drops below or rises above a range set by SI, and is to have a flexible range capable of alarms from 0.35 m/s (70 fpm) to 0.76 m/s (150 fpm). Audible alarm shall pulse at 80 dBA
 - b. The monitor shall be UL listed with all alarm circuit electric component, external tubing, restrictors and manifolds furnished complete. Monitor shall have light emitting diode display, which provides clear indication of airflow conditions. Safety monitor shall be tamperproof.
 - c. Alarm Signal. Audible pulsating signal and a visual, large flashing red light emitting diode.
 - d. Silence push button, which temporarily overrides the audible alarm for a period of no longer than 5 minutes, shall be accessible on the front of the Safety Monitor.
 - e. During temporary silence of the audible alarm, the visual alarm shall remain activated until the alarm condition is corrected.
 - f. After the alarm condition is corrected and the face velocity and volume is returned to the specified levels, the safety monitor shall automatically reset and begin routine monitoring.
 - g. Test circuit shall be provided to verify proper safety monitor operations
 - h. Electrical Rating: Maximum 15 VDC and maximum current rating of 200 MA.
 - i. An air monitor or alarm, comparable to ALNOR Airguard 335, or equal is acceptable

- j. Connect between the fume hood and the filter or damper
 - k. Flow tube device (floating indicators) or ribbons hanging in the air stream are not acceptable airflow indicators
13. Exterior construction
- a. Chemical Resistant finish
 - b. End panels fastened to frame with screws
 - c. Unused holes (interior or exterior) shall be plugged or blanked
14. Air Foil that provides an air sweep across the work surface with the sash in the fully lowered position. Air foils installed over the work surface edge, allowing for air flow under the air foil are preferred.
15. Interior end panels require an access panel with gas tight gasket.
16. Baffles shall be constructed so that they may not be adjusted to restrict the volume of air exhausted through the laboratory hood.
17. Fans shall run continuously without local control from the fume hood location and independently of any time clocks.
18. For new installations or modifications of existing installations, controls for laboratory hood services (e.g., gas, air, and water), should be located external to the hood and within easy reach.
19. Shutoff valves for services, including gas, air, vacuum, and electricity shall be outside of the hood enclosure in a location where they will be readily accessible in the event of fire in the hood. The location of such a shut-off shall be legibly lettered in a related location on the exterior of the hood.
20. Laboratory hoods shall not have an on/off switch located in the laboratory unless necessary to the operation and approved by OSHM. Exhaust fans shall run continuously without direct local control from laboratories.
21. Drying ovens shall not be placed under fume hoods.
- I. Power and Electrical
- 1. Receptacles per National Electrical Manufacturers Association (NEMA) 5-15R: 20A – 125V AC three-wire duplex polarized receptacles. Receptacles shall be GFI. Receptacles: Harvey Hubble-Inc.'s No. 5252, Arrow Hart, Leviton, or equal.
 - 2. Plate Covers: Meet usage, Bell or equal
 - 3. Switch for lighting: Hubbel #1221 or equal.

4. Flexible Conduit: 15 mm (½") complete with wiring as required
5. Light Fixture: Heavy duty fluorescent strip light with 430 Ma rapid start lamps and 120 volt HPF ballasts. Provide three foot length for four foot hoods and four foot length for six foot hoods. Light Fixture: Garco #RN 9942 – 36H, Columbia Lighting Inc; Smoot-Holman Company; Benjamin Products of Thomas Industries, Inc; or equal.
6. Chemical fume hood exhaust fans should be connected to an emergency power system in the event of a power failure.
7. Emergency power circuits should be available for fan service so that fans will automatically restart upon restoration after a power outage.
8. Momentary or extended losses of power shall not change or affect any of the control system's set points, calibration settings, or emergency status. After the power returns, the system shall continue operation without the need for any manual intervention. Alarms shall require manual reset, should they indicate a potentially hazardous condition.
9. Fume hood ventilating controls should be arranged so that shutting off the ventilation of one fume hood will not reduce the exhaust capacity or create an imbalance between exhaust and supply for any other hood connected to the same system.
10. In installations where services and controls are within the hood, additional electrical disconnects shall be located within 15m (50 ft) of the hood and shall be accessible and clearly marked. (Exception: If the electrical receptacles are located external to the hood, no additional electrical disconnect shall be required).
11. Hood lighting shall be provided by UL listed fixtures external to the hood or if located within the hood interior, the fixtures shall meet the requirements of NFPA 70, (National Electrical Code).
12. Light fixtures should be of the fluorescent type and replaceable from outside the hood. Light fixtures must be displaced or covered by a transparent impact resistant vapor tight shield to prevent vapor contact.
13. The valves, electrical outlets and switches for utilities serving the hoods should be placed at readily accessible locations outside the hood. All shutoff valves should be clearly labeled. Plumbing (e.g., vacuum lines) should exit the sides of the fume hood and not the bench top.

J. Sashes

1. Hoods shall have transparent movable sashes constructed of shatter-resistance flame resistant material and be capable of closing the entire front face.
2. Vertical rising sashes are preferred. Consult with the Smithsonian Institution OSEH regarding the use of horizontal sashes. If permitted, sash panels (horizontal sliding) must be 310 to 360 mm (12 to 14 inches) in width.

3. Vertical type: 6 mm (¼") thick laminated safety glass complete with 6 mm (¼") deep stainless steel metal channels on sides, top and bottom; or frameless.
4. Mechanical stops shall ensure that sash work opening is 450 mm (18") as measured from the top of the fume hood work surface to the bottom of the sash.
5. A manual override shall be provide to allow the vertical sash to be raised above the maximum opening to allow lab apparatus to be installed or removed.
6. Operating face velocity at 450 mm (18") shall be set between 0.5-1 m/s (100 – 120 fpm).
7. A force of 2.2 kilograms (5 pounds) shall be sufficient to move vertically and/or horizontally moving doors and sashes.

K. Ducting

1. Fume hood exhaust should be manifolded together except for the following:
 - a. Perchloric/hot acid hood applications
 - b. Fume hoods with wash down equipment
 - c. Fume hoods that could deposit highly hazardous residues on the ductwork
 - d. Exhaust requiring HEPA filtration or other special air cleaning
 - e. Situations where the mixing of exhaust materials may result in a fire, explosion, or chemical reaction hazard in the duct system
1. Manifolded fume hood exhaust ducts shall be joined inside a fire rated shaft or mechanical room, or outside of the building at the roofline.
3. Horizontal ducts must slope at least 25 mm per 3 m (1" per 10 ft) downward in the direction of airflow to a suitable drain or sump.
4. Ducts exhausting air from fume hoods should be constructed entirely of noncombustible material. Gaskets shall be resistant to degradation by the chemicals involved. Gaskets shall be fire resistant.
5. Automatic fire dampers shall not be used in laboratory hood exhaust systems. Fire detection and alarm systems shall not be interlocked to automatically shut down laboratory hood exhaust fans.

L. Exhaust

1. New exhaust fans should be oriented in an up-blast orientation.
2. Hood exhaust stacks shall be coordinated and developed with a wind tunnel analysis specialist. Refer to section 15.0 Wind Engineering for additional requirements.
3. Hood exhaust shall be located on the roof as far away from the outside air intakes as possible to prevent re-circulation of laboratory hood emissions within a building. For

toxic gas applications, the separation distance shall be a minimum of 23 m (75 ft) from any outside air intake.

4. A minimum 3 meter (10 foot) vertical separation must be established between the stack discharge and the adjacent roof lines and/or air intakes.
5. Discharge from exhaust stacks must have a velocity of at least 15 m/s (3,000 fpm). Achieving this velocity should not be done by the installation of a cone type reducer. The duct may be reduced, but the duct beyond the reduction should be of sufficient length to allow the air movement to return to a linear pattern. Strobic type exhaust fans may be used to address exhaust velocity requirements.
6. Rain caps that divert the exhaust toward the roof are prohibited.
7. Fume hood exhaust may be required to be treated as determined by local codes and planned operations within the hood.
8. Laboratory ventilation exhaust fans shall be spark-proof and constructed of materials or coated with corrosion resistant materials for the chemical being transported. V-belts drives shall be conductive.
9. Vibration isolator shall be used to mount fans. Flexible connection sections to ductwork, such as neoprene coated glass fiber cloth, shall be used between the fan and its intake duct when such material is compatible with hood chemical use.
10. Each exhaust fan assembly shall be individually matched (cfm, static pressures, brake horsepower, etc.) to each laboratory ventilation system.
11. Exhaust fans shall be located outside the building at the point of final discharge. Each fan shall be the last element of the system so that the ductwork through the building is under negative pressure. For multiple risers through a rated shaft, manifolding ducts to a common plenum through which exhaust fans draw the laboratory exhaust can be incorporated into the design. Design must be approved by Smithsonian Institution OSHM prior to development and construction.
12. Fans shall be installed so they are readily accessible for maintenance and inspections without entering the plenum.

M. Plumbing

1. Cup Sink shall be flush with the work surface and shall conform to the usage requirements, complete with stainless steel tailpiece as required.
2. Make provisions for cold water only for each hood, in accordance with utility service symbols. Provide vacuum breaker required at each fume hood outlet, in addition to the main backflow preventer.
3. Run internal electric wiring in conduit. Do not run conduit through hood interior or across the hood.

4. Utilities controls shall be located outside of hood interior for convenient access and use.
5. Fixtures shall be Water Saver Faucet Company, Chicago Faucet, T & S, or equal. The following specifications refer to the Water Saver Faucet Company to establish quality, utility, and appearances.
 - a. Gas, air, water, steam, and vacuum fixtures shall be made up of remote control valves L-3185 (15 mm (1/2") IPS pipe thread, 10 mm (3/8") NNPT outlet pipe threads) with guide bushing "B" with 4-arm handle and color plastic for index disc, and for service
 - b. For gas, air, and vacuum, the remote control valve shall be connected to a Water Saver L-14 (or equal) serrated nozzle with 10 mm (3/8") male threads, 10 serrations, and of dimensions as shown on the drawing. Valve shall have stainless steel seat and stainless steel renewable floating cone unit.
 - c. For water, the remote control valve shall be connected to a Water Saver L171-WSA with vacuum breaker (or equal) serrated nozzle with a 1/2 inch pipe and elbow. Valves shall have "Water Saver: standardized renewable operating unit".
 - d. Access panel to service the utilities shall be gasketed with approved gasket material.
 - e. Plumbing shall not be run through hood interior or across front of hood.
 - f. Water faucets shall have a vacuum breaker.
 - g. Pre-plumb all utilities

N. Wind Engineering

1. A wind tunnel evaluation is required for all new construction. Any new construction project that produces emissions of a hazardous, noxious, odoriferous, or otherwise nuisance character and that poses a health and safety risk is to be evaluated using the best available technology for wind tunnel studies. Common emission sources can include laboratory exhaust, cooling towers, generators, incinerators, kitchen exhaust, and vent stacks.
2. A wind tunnel evaluation may be required for remodeling projects if new exhausts are being added that may impact sensitive receptors, when the total volume of the exhaust is being substantially increased, or when the project may be affected by nearby existing building. Sensitive receptors can include air intakes, courtyards, operable windows, or sensitive animal populations that are either part of the facility being remodeled or that exist nearby.
3. Wind tunnel engineering evaluations shall be conducted for all wind directions striking all walls of a building where fume hood exhaust is likely to have significant ground level impact, or is likely to affect air intakes for buildings located nearby.

4. Required Dilution: The required dilution is based on the chemical makeup of the exhaust and the type of receptors that are affected. Target dilution factors are 1/1,000 at minimum, as measured from the top of the exhaust fan to the receptor in question. For highly toxic emissions where a 1/1000 dilution factor is inadequate, the appropriate dilution level should be calculated for the specific application.
5. Chemical Parameters: Chemical parameters to be evaluated include, but are not limited to: worst case spill releases and modeling with chemicals possessing highest toxicities, greater volatility and lowest threshold limit values (TLV).
6. Wind tunnel study parameters chosen shall use the best available technology and the current industry testing standards. The ASHRAE Handbook of Fundamentals or the Environmental Protection Agency (EPA) Guideline for Fluid Modeling of Atmospheric Diffusion, EPA – 600/8-81-009 should be consulted. At a minimum, the wind tunnel study shall take into account probable evaporation times based on ventilation rates, exhaust stack height and diameter, exit velocity, exhaust location, wind speed, and direction, building features and any nearby features that could influence emission dispersion.
7. Emergency generator exhaust shall be considered in the wind tunnel engineering study.

O. Noise

1. System design must provide for the control of all exhaust system noise (combination of fan generated noise and air generated noise) in the laboratory. Systems must be designed to achieve an acceptable Sound Pressure Level (SPL) frequency spectrum (room criterion) as described in the ASHRAE Handbook– HVAC Applications.

P. Lab Hood Commissioning

1. Balance, test, and certify each fume hood in accordance with the latest edition of ASHRAE 110 Testing Requirements. Fume hood field tests shall be performed by a qualified independent testing company on each hood to determine face velocity, containment, and airflow patterns. Proper operation of fume hoods must be demonstrated by the contractor installing the fume hood prior to project closeout.
2. Fume hood face velocity to be maintained at between 0.5 – 0.6 m/s (100 – 120 fpm) at all times during normal operation.
3. As installed, under the ASHRAE 110 test method, fume hoods must meet the testing criteria 4.0A/0.05 as specified in the Industrial Ventilation Handbook (4.0 liters/minute release rate of tracer gas, as installed, less than 0.05 ppm of tracer gas detected).
4. There shall be no visible smoke flow out of the fume hood during the flow visualization test.
5. Balance, test, and certify each glove box, biosafety cabinet and laminar flow hood in accordance with the latest edition of ANSI/NSF 49 Testing Requirements. Each hood

test shall be performed by a qualified independent accredited Biological Cabinet Field Certifier to determine proper containment and certify the effectiveness of internal filtration.

Division 26 Electrical

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 International Electrical Code (IEC) – Latest edition
- 1.02 NFPA 70 National Electrical Code (NEC) – Latest edition
- 1.03 NFPA 101 Life Safety Code
- 1.04 Local Jurisdiction Requirements
- 1.05 Smithsonian Sustainability Plans – Latest versions
- 1.06 Executive Order 13514
- 1.07 ASHRAE 90.1
- 1.08 Illuminating Engineering Society of North America (IESNA)

II. Design Requirements

- 2.01 Any deviation from these standards requires the approval of the Smithsonian Associate Director for Engineering and Technical Services.
- 2.02 The design shall be in accordance with the A/E Special Conditions. Where a conflict occurs between the AE Special Conditions and the Smithsonian Institution Design Standards, the most stringent shall apply.
- 2.03 Division One (Supplementary Conditions for Construction) is available on the OFEO web site. This information includes specific building operations and when certain types of construction, demolition, welding times, deliveries, etc. can be accomplished.
- 2.04 The designer must provide an Electrical Systems Design Narrative and all calculations specified in the A/E Special conditions at each submission. Calculations include but are not limited to load calculations, lighting calculations, fire pump calculations and a coordination and short circuit study. For short circuit analysis, point to point method is not acceptable. The short circuit study shall be performed with the aid of a digital computer program, preferable SKM PowerTools software and shall be in accordance with the latest applicable IEEE and ANSI standards. Provide an Arc Flash study

III. Specifications

260xxx - Conductors and Cables

260500 Common Work Results for Electrical

- A. All conductors, busses shall be copper. List no more than five manufacturers for electrical equipment in specifications.
- B. Refer to 260500 security system supplement for security system distribution.

260513 Medium Voltage Cables

- A. Cables shall be copper conductors, triplexed sized in accordance with calculations, rated 15 kv, MV-105 133% insulation level, with (1) #1/0 bare, stranded ground wire EPR insulation, manufactured and tested to ICEA S-93-639 / NEMA NC 74.
- B. Provide labels for all feeders in manholes.
- C. Underground conduits for the medium voltage system shall be concrete encased with warning tape installed 300mm (1 foot) above the concrete.

260519 Low-Voltage Electrical Power Conductors and Cables

- A. Minimum wire size shall be #12 AWG THHN, THWN. All conductors shall be copper. Homeruns to lighting and receptacle panels which exceed 75ft shall be minimum #10 AWG.
- B. As part of electrical renovation to existing systems, all wiring shall be removed back to the source for all demolished or removed equipment. No wiring shall be abandoned in place without the express consent of the Smithsonian Institution.
- C. Do not show more than a 3-phase circuit; or 3-phase conductors, a neutral conductor and an equipment grounding conductor in a single conduit.
- D. Feeder conductors shall be sized in accordance with the 25% spare capacity provided for each panelboard.

260519.3 Undercarpet Electrical Power Cables.

- A. Undercarpet Electrical Power Cables shall only be used with the consent of the Smithsonian Institution.

260523 Control-Voltage Electrical Power Cables

- A. Coordinate requirements for fire alarm control conductors with OEDC Fire Alarm Specifications.
- B. Refer to Smithsonian Institution Security Design Criteria for requirements for security alarm control conductors.

260526 Grounding and Bonding for Electrical Systems

- A. Grounding conductors for No.8 AWG and smaller shall be solid and grounding conductors No.6 and larger shall be stranded.
- B. Install ground bars in all telecommunications rooms unless otherwise indicated.
- C. Comply with IEEE C2 grounding requirements.
- D. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
- E. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- F. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.
- G. Grounding and Bonding for Piping: Metal Water Service Pipe:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductors on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

260xxx - Raceways and Supports**260529 Hangers and Supports for Electrical Systems**

- A. Conduits shall be fastened with UL clips approved by the SI. Supporting of conduits with tie wires, perforated straps or similar means shall not be permitted. Resting conduit on structural steel is not an acceptable means of support.

260533 Raceways and Boxes for Electrical Systems

- A. Minimum conduit size shall be 21MM. Conduits routed indoors shall be EMT unless otherwise accepted by COTR. Conduit routed underground shall be PVC schedule 80. Conduit routed above ground exterior shall be rigid galvanized steel. Contractors shall provide coordinated MEP conduit/duct/piping plan as part of submittal process.
- B. Connectors shall be steel set screw type unless required differently by codes or security requirements.

260536 Cable Trays for Electrical Systems

- A. Where cable trays are routed exposed below ceilings, provide non-ventilated bottom trough type cable tray painted to match wall color. Ladder type or basket type is acceptable above ceilings. Coordinate with OCIO through COTR for depth and width of trays.

260539 Underfloor Raceways for Electrical Systems

- A. Where applicable provide underfloor raceways below raised access flooring. Underfloor raceways shall be comprised of conduit and junction boxes or underfloor bus track. Coordinate with SI representative for preference.
- B. Raceways shall be installed parallel or perpendicular to building walls.
- C. Ground all underfloor raceway components.
- D. Coordinate final locations of junction boxes with furniture plans.
- E. Where applicable, route underfloor raceways for electrical systems perpendicular to underfloor raceways for telecommunications systems. Coordinate with OCIO through COTR.
- F. Coordinate with SI user group through COTR for acceptable service fitting types and finishes

260543 Underground Ducts and Raceways for Electrical Systems

- A. Duct banks shall consists of parallel sets of Type I CSA certified PVC conduit encased in concrete. Conduits shall be minimum 6" and spaced a minimum 7" center to center.
- B. Provide minimum 1 spare duct in ductbank.
- C. Coordinate requirements of medium voltage ductbank with the guidelines of the local utility where the ductbank delivers primary feeders from local utility substation/transformer/manhole to SI property.

260548 Vibration and Seismic Controls for Electrical Systems

- A. No specific Smithsonian Institution standards. Follow industry standard best practices and applicable codes.

260553 Identification for Electrical Systems

- A. Provide screwed on labels for all electrical equipment indicating panel name and voltage; equipment name and panel equipment is fed from. Provide painted on voltage label every 20' on conduit, identifying voltage.

260573 Overcurrent Protection Device Coordination Study

- A. Provide overcurrent protection device coordination study and short circuit analysis in electronic format in accordance with SI AE Special Conditions.

260xxx - Power Monitoring, Lighting Control Systems**260913 Electric Power Monitoring and Control**

- A. Provide electric power monitoring and control for the emergency distribution system. The electric power monitoring and control system shall monitor and control the positions of all automatic transfer switches and provide real time load information.
- B. The electric power and monitoring system shall be monitored at a central location as directed by the SI representative. Basis of design for electrical power monitoring and control system is Square D Power Logic.
- C. Provide testing and commissioning when new devices are added or removed from the system.

260923 Lighting Control Devices

- A. Utilize occupancy sensor controls in all normally occupied non-public spaces such as offices and restrooms. Provide manual override switches for after-hour use.
- B. Unless otherwise prohibited utilize daylight sensors in non-public office spaces located along building perimeter.
- C. Utilize toggle switches in utility spaces such as electrical and mechanical rooms and telecommunication closets.
- D. All lighting circuits must run to a central lighting control system.
- E. Where applicable and approved by the appropriate SI Representatives: add occupancy sensor controlling dimmed circuits for all public spaces and displays.
 - 1. Devices shall be programmed so the visitor experience is not compromised.
 - 2. To maximize usefulness of sensors, the location of sensors must be carefully integrated into the exhibit and the museum program to allow the necessary granularity of control.
 - 3. Controls shall be provided to re-program attributes of occupancy sensors including varying time delay periods for when the museum is open vs. when it's closed. Time delay periods shall be variable from 30 seconds to permanently on.

4. All circuits in public spaces controlled by occupancy sensors shall be placed on dimmers.
 - a. SI personnel shall have the capability to set the following attributes without the need to call a factory representative:
 - I. setting the rate of fade for each dimmed circuit or group of circuits,
 - II. grouping of control devices, applying schedules to control devices,
 - III. setting the length of time delay on sensors.
- F. The emergency lighting system shall be either continuously in operation or shall be capable of repeated automatic operation without manual intervention.

260933 Central Dimming Controls

- A. Where applicable provide appropriate lighting controls for public exhibit spaces to control the exhibit lighting systems.
- B. Coordinate with SI representative for exhibit renovations to determine the building standard for dimming controls. Construction Document Specifications shall include training for museum staff.
- C. System shall be integrated with building fire alarm and/or mass notification system for automatic override during an emergency.
- D. The system shall be capable of interfacing with the audio-visual control system.
- E. Network lighting controls shall follow all Smithsonian OCIO standards necessary that will allow OCIO to maintain and control system after installation.
 1. The contractor shall meet OCIO standards for items including but limited to:
 - a. Quality of wire.
 - b. Type and manufacture of switches, routers and associated network equipment.
 - c. The type of fiber and copper connections.
 - d. Lighting networks shall be protected VLAN segments of the SI network.
- F. All circuits in public spaces controlled by occupancy sensors shall be placed on dimmers.
 1. SI personnel shall have the capability to set the following attributes without the need to call a factory representative:
 - a. setting the rate of fade for each dimmed circuit or group of circuits,
 - b. grouping of control devices, applying schedules to control devices,
 - c. setting the length of time delay on sensors.

260936 Modular Dimming Controls

- A. Unless otherwise noted modular dimming controls are for select non-public spaces.

- B. Provide modular dimming controls for conference rooms, meeting rooms or other similar non-public multi-user occupancies.
- C. Coordinate with SI representative to establish preset scenes and identify lighting zones to be controlled together. All lighting control groups (commonly known as Zones) shall be determined during the design phase. The programming of presets/scenes and daily schedules shall be completed during the construction phase and with the approval of SI representative.
- D. Coordinate locations of master station and remote stations with the fixed furniture and equipment within the space and the SI representative.
- E. Where applicable in multi-user occupancy spaces with moveable partitions, integrate the lighting controls with the positions of the partitions, such that each configuration of the partition walls is a preset scene.
- F. System shall be integrated with building fire alarm and/or mass notification system for automatic override during an emergency.
- G. Modular Dimming Controls for non-public spaces should be tied into the buildings central lighting control system as determined by the SI representative.
- H. The system shall be capable of interfacing with the audio-visual control system and video teleconferencing system if applicable.
- I. Network lighting controls shall follow all Smithsonian OCIO standards necessary that will allow OCIO to maintain and control system after installation.
 - 1. The contractor shall meet OCIO standards for items including but limited to:
 - a. Quality of wire.
 - b. Type and manufacture of switches, routers and associated network equipment.
 - c. The type of fiber and copper connections.
 - d. Lighting networks shall be protected VLAN segments of the SI network.
- J. Specifications for system shall include training for end user on the operation and maintenance of the system to include but not limited to how to set scenes and change the lighting zones.

260943 Network Lighting Controls

- A. For new construction and where applicable for renovations provide a IT- based network lighting control system capable of monitoring on-off status and performing on-off operation.
- B. Manual switches, internal time clocks or other control systems shall be provided to send a signal to the network lighting controls to turn on or off a group of lighting loads. Coordinate with SI Representative for locations of manual switches.
 - 1. Manual override switches shall be included to provide control beyond scheduled hours.

2. Over-ride controls shall be from a single point of contact without the necessity of using multiple lighting programs, multiple computers or logging onto multiple processors.
- C. Lighting control system shall have the capacity to be programmed so overrides automatically time out at a user defined time.
 1. Software shall allow overrides to be scheduled 364 days in advance.
- D. The lighting control software shall allow Smithsonian personnel to have the following capabilities.
 1. Ability for SI personnel to group circuits into user defined zones.
 2. Ability for SI personnel to apply schedules to zones.
 3. Ability to turn entire lighting system on and off from a single point of contact.
 4. Ability to schedule entire lighting system from a single point of contact.
 5. Ability to turn individual zones on and off throughout the facility without the need to log onto multiple processors, multiple computers or multiple programs.
 6. Multiple lighting control systems shall be integrated into a common controller or set of switches.
- E. Network lighting controls shall interface with all local modular dimming controls for non public multi-user spaces and central dimming controls for public exhibit spaces. Turning off lights shall not impact pre-programmed lighting controls and cause the systems to be reset.
- F. The network lighting controls shall have a building automated system interface.
- G. Follow OCIO wiring standards for any fiber or copper connections.
- H. The emergency lighting system shall be either continuously in operation or shall be capable of repeated automatic operation without manual intervention.

261xxx - Electrical Systems Above 600V

261116 Secondary Unit Substations

- A. Provide in accordance with NEC Article 490.III Equipment – Metal-Enclosed Power Switchgear and Industrial Control Assemblies.

261200 Medium-Voltage Transformers

- A. 13.8 KV Transformers (indoor use)
 1. Transformers shall be silicone oil liquid filled, sealed tank, self cooled, type LNaN-LNAF, 2 winding, step down, with a temperature rise ate rated self cooled load of 55c over ambient of 40c maximum and 30C average.
 2. The capacity of each transformer shall be:
 - a. 100% kva at 55C rise without fans

- b. 112% kva at 65C rise without fans, with no loss of transformer life
 - c. 133% kva at 65C rise with fans, with no loss of transformer life
 - d. Fans shall be provided
 - 3. High voltage windings shall be 13.8KV, delta connected, with four 2% rated kv taps, two above and two below nominal voltage.
 - 4. Low voltage winding shall be as required, wye connected, with the wye connection solidly grounded outside the tank.
 - 5. The basic impulse insulation level shall be 95kv.
 - 6. The impedance shall be between 5.5% and 6.3% including all tolerances.
 - 7. Transformers shall be complete with all standard accessories, including but not limited to the following:
 - a. Off load circuit tap changer operable from ground level by a single external wheel, with provisions for padlocking in any position.
 - b. Tap position indicator.
 - c. High internal tank pressure relief device.
 - d. Hermetically sealed dial type oil temperature thermometer, three stage, with trip, fan start and alarm contacts.
 - e. Liquid level gauge with alarm contact, bottom drain valve and sampling device.
 - f. Two tank grounding studs for No. 4/0 AWG conductor.
 - g. Lifting eyes, welded bottom corner jacking steps and provisions for skidding.
 - h. Diagrammatic nameplate of non-corroding material.
 - i. Sudden gas pressure relay with trip and alarm contacts. Seal-in or lockout relays shall operate on 125v DC.
 - 8. All alarm contacts shall be wired out to a control enclosure.
 - 9. Windings and all current carrying conductors shall be copper.
- B. 4160V Transformers (indoor use)
- 1. Transformer shall be high efficiency, low impedance type in accordance with NEMA TP 1- 2002.
 - 2. Transformer shall be power type AFA indoor, air cooled, dry type with continuous capacity.
 - 3. Transformers shall be three phase delta primary, Wye secondary. Insulation shall be Class H.
 - 4. Transformers shall have four 2% full capacity primary taps, two above and two below normal voltage. Provide off load tap changer.

- 5. Maximum sound level at AFA rating shall be 60db., Transformer shall have 50kv B.I.L. (Basic impulse Insulation Level), rating. The transformers shall be equipped with fans to increase capacity to 133% nameplate rating.
- C. Provide network protectors with external access to fuses. Basis of design for network protectors is Cuttler Hammer CM252.
- D. All transformer vaults for new construction must have dual means of egress. One egress shall be onto the exterior ground and the other into a corridor.

261300 Medium-Voltage Switchgear

- A. Coordinate with local utility for minimum requirements for terminations and over current protection.
- B. Provide electrical safety mats in front of switchgear with rating equivalent or greater than rating of associated switchgear.
- C. Provide appropriate warning labels indicating flash hazard boundary, hazard risk category and PPE level required to service the equipment.
- D. Circuit breakers shall be vacuum type.
- E. Switchgear shall be front accessible. Each switchgear section must be isolated by vertical steel barriers. Each switchgear section shall have hinged doors.
- F. All switchgear vaults for new construction with equipment rated over 1200 amps must have dual means of egress. One egress shall be onto the exterior ground and the other into a corridor.
- G. Floor mounted switchgear shall be mounted on 100mm (4 in) high equipment pads. Equipment pads shall be at least 100mm larger than the equipment on all sides.
- H. Contractor shall provide full functional test sets for protective relays and for breakers testing on any electrical distribution.

262xxx - Electrical Systems 600V and below

262200 Low-Voltage Transformers

- A. Dry type transformers shall be NEMA TP 1 compliant.
- B. Dry type transformers shall be indoor, air cooled, dry-type of the size, rating and capacities to suit.
- C. All windings and terminations shall be copper.
- D. Transformers shall be of the 1.2kv class, standard B.I.L. (Basic impulse Insulation Level), with Class 220 insulation.

- E. Locate transformers in spaces such that sound level is not increased by sound reflection. The spaces shall be adequately ventilated to prevent temperature rise from exceeding the transformer rating.
- F. Transformers shall be mounted such that vibrations are not transmitted to the surrounding structure.
- G. Floor mounted transformers shall be mounted on 100mm (4 in) high equipment pads. Equipment pads shall be at least 100mm larger than the equipment on all sides.

262300 Low-Voltage Switchgear

- A. The switchgear shall be a complete, metal enclosed, factory assembled, tested and shipped ready for installation including main and tie breakers, metering and power distribution section of required short circuit rating and ampacity.
- B. Provide main circuit breaker for each service entrance section. Provide ground fault protection on service entrance feeders.
- C. Provide appropriate warning labels indicating flash hazard boundary, hazard risk category and PPE level required to service the equipment.
- D. Buses shall be high strength, high conductivity, tin plated copper. Provisions shall be made for extending the buses to future cubicles at each end of the switchgear. Buses shall be joined together with a minimum of two bolted connections. Bus joint hardware shall be noncorroding. A continuous copper ground bus shall be run near the bottom, the full length of the switchgear.
- E. The metal frames of all components shall be connected to the ground bus. Provide a plug for connecting to the external ground conductors at each end of the bus. The momentary rating of the ground bus shall be equal to or greater than that of the apparatus in the assembly. The minimum size shall be 7 x 50mm. Provide bus transition section where required, with bolted access panels.
- F. Provide a minimum of two spares and two prepared spaces in all new switchgear. Provide spare breakers, one for each frame size. Locate gutter on the bottom of the switchgear. Switchgear shall have draw out breakers with adjustable breaker settings. Breaker settings shall be adjusted in accordance with the short circuit and coordination study required by the SI AE Special Conditions.
- G. Provide switchgear elevations showing all dimensions on construction documents. Provide enlarged electrical room plans illustrating all physical dimensions of electrical equipment.
- H. Third party testing of switchgear is required if there are in field modifications.
- I. Provide label on each switchgear cube identifying load served.
- J. For renovations, new equipment must be compatible with existing power monitoring and control system of the facility. Test equipment shall be provided if new switchgear is of a different manufacturer than the previous switchgear.

- K. All electrical rooms containing switchgear rated over 1200 amps for new construction must have dual means of egress. One egress shall be onto the exterior ground and the other into a corridor.
- L. Floor mounted switchgear shall be mounted on 100mm (4 in) high equipment pads. Equipment pads shall be at least 100mm larger than the equipment on all sides.
- M. Contractor shall provide full functional test sets for protective relays and for breakers testing on any electrical distribution.

262313 Paralleling Low-Voltage Switchgear

- A. Provide a minimum of two spares and two prepared spaces in all new switchgear. Provide spare breakers, one for each frame size.
- B. Locate gutter on the bottom of the switchgear.
- C. Switchgear shall have draw out breakers with adjustable breaker settings. Breaker settings shall be adjusted in accordance with the short circuit and coordination study required by the SI AE Special Conditions.
- D. As part of the construction documents, provide switchgear elevations showing all dimensions on construction documents. Provide enlarged electrical room plans illustrating all physical dimensions of electrical equipment.
- E. Third party testing of switchgear is required if there are in field modifications.
- F. For renovations, new equipment must be compatible with existing power monitoring and control system of the facility.
- G. Floor mounted switchgear shall be mounted on 100mm (4 in) high equipment pads. Equipment pads shall be at least 100mm larger than the equipment on all sides.

262413 Switchboards

- A. The switchboards shall be a complete, metal enclosed, factory assembled, tested and shipped ready for installation including main and tie breakers, metering and power distribution section of required short circuit rating and ampacity.
- B. Indicate available fault current at each bus on the switchboard one-line diagram. Indicate settings of adjustable breakers on the one-line diagram.
- C. Provide main circuit breaker for each service entrance section. Provide ground fault protection on service entrance feeders.
- D. Provide appropriate warning labels indicating flash hazard boundary, hazard risk category and PPE level required to service the equipment.
- E. Breakers in switchboards shall be bolt on type.

- F. Third party testing of switchboard is required if there are in field modifications.
- G. Provide gutter on bottom of the switchboard.
- H. Provide a minimum of two spares and two prepared spaces in all new switchboards. Provide spare breakers, one for each frame size.
- I. Provide switchboard elevations showing all dimensions on construction documents. Provide enlarged electrical room plans illustrating all physical dimensions of electrical equipment.
- J. Switchboards shall be mounted on 100mm (4 in) high equipment pads. Equipment pads shall be at least 100mm larger than the equipment on all sides.
- K. Cascade type transient voltage surge suppression (TVSS) devices shall be installed in switchboards serving computer or laboratory equipment. Oversized neutral conductors shall be provided for feeders supplying laboratory receptacle panelboards and computer receptacle panelboards.

262416 Panelboards

- A. Bussing in every panel shall be copper and shall extend the full length of the panel. Circuit breakers shall be current limiting molded case type. Provide a minimum 25% spare capacity in panel (6 prepared spaces, 4 prepared spares, feeder ampacity to include an additional 25% capacity). Coordinate with SI representative if 25% spare is not achieved.
- B. Provide enclosure with door in door construction with a hinged cover. Panelboard shall have tool less entry for easy maintenance. Panels shall have a maximum of 42 poles.
- C. Panelboards shall be mounted such that the top of the panel enclosure is 2m above finished floor.
- D. Panelboards shall have typed directories indicating location and load type. Provide Arc Flash labels.
- E. Indicate homeruns for all circuits on the drawings.
- F. For renovations where existing loads are removed and new loads added to the panelboards, provide updated typed directories, load calculations indicating availability of power capacity at the panel.
- G. Panelboards that are not within sight of the circuit breaker serving the respective feeder shall be provided with main circuit breakers.
- H. Panelboards shall be fully rated for the fault current available. Series rated panelboards shall not be used.
- I. Laboratory panelboards shall be rated for 100 amperes minimum and shall be provided with main circuit breakers.

- J. Twenty ampere branch circuits for lighting and receptacles shall be limited to twelve amperes of load to allow for future additions of load.
 - 1. Each 120 volt lighting branch circuit will be limited to 1600 VA of load.
 - 2. Each 277 volt lighting branch circuit shall be limited to 3600 VA of load.
- K. Cascade type transient voltage surge suppression (TVSS) devices shall be installed in panelboards serving computer or laboratory equipment. Oversized neutral conductors shall be provided for feeders supplying laboratory receptacle panelboards and computer receptacle panelboards.

262419 Motor-Control Centers

- A. Motor control centers shall be Class I, Type B as a minimum.
- B. Motor control centers shall have tinned copper main bus and tinned copper vertical buses in each section.
- C. Enclosures shall be full height barrier to isolate the vertical bus from the starters. Each starter shall be provided with an engraved nameplate identifying load served.
- D. Cable lugs or busduct terminals shall be provided as required. The main bus shall be adequately sized to match feeder size.
- E. Individual 120V control transformers with fused primary shall be supplied for each starter shown. A ground bus shall be provided for the full length of each MCC.
- F. Each MCC shall have a minimum of one spare section for full height of MCC to house automatic temperature control relays, fire alarm shut down relays, smoke evacuation wiring terminals and accessories. The spare sections shall be fitted with a suitable stiffened hinged access door for full height of section.

262500 Enclosed Bus Assemblies

- A. Install busduct in accessible areas. Coordinate routing of busduct with SI representative. Busduct shall have copper bus with 100% ground.

262600 Power Distribution Units

- A. Provide power distribution units for large data centers and telecommunication rooms with data racks.
- B. Where applicable provide in-row PDU with the data racks.
- C. If floor mounted cabinet power distribution units are provided, the cabinet shall be front accessible with top or bottom cable entry.
- D. PDU's shall have provisions for dual feed electrical service.

- E. Each PDU shall have 200% rated neutral bus.

262713 Electricity Metering

- A. Provide electric meters at panels that provide power to equipment that serves Smithsonian Business Ventures activities or other for profit exhibits. Meters shall record KW/hrs.

262726 Wiring Devices

- A. Wiring devices shall be specification grade unless otherwise noted.
- B. Coordinate color of faceplate with exhibit and or interior design of the space. Provide labels on faceplates indicating circuit.
- C. General purpose receptacles shall be 20A 120V, 2-wire, grounding, NEMA 5-20R. Coordinate NEMA ratings of receptacles larger than 20 amps with individual equipment being connected. Locate general purpose receptacles at 6' on center along walls.
- D. Receptacles on normal power shall be white.
- E. Receptacles on emergency power shall be red.
- F. Isolated ground receptacles shall be orange.
- G. A maximum of six duplex general-purpose receptacles shall be connected to a 20 ampere, 120 volt branch circuit.
- H. Confirm with SI representative for the use of surface mounted raceway

262xxx - Motor Controls and Disconnects

262813 Fuses

- A. Unless otherwise indicated utilize fast acting type fuses.
- B. Use of fuses is limited to enclosed switches and controllers. Fuses shall not be used for feeder and branch circuit over current protection within panelboards, switchboards or switchgear.
- C. Coordinate fuse selection for elevator controllers with Div 14 Conveying Systems.

262816 Enclosed Switches and Circuit Breakers

- A. Circuit breaker switches shall be current limiting molded case circuit breakers.
- B. Fuse type enclosed switches shall be fast acting type unless otherwise noted.
 - 1. Fuses shall be cartridge type.

- C. NEMA rating of enclosures for outdoor use shall be NEMA 3R.

262913 Enclosed Controllers

- A. Coordinate selection of motor controllers with motor provided for compatibility.
- B. Controllers shall have integral disconnecting means.
- C. NEMA rating of enclosure for outdoor use shall be NEMA 3R.

262923 Variable- Frequency Controllers

- A. Coordinate selection of VFD's with mechanical engineers.
- B. Variable frequency drives (VFD) shall be provided for all motors that require adjustable speed operation.
- C. Any motor controlled by Variable Frequency Driver (VFD) requires bearing protection to prevent damage from harmful shaft currents.

263xxx - Emergency and Standby Systems

263213 Engine Generators

- A. Generators shall not be located on the roofs of existing or new construction buildings.
- B. Where diesel generators are used, specify ultra low sulfur content fuel.
- C. If natural gas is available on site and it is a reliable source (as determined by appropriate SI representative), natural gas generator may provide for emergency (Life Safety).
- D. Coordinate with Homeland Security Shelter - In - Place emergency generator run time requirements.
- E. Refer to Smithsonian Institution Security Design Criteria for additional requirements for emergency generators.
- F. Provide permanent load bank to test at 100% of load.
- G. As a minimum, the following loads shall be placed on emergency power:
 - 1. Life safety loads to include elevators
 - 2. Sump pumps
 - 3. Head end communication systems
 - 4. Security systems

5. Telephones in electrical rooms
 6. Coordinate with local building representative from SI for any additional user requested emergency loads.
- H. Provide exterior connection for portable generator.
- I. Provide double ended emergency switchboard/switchgear to allow for connection to both stationary emergency generator and portable generator. Incoming sections shall have kirk-key interlock to prevent simultaneous use.
- J. Confirm the noise level requirement of the generator with the local SI representative.

263323 Central Battery Equipment

- A. Do not use valve-regulated lead acid batteries. Provide sealed batteries for UPS systems.

263353 Static Uninterruptible Power Supply

- A. Provide uninterruptible power supply for telecommunication racks and related equipment. Coordinate with SI representative for other load types.

263600 Transfer Switches

- A. All automatic transfer switches shall be four-pole.
- B. Provide automatic transfer switches with maintenance by-pass to allow for maintenance and repair without the requiring shutdown of associated system.
- C. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics.
1. Fully automatic make-before-break operation.
 2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
 3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
 - a. Initiation occurs without active control of generator.
 - b. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
 4. Failure of power source serving load initiates automatic break-before-make transfer.

264xxx - Lightning Protection, Cathodic Protection, TVSS

264113 Lightning Protection System

- A. Perform a lightning risk assessment and provide a lightning protection system in accordance with NFPA 780 and inspected, and certified Master Label per UL 96.
- B. Coordinate placement of air terminals and down conductors to minimize visibility.

264200 Cathodic Protection

- A. Provide cathodic protection for metal conduits that are direct buried in earth.

264313 Transient Voltage Suppression for Low-Voltage Electrical Power Circuits

- A. Provide transient voltage surge suppression on service entrance switchgear. It is not required at distribution panels and branch circuit panels.
- B. Provide surge suppression for distribution panels serving computer / communication centers.

265xxx - Interior Lighting Systems

265100 Interior Lighting

- A. Non-Public Spaces
 - 1. Lighting for non-public areas shall include emergency egress lighting and house lighting. Light levels for emergency egress and house lights should provide sufficient illumination for security cameras with a minimum illumination level of 1 ft-candle average from emergency lighting. Coordinate with camera manufacturer for minimum light level requirements. Provide point by point lighting calculations for non-public areas at the floor levels for emergency egress lighting.
 - 2. Lighting power densities in offices, storage areas, laboratories, shops, utility spaces shall be less than or equal to the design requirements as defined by ASHRAE 90.1.
 - 3. Utilize energy efficient T8 or T5 fluorescent lamps with energy efficient electronic ballasts. T10 and T12 lamps are not permitted.
 - 4. Limit lamp types to no more than five, three of which should be in bench stock.
 - 5. Lamps shall be TCLP compliant.
 - 6. Lamps for collections areas shall be provided with UV filters.
 - 7. Exit signs shall be LED type and connected to an emergency panel. Unless otherwise noted, battery powered exit signs are not allowed.
 - 8. Provide wire guards for fixtures located in mechanical and electrical rooms.

9. All lights in transformer vaults, switchgear rooms, electrical closets/rooms, generator rooms shall be connected to emergency power.
10. Provide overhead fluorescent type fixtures as emergency lights with minimum 1 ft-candle at the floor surface.

B. Public Spaces

1. Lighting for exhibit areas shall include emergency egress lighting and house lighting. Light levels for emergency egress and house lights should provide sufficient illumination for security cameras with a minimum illumination level of 1 ft-candle average from emergency lighting. Coordinate with camera manufacturer for minimum light level requirements. Provide point by point lighting calculations for exhibit areas at the floor levels for emergency egress lighting.
2. Emergency egress lighting in exhibit areas shall be normally off. Provide emergency override relays for emergency lighting to turn on upon loss of normal power. Provide overhead fluorescent type fixtures as emergency lights with minimum 1 ft-candle at the floor surface.
3. For renovation projects coordinate with SI representative for available power capacity prior to design.
4. Utilize energy efficient lighting to the greatest extent possible. Coordinate lamp types with SI Exhibit Designers during the design.
5. Exit signs shall be LED type. Unless otherwise noted, battery powered and tritium exit signs are not allowed.
6. Lighting track
 - a. Lighting track shall have separate neutrals for each phase conductor.
 - b. All lighting track shall be two circuit track unless otherwise indicated by SI exhibit designers.
 - c. Track lighting fixtures
 - i. Shall accept a minimum of two accessories; including but not limited to ultra-violet lenses, light reduction screens, and spread lenses.
 - ii. Shall contain glare reducing snoots and louvers to maintain a 45-degree cutoff from the viewer's perspective.
7. Lenses and filters
 - a. Lens manufacturers shall publish optically measured transmission rate for glass. Lenses shall be optically clear unless otherwise indicated.

- b. UV lenses shall be included on all lighting fixtures illuminating displays and artifact storage areas for lighting sources including but not limited to: Metal Halide, HID and Fluorescent. A&E shall contact the appropriate SI personnel to determine the necessity of installing filters on Halogen, Incandescent and LED luminaries.
- c. Samples shall be provided for lighting fixtures and lighting track that include but are not limited to:
 - i. Lighting track with associated lighting track hardware
 - ii. Lighting fixtures
 - iii. All lighting accessories such as lenses and louvers.

265561 Theatrical Lighting

- A. Section not applicable

265xxx - Exterior Lighting Systems

265600 Exterior Lighting

- A. As a minimum provide exterior lighting power densities in accordance with ASHRAE 90.1. Coordinate selection of fixtures with local SI representative and any local jurisdiction requirements for aesthetics.
- B. Exterior lighting shall include the path to exit discharge for life safety and shall be on an emergency circuit.

265668 Exterior Athletic Lighting

- A. Follow IESNA recommendations for foot-candle levels and coordinate with SI representative for fixture aesthetics.

Division 31 – Earthwork

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design. For projects located in the metropolitan Washington DC area, the following is a partial listing of local jurisdictional requirements. The A/E shall be responsible to determine all local jurisdictional requirements which are applicable to the project.

1.01 Local Jurisdiction Requirements

- A. A/E shall be responsible for the coordination with local utility authorities.
 - 1. For projects in Washington DC that includes, but is not limited to: Washington Gas, DC Water, PEPCO, WMATA, Miss Utility, District of Columbia Department of Transportation, GSA (steam tunnels). Projects on the National Mall must also take into consideration adjacent property owners and stakeholders, i.e. Secret Service, Department of Homeland Security, NPS, etc.
- B. The A/E shall be responsible for identifying and obtaining all required design approvals and permits from Federal, State, and local jurisdictions having authority over the project site.
 - 1. For projects in Washington DC that includes, but is not limited to: Erosion and Sediment Control and Stormwater Management approval (DC Department of Health), Public Space Permit (DC Department of Transportation), and Building Permit (DC Department of Consumer and Regulatory Affairs).
- C. Local agency design criteria should be used to the extent possible.
 - 1. For projects in Washington DC that includes, but is not limited to: District of Columbia Department of Transportation Standard Specifications for Highways and Structures, National Park Service (NPS) Streetscape Manual- Interagency Initiative for National Mall Road Improvement Program, National Capital Planning Commission Requirements, and District of Columbia Historic Preservation Office Requirements, U.S. Commission of Fine Arts.

1.02 Smithsonian Requirements

- A. Comply with SI Security Design Criteria.

II. Design Requirements

- 2.01 Existing natural features such as trees, slopes, and drainage characteristics should be preserved and protected, whenever possible.
- A. Identify, assess, and protect existing vegetation of aesthetic, historic, and ecological value. Preserve existing onsite vegetation and its storm water management, air quality, and microclimate benefits.
 - B. Minimize soil disturbance whenever possible to preserve and protect soil resources from damage by limiting the area of site disturbance, controlling erosion and compaction during construction. This is a critical step to preserving soil structure, and maintaining infiltration and groundwater recharge.
 - C. A/E must coordinate with the Smithsonian Institution arborist to verify areas and methods for tree protection to be used for all trees within the limit of disturbance.
 - D. Earthwork cut and fill quantities should be balanced to the extent possible.
 - E. For excavation work near existing trees and plants to be preserved use of pneumatic equipment is recommended.
- 2.02 All grades adjacent to buildings shall maintain a positive slope to allow for drainage away from the structure.
- 2.03 The extent of the existing irrigation system shall be investigated and clearly identified on the plans. The plans shall clearly indicate that the existing irrigation system shall be protected at all times during site clearing and earthwork operations and that any damage to the existing irrigation system as a result of the site clearing and earthwork operations shall be repaired at the contractor's expense.
- 2.04 Coordinate earthwork specifications with specific soil placement, settlement and compaction requirements specified in Division 32 for planting soil and landscaping work.

III. Specifications

311xxx – Site Clearing

311300 Selective Tree and Shrub Removal and Trimming

- A. All tree removal requires prior approval by Smithsonian project manager.
- B. Tree removal shall meet local standards.

311400 Earth Stripping and Stockpiling

- A. All suitable topsoil shall be stockpiled.

- B. Excavated material shall be stored within the limits of disturbance.
- C. Smithsonian Gardens integrates an effective green waste management strategy into its daily operations by properly treating and disposing of all its biodegradable wastes rather than sending them to a landfill.
 - 1. Strip and stockpile in areas where compaction or disturbance will occur or is anticipated.
 - 2. Separate topsoil horizons O and A from sub soil horizon B.
 - 3. Segregate topsoil types.
 - 4. The optimal size of stockpiles is 6 feet maximum height for sandy soils, and 4 feet maximum height for clay loam soils to minimize crush loading. The larger the piles and the longer the storage time, the longer it will take to reactivate the soil biology properties.
 - 5. Do not cover topsoil stockpiles with impervious materials. Doing so will reduce air penetration and increase soil temperature, killing critical biological organisms within the soil. However, erosion and sedimentation control procedures shall be implemented.
 - 6. The soil types need to be selected to meet the specific needs they are intended to support. To ensure a successful, sustainable project, match soil characteristics/type with planting and stormwater management goals and anticipated levels of use and compaction.
 - 7. Test topsoil after stockpiling to determine the type and amount of amendments needed to reactivate biological properties and handle drainage needs.
 - a. Consider the use of compost as an amendment since it is often the most effective way to rebuild structure, improve drainage and biological activity without overloading nutrient content or increasing salinity levels as may happen with inorganic fertilizer amendments.
 - b. Adjust soil pH and fertility as indicated by testing.

31 2xxx – Earth Moving

312300 Excavation and Fill

- A. The design and preparation of the subgrade should be considered in coordination with the soil placement plan, planting and stormwater objectives.
- B. Below planting bed and lawn areas, subgrades should be prepared in a manner that supports healthy rooting conditions. Specify performance requirements for compaction and infiltration rates and provide frequency of testing to ensure contractor compliance with the requirements.
 - 1. Provide subsurface drainage in planting areas where subsurface conditions do not provide sufficient infiltration.

- C. In areas where green infrastructure Best Management Practices (BMPs) are designed to promote infiltration, specify performance requirements for compaction and infiltration rates and provide frequency of testing to ensure contractor compliance with the requirements.
 - 1. In the design process provide specific site investigation testing including borings and infiltration tests in proposed infiltration BMP locations to ensure the viability with design intent.

Division 32 – Exterior Improvements

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design.

- 1.01 These design standards shall be used in conjunction with and cross-checked with the current existing SI OPS standards, OSHM standards, OCIO standards, historic preservation policy standards, and accessibility standards. Refer to the Smithsonian Institution, Office of Facilities Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a complete list of codes, standards and guidelines. This list is available on the OFEO web site (www.ofeo.si.edu).
- 1.02 All projects on the National Mall shall incorporate approved precinct studies/criteria developed by/for the Smithsonian Institution into building and site design. Any future projects that do not follow approved precinct studies/criteria may require approval and NEPA/Section 106.
 - A. These include, but are not limited to: Site Security – Smithsonian Institution Security Design Criteria, Smithsonian Institution Exterior Signage Master Plan, Smithsonian Institution Water Reclamation Study, Mall Streetscape Manual, Monumental Core Framework Plan, Smithsonian Institution Master Plans, and Smithsonian Mall-Wide Perimeter Security Master Plan.
 - B. Projects on the National Mall require coordination with NPS and District of Columbia to verify “ownership” of the sidewalks.
- 1.03 Local Jurisdiction Requirements
 - A. A/E shall be responsible for the coordination with local utility authorities.
 1. For projects in Washington DC that includes, but is not limited to: Washington Gas, DC Water, PEPCO, WMATA, Miss Utility, District of Columbia Department of Transportation, GSA (steam tunnels). Projects on the National Mall must also take into consideration adjacent property owners and stakeholders, i.e. Secret Service, Department of Homeland Security, NPS, etc.
 - B. The A/E shall be responsible for identifying and obtaining all required design approvals and permits from Federal, State, and local jurisdictions having authority over the project site.
 1. For projects in Washington DC that includes, but is not limited to: Erosion and Sediment Control and Stormwater Management approval (DC Department of Health), Public Space Permit (DC Department of Transportation), and Building Permit (DC Department of Consumer and Regulatory Affairs).
 - C. Local agency design criteria should be used to the extent possible.

1. For projects in Washington DC that includes, but is not limited to: District of Columbia Department of Transportation Standard Specifications for Highways and Structures, National Park Service (NPS) Streetscape Manual- Interagency Initiative for National Mall Road Improvement Program, National Capital Planning Commission Requirements, and District of Columbia Historic Preservation Office Requirements, U.S. Commission of Fine Arts.
- 1.04 All projects must provide adequate accommodation for emergency access for fire, ambulance, police and service vehicles; including access for policing the building perimeter and pedestrian paths.

II. Design Requirements

- 2.01 This document is not intended to cover outdoor exhibits or collection gardens, nor is it intended to cover interior plants.
- 2.02 Early collaboration between maintenance and design teams allows for thoughtful decision making that increases the probability that projects will be maintained properly and that operational knowledge will be incorporated into the design and that maintenance personnel will be more vested in the project.
- A. The project will be designed to survive for a life span established by the Smithsonian project manager.
 - B. It is recommended to request a 35% submission review by OFMR, which includes building maintenance and Smithsonian Gardens.
 - C. Pedestrian paving must be sized to receive service vehicle and emergency vehicle loads, for example; snowplowing, façade maintenance lifts.
 - D. Plazas and entrances shall have adequate power and water supplies for ease of maintenance and versatility of use of space for both daily and event uses.
 - E. Planting locations shall accommodate cleaning and maintenance activities, which may include the need for lifts to access façade.
 - F. To decrease the possibility of waterproofing issues, the use of raised planters requiring waterproofing attached to or above buildings is not recommended and requires approval of Smithsonian project manager.
- 2.03 Soil characteristics play a major role in the health of vegetation and in water management. It is essential to determine soil conditions early in the design process and is critical to achieving a high performance landscape.
- A. Soils must be accurately assessed to gain a thorough understanding of soil quality, contamination, percolation, and bearing capacity. This analysis should determine protection efforts, drainage rates, and amendment requirements. The amount of soil testing needed is based less on site size than site complexity. Utilize visual inspection, site history and context,

and interviews to determine amount and type of testing needs.

- B. If soil testing reveals that the existing soils are not healthy or if there is limited space for storing, it is recommended that existing soils be removed and replaced with new soils with characteristics that match the intended planting, stormwater management goals, and anticipated levels of use and compaction.
 - C. If soil testing determines that the existing soils are healthy and there is sufficient room for storing soils on-site, consult with the design manager to determine if soil preservation is recommended and if a Soil Management Plan should be created to outline the soil preservation process to take place on-site. This plan should delineate the limit of disturbance, ensure soil restoration/rejuvenation, define the boundaries of vegetation and soil protection zones, and define soil preservation locations.
 - D. Test soil after stockpiling to determine the type and amount of amendments needed to reactivate biological properties and handle drainage needs. Consider the use of compost as an amendment since it is often the most effective way to rebuild structure, improve drainage and biological activity without overloading nutrient content or increasing salinity levels as may happen with inorganic fertilizer amendments. Adjust soil pH and fertility as indicated by testing.
 - E. Consider the use of engineered soils when naturally-occurring soils are not well-suited to the programmatic use or are unable to withstand urban stresses and conditions.
 - F. Coordinate soil and subsoil requirements with Division 31 Earthwork requirements to ensure proper handling, placement, settlement and performance testing during construction.
- 2.04 Provide adequate soil volumes and depths to allow trees, shrubs, and plants to achieve mature size. Soil depths should be as deep as practical to allow trees, shrubs, and plants to achieve mature size. However, factors such as, soil type, plant selection, maintenance expectations, exposure, underdrainage requirements and available irrigation will determine the appropriate soil depth required. Smithsonian Gardens recommend the following depths:

Lawns = 300 mm (12") of topsoil

Shrubs and perennials = 450 mm (18")

Trees = depth of rootball, but no less than 760 mm (30") where possible

- A. The following are the minimum soil volumes for viable planting/root of trees:

Shade trees = 28 cubic meter (1000 cubic feet)

Ornamental trees = 11 cubic meter (400 cubic feet)

- B. Increase soil volumes when using sand-based or stone-based structural soils to compensate for depleted soil resources within the structural soil matrix.
- C. Street tree health can be enhanced by increasing soil volumes under paving. When possible use linear trenches or root paths to allow connections between soils volumes/pits. Utilize suspended pavement systems or structural soil systems to provide viable horticultural performance of soils below pavement areas. Utilize root paths to link isolated soil volumes to existing on-site soil resources.

- 2.05 Promote plant survival through plant selection and placement. Consider associating plant needs with water sources, soil types, level of care. Plants that are not adapted to the local environment require more inputs than well-suited selections.
- A. New plant material shall be non-invasive and appropriate for site conditions, climate, and design intent, preferably a native or adapted non-invasive species, obtained locally. When possible, Smithsonian Gardens recommends acquiring plants from nurseries north of the metro area to help ease the acclimation period. Plants not adapted to the local environment require more input than well-suited selections.
 - B. Recognize that landscapes are based on growth and change over time. Establish goals for periods of time; 5 years, 10 years, 25 years, and 100 years. Develop long-term management plans that require monitoring over time and anticipate changes to the plan, but plant for current conditions.
 - C. Recommended planting schedule
 1. Spring, March 1 through May 15
 2. Fall, September 15 through December 1
 - D. Plant selections for projects on the National Mall and National Zoo require coordination with Smithsonian staff.
 1. For projects on The National Mall, plant selections are to be coordinated with Smithsonian Gardens and plantings are required to be located in GPS to meet the American Association of Museum standards.
 2. For projects at the National Zoo, plant selections are to be coordinated with the Horticulture Division at the National Zoo.
 - E. Develop and implement a plan for the control and management of known existing invasive plants to limit damage to local ecosystems - before, during and after construction.
 - F. Develop plan for tree and vegetation removal and transplantation.
 1. Tree removal requires approval by Smithsonian Gardens.
 2. Tree removals to be undertaken by a certified arborist.
 3. Plant material removed for re-use shall be balled, bagged, and protected in accordance with instructions prepared by Smithsonian Gardens.
 - G. Avoid utility conflicts. Plan and coordinate utility locations and installation with proposed planting and soil designs to avoid long-term maintenance conflicts. Since utility improvements often significantly precede planting operations during construction, provide utility corridor location plans with coordinate or other layout controls within contract documents to ensure contractor compliance with indicated utility locations to prevent conflicts.
 - H. Reduce turfgrass wherever feasible, specifically in tree boxes and areas directly under trees. Use ground cover in lieu of grass to reduce water consumption, and minimize the need for

pesticides and fertilizers. This significantly reduces chemical and nutrient loading of groundwater and surface water. Eliminates the need for regular mowing and reduces maintenance cost, energy consumption, and air and noise pollution.

- 2.06 Exterior materials and finishes and furnishings shall be coordinated with local jurisdiction requirements, Smithsonian Institution Standards, with consideration of matching existing materials on site and within the context of the project.
- A. Paving and metalwork, such as railings and guards, shall be specified to match, or designed to match, the existing metalwork materials, finishes and treatments. Expectations must be approved by Smithsonian Institution project manager.
 - B. Hardscape and structure materials shall be of local, natural materials wherever possible. Consider use of recycled materials such as glass, rubber, or crushed concrete for base courses and aggregates when possible, especially when recycled from on-site materials.
 - C. Special elements and landscape features and structures shall be designed in accordance with any historic or preservation standards or expectations when appropriate and applicable.
- 2.07 Attention to microclimate and human comfort zone shall be an integral part of any design.
- 2.08 Security considerations should be integral to all site planning and landscape design. Crime prevention through environmental design techniques shall be used to help prevent and mitigate crime.
- A. The project shall be designed to ensure safety and security for perimeter and vehicular and pedestrian circulation areas.
 - B. Planting design and location must ensure unobstructed views for security personnel or CCTV surveillance and, that over time, plant materials will not become hiding places for assailants.
 - C. A/E must closely coordinate with the Smithsonian project manager early in the design process to determine that the security requirements for the site are met.
 - D. Site perimeter barriers, such as planters, low walls, water features, trees, or hardened street furniture shall be integrated with surroundings and incorporated into overall design to be as inconspicuous as possible.
 - E. Bollards may be acceptable when integrated into the building or landscape design.
- 2.09 Translation of interior exhibits into the programming and design of the landscape is encouraged where applicable and appropriate.
- 2.10 Coordinate hardscape and planting areas with subsurface utility and infrastructure design.
- A. Utility manholes must be traffic-rated with anti-slip, ADA compliant grates/lids.
 - B. Use of coordinated utility corridors to reduce site disturbance and planting conflicts is recommended.

- 2.11 Please refer to the following Divisions for further information.
- A. Refer to General Requirements Division.
 - B. Refer to Division 02- Existing Conditions.
 - C. Refer to Division 05- Metals section Metal Fabrications for railings and guards requirements.
 - D. Refer to Division 07- Thermal and Moisture Protection for green roof requirements.
 - E. Refer to Division 10- Specialties for site signage and flagpole requirements.
 - F. Refer to Division 12- Furnishings for site furnishings requirements.
 - G. Refer to Division 22- Plumbing for drinking fountain requirements and irrigation related requirements.
 - H. Refer to Division 26- Electrical for site lighting requirements.
 - I. Refer to Division 31- Earthwork.
 - J. Refer to Division 33- Utilities.
 - K. Refer to Smithsonian Institution Gardens standard technical specification sections.

III. Specifications

321000 - Bases, Ballasts, and Paving

321113 Subgrade Modifications

- A. Subgrade modifications shall be designed in accordance with the recommendations of a licensed Geotechnical Engineer with knowledge of the local site conditions.

321116 Subbase Courses

- A. Subbase course material and installation shall be in accordance with the local Department of Transportation standards and requirements.

321123 Aggregate Base Courses

- A. Aggregate base course material and installation shall be in accordance with the local Department of Transportation standards and requirements.

321126 Asphaltic Base Courses

- A. Asphaltic base course material and installation shall be in accordance with the local Department of Transportation standards and requirements.

321129 Lime Treated Base Courses

- A. Lime treated base course material and installation shall be in accordance with the local Department of Transportation standards and requirements.

321133 Cement Treated Base Courses

- A. Cement treated base course material and installation shall be in accordance with the local Department of Transportation standards and requirements.

321136 Concrete Base Courses

- A. Concrete base course material and installation shall be in accordance with the local Department of Transportation standards and requirements.

321200- Flexible Paving**321213 Preparatory Coats**

- A. Preparatory tack and prime coats for flexible paving shall be in accordance with the local Department of Transportation standards and requirements.

321216 Asphalt Paving

- A. Asphalt paving mix designs and installation shall be in accordance with the local Department of Transportation standards and requirements.

321219 Asphalt Paving Wearing Courses

- A. Asphalt paving wearing course mix designs and installation shall be in accordance with the local Department of Transportation standards and requirements.

321233 Flexible Paving Surface Treatments

- A. Flexible paving surface treatments materials and installation shall be in accordance with the local Department of Transportation standards and requirements.

321236 Seal Coats

- A. Seal coat materials and installation shall be in accordance with the local Department of Transportation standards and requirements.

321243 Porous Flexible Paving

- A. Porous flexible paving mix designs and installation shall be in accordance with the local Department of Transportation standards and requirements.

1. Coordinate the use of porous flexible paving with designed base courses to encourage stormwater infiltration, storage and disposal.
 2. Verify subgrade conditions by testing to determine infiltration viability.
 3. If infiltration is proposed as part of the porous flexible paving systems, specify type and frequency of performance testing to ensure contractor compliance. Coordinate requirements with Division 31 Earthwork.
 4. Design porous flexible paving systems in accordance with the recommendations of the National Asphalt Pavement Association's Porous Asphalt Pavement for Stormwater Management (latest edition) for the specification of pavers, base courses, installation, and maintenance .
- B. If porous pavement is to be used as a Low Impact Development (LID) measure, regular maintenance (sweeping/vacuuming) of the pavement will be critical to ensure the pavement maintains its porosity. If regular maintenance cannot be assured, other LID measures may be more appropriate.

321273 Asphalt Paving Joint Sealants

- A. Asphalt paving joint sealants and installation shall be in accordance with the local Department of Transportation standards and requirements.

321300 Rigid Paving

321313 Concrete Paving

- A. Concrete paving mix design and installation shall be in accordance with the local Department of Transportation standards and requirements.

321313 Exposed Aggregate Concrete Paving

- A. Aggregate to be supplied by a single approved gravel pit for duration of project. There shall be no shale in the aggregate mix.
- B. All sidewalk improvements or modifications on the National Mall to be coordinated with NPS, and the exposed aggregate concrete to match sample, which is currently located adjacent to National Gallery, for aggregate size and color.
- C. A mock-up to ensure match is required for all projects.

321343 Pervious Concrete Paving

- A. Pervious concrete paving mix designs and installation shall be in accordance with the local Department of Transportation standards and requirements.
1. Coordinate the use of pervious concrete paving with designed base courses to encourage stormwater infiltration, storage and disposal.

2. Verify subgrade conditions by testing to determine infiltration viability.
 3. If infiltration is proposed as part of the pervious concrete paving systems, specify type and frequency of performance testing to ensure contractor compliance. Coordinate requirements with Division 31 Earthwork.
 4. Design pervious concrete systems in accordance with the recommendations of the ACI 522.1 Specification for Pervious Concrete (latest edition) for the specification of concrete, installation, testing and quality control.
- B. If pervious concrete pavement is to be used as a Low Impact Development (LID) measure, regular maintenance (sweeping) of the pavement will be critical to ensure the pavement maintains its porosity. If regular maintenance cannot be assured, other LID measures may be more appropriate.

321373 Concrete Paving Joint Sealants

- A. Concrete paving joint sealants and installation shall be in accordance with the local Department of Transportation standards and requirements.
- B. Ensure that the type of joint sealant specified is appropriate for the expected use of the pavement. For example, fuel resistant joint sealants should be specified in areas subject to fuel spillage.

321400 Unit Paving

321440 Stone Paving

- A. Stone paving surfaces should be slip resistant, i.e. flamed finish.

321443 Porous Unit Paving

- A. Porous paving shall be of durable design with low-maintenance requirements
- B. Paving selection requires approval of Smithsonian project manager.
- C. Coordinate the use of pervious concrete paving with designed base courses to encourage stormwater infiltration, storage and disposal.
- D. Verify subgrade conditions by testing to determine infiltration viability.
- E. If infiltration is proposed as part of the pervious concrete paving systems, specify type and frequency of performance testing to ensure contractor compliance. Coordinate requirements with Division 31 Earthwork.
- F. Design porous paving systems in accordance with recommendations of the Interlocking Concrete Pavement Institute (ICPI) for the specification of pavers, base courses, installation, and maintenance.

321600 Curbs, Gutters, Sidewalks, and Driveways

321613 Curbs and Gutters

- A. Curb and gutter materials and installation shall be in accordance with the local Department of Transportation standards and requirements.

321633 Driveways

- A. Driveways shall be designed to accommodate the largest vehicles expected to utilize the facility.

321700 Paving Specialties

321723 Pavement Markings

- A. Pavement marking materials and installation shall be in accordance with the local Department of Transportation standards and requirements, and the latest edition of the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD).

321743 Pavement Snow Melting Systems

- A. Preference for use of magnesium chloride and corn-based, or other materials not toxic to plants, water life and animals, in lieu of mechanical systems.
- B. If 'mats' are used, systems to be sectionalized systems for continuous operation and ease of maintenance. Consider sleeving for replacement. Consider overall energy use, and maintenance access.

321800 Athletic and Recreational Surfacing

321816 Playground Protective Surfacing

- A. Playground surfacing shall be approved by Smithsonian project manager.

323100 Fences and Gates

323113 Chain Link Fences and Gates

- A. Chain-link must be of maintenance-free finishes, such as vinyl-coated or anodized finishes.

323119 Decorative Metal Fences and Gates

- A. Decorative metal must be of durable design with low maintenance requirements. Selection requires approval by Smithsonian project manager.

323200 Retaining Walls

- A. Retaining walls are to be of durable design with low-maintenance finish.
- B. All retaining walls must be approved by Smithsonian project manager.
- C. Perimeter walls and stair elements should be designed at a comfortable height and depth for seating.

323900 Manufactured Site Specialties

323913 Manufactured Metal Bollards

- A. Bollards shall have a maintenance-free finish.
- B. All operable Bollards must have positive drainage and/or underdrainage.

327000 Wetlands

327100 Constructed Wetlands

- A. Constructed wetlands shall be in accordance with all applicable Federal, State and local authorities having jurisdiction.

327200 Wetlands Restoration

- A. Wetlands restoration shall be in accordance with all applicable Federal, State and local authorities having jurisdiction.

328000 Irrigation

328400 Planting Irrigation

- A. Irrigation equipment to be Rain Bird MAXICOM2 or compatible in order to be consistent with existing centrally-controlled irrigation system that monitors flows and quantity of water use.
- B. Rain Bird Training and Certification is required for employees operating irrigation systems. Training and operational/maintenance manual required for new system commissioning.
- C. Irrigation plans to be designed by certified irrigation designer. Design-Build approach to irrigation design is not permitted.
- D. Irrigation design is to include full design including main line layout, controller locations, and head layout, and to be coordinated with other trades. It must connect to central control MAXICOM system, which requires coordination with Smithsonian Gardens.

Some portion of the water budget shall be apportioned for landscape maintenance, and the irrigation design will adhere to the approved water budget. The Smithsonian Institution's preference is for irrigation systems shall be fed from an alternate source of water, such as harvested rainwater, condensate or nuance groundwater whenever possible. However, if domestic water must be used for irrigation systems, it shall be metered separately.

- E. Irrigation systems are to be metered, separate from domestic water source, to monitor water use, per the recommendations in the Water Reclamation Study.
- F. Mainline piping to be schedule 40 PVC, minimum. Consider the use of HDPE piping instead of PVC, due to the recyclability, re-use, and toxicity. It is also stronger and less susceptible to freeze damage.
- G. Placement of trace wires during installation and repair of irrigation systems is required to facilitate detection of pipes later.
- H. Irrigation systems are to be considered a utility for any ground disturbing activities, and required on civil utility drawings.
- I. Irrigation systems are to be designed and sized to handle anticipated pressure and allow for expansion of area and flow rate.
- J. Typical irrigation system shall utilize computer-operated control system with weather station.
- K. All irrigation pipes must be sized to receive vehicular loads whether under walks or in planting beds.
- L. Exercise caution to avoid disturbance of existing plant materials and roots systems.

Depths of bury

Mainlines: 406 mm (16") to 508mm (20")

Laterals: 356 mm (14") to 406 mm (16")

Within planters: at base of soil fill

- O. Zone irrigation systems by planting types in order to reduce irrigation demand.

328413 Drip Irrigation

- A. Use of drip irrigation is limited due to pest problems on previous projects.
- B. Smithsonian Gardens approval is required.

329100 Planting Preparation**329113 Soil Preparation**

- A. Smithsonian Gardens through the COTR must approve the requirements for soil preparation.
- B. Imported soil to be ASTM D 5268, fertile, naturally sandy loam as defined by USDA Handbook no. 18, Figure 38.

329119 Landscape Grading and Compaction

- A. Compaction: Place soils such that the compaction is between 80% and 85% after settlement. Place soils in 8" maximum lifts and test at each lift to ensure compliance with compaction requirements.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, seeding or sodding, obtain Smithsonian project manager's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

329200 Turf and Grasses**329223 Seeding**

- A. Smithsonian Gardens approval is required to utilize seeding.

329223 Sodding

- A. Comply with recommendations of the Turfgrass Producer's International (TPI) "Guidelines Specifications for Turfgrass Sodding", (latest edition).
- B. Sod must be watered prior to installation and rolled after placement to ensure positive drainage and to avoid puddling.
- C. Sod to be certified sod, non-netted and a minimum of one year old. It shall be 90:10, consisting of minimum of three varieties tall fescues and one Kentucky Bluegrass. Smithsonian Gardens through the COTR must approve the source of the sod.
- D. All disturbed areas, not paved or planted, to be seeded to meet Smithsonian Institution Garden technical specification standards.
- E. Smithsonian Gardens must approve the source of the sod.
- F. For all projects on the National Mall sodding is required.

329223 Reinforced Turf

- A. Consider use of reinforced turf to be installed for infrequently used vehicular applications such as maintenance drives.
- B. Do not use reinforced turf in fire lanes.

329300 Plants**329313 Groundcovers**

- A. Groundcovers to be planted in even rows with triangular spacing, 18"o.c. max.

329313 Trees

- A. Shade Trees to be specified at 88 mm (3-1/2") caliper.
- B. Use of large tree plantings is not recommended. Planting of trees over 125 mm (5") in caliper requires approval of Smithsonian project manager.

329400 Planting Accessories**329413 Landscape Edging**

- A. Landscape edging to be metal. All others as approved by Smithsonian Project Manager.

329443 Tree Grates

- A. Tree grates to have frame and be split capable for center opening enlargement to accommodate tree growth.

329600 Transplanting**329633 Shrub Transplanting**

- A. Transplant and storage of trees is to be in accordance with Smithsonian Gardens specifications and requires Smithsonian Garden approval. An aerial irrigation and watering system is required during storage.

329643 Tree Transplanting

- A. Transplant and storage of trees is to be in accordance with Smithsonian Gardens specifications and requires Smithsonian Garden approval. An aerial irrigation and watering system is required during storage.

Division 33 – Utilities

I. Reference Codes, Standards and Guidelines

The following list contains the codes, standards and guidelines to which the text refers in this Division. The A/E is responsible for the research of all codes, standards and regulations, including federal, state and local, which are applicable to the project design. Refer to the Smithsonian Institution, Office of Facilities, Engineering and Operations, Codes, Standards and Guidelines, latest edition, for a list of codes, standards and guidelines. All design work shall comply with the requirements of the latest edition of codes and regulations in use at the time of the design. For projects located in the metropolitan Washington DC area, the following is a partial listing of local jurisdictional requirements. The A/E shall be responsible to determine all local jurisdictional requirements which are applicable to the project.

- 1.01 Local Jurisdictional Requirements- Water and Sewer Piping and Structures
 - A. District of Columbia Water and Sewer Authority (DCWASA) Requirements
 - B. Washington Suburban Sanitary Commission (WSSC) Requirements
- 1.02 Local Jurisdictional Requirements- Storm Drainage Piping and Structures
 - A. District of Columbia Department of Transportation Standard Specifications for Highways and Structures
 - B. Maryland Department of Transportation Standard Specifications for Construction and Materials
 - C. Virginia Department of Transportation Road and Bridge Specifications
- 1.03 Local Jurisdictional Requirements- Electric Utilities
 - A. PEPCO Requirements
 - B. Dominion Power Requirements
- 1.04 Smithsonian Sustainability Plans
- 1.05 Smithsonian Institution Mall-Wide Water Reclamation Initiatives, National Museum of Natural History- Final report.
- 1.06 Energy Independence and Security Act of 2007 (EISA 2007)
- 1.07 International Plumbing Code (IPC)- Latest edition
- 1.08 SI Security Design Criteria

II. Design Requirements

- 2.01 "Miss Utility" does not locate utility lines located within Smithsonian Institution properties. SI contracts with private utility locating companies for this service.
- 2.02 Irrigation systems are to be considered a utility for any ground disturbing activities and required to be indicated on Civil utility drawings.
- 2.03 Plazas and entrances shall have adequate power and water supplies for ease of maintenance and versatility of use of space for both daily and event uses.
- 2.04 Systems to be metered to monitor water use, per the recommendations in the Water Reclamation Study
- 2.05 Utility elements shall provide convenient access and be integrated with building and landscape design.
- 2.06 Create combined utility drawings as part of the design process to indicate utility locations for all engineering design and disciplines to identify realistic utility corridor locations, conflicts and construction impacts.
 - A. Coordinate combined utility drawings with proposed tree protection plans, soil preparation and placement plans and planting plans.
 - B. For projects with critical protection of existing trees or vegetation, provide utility corridor plans with coordinates or other surface layout controls to ensure protection of critical root zone areas.
 - 1. Cross coordinate utility corridor requirements with tree protection specifications.
 - 2. Consider the use of pneumatic soil excavation in areas of close proximity to critical rootzones as a way of mitigating damage.

III. Specifications**330xxx– Operation and Maintenance of Utilities****330100 Operation and Maintenance of Water Utilities**

- A. Operation and maintenance of site water utilities shall be in accordance with the local water authority having jurisdiction over the project site.

330110 Operation and Maintenance of Sewer Utilities

- A. Operation and maintenance of site sewer utilities shall be in accordance with the local sewer authority having jurisdiction over the project site.

330110 Operation and Maintenance of Electrical Utilities

- A. Operation and maintenance of site electrical utilities shall be in accordance with the local electrical company having jurisdiction over the project site.

330110 Operation and Maintenance of Communications Utilities

- A. Operation and maintenance of site telecommunication utilities shall be in accordance with the local telecommunications company having jurisdiction over the project site.

330xxx- Common Work Results for Utilities**330513 Manholes and Structures**

- A. Manholes and structures shall meet the requirements of the local agencies (Water/Sewer authority, Department of Transportation, etc.) having jurisdiction over the project site.
- B. Manholes and structures located within areas subject to vehicular traffic shall be designed to withstand the loading from the heaviest vehicle expected to impact that structure. At a minimum, the design shall meet AASHTO HS-20 loading.
- C. Manholes and structures located in areas not normally subject to vehicular traffic but which could be impacted by occasional maintenance vehicles shall be designed to meet AASHTO HS-20 loading.

330516 Utility Structures

- A. Utility structures shall meet the requirements of the local agencies (Water/Sewer authority, Department of Transportation, Electric Utility Company, etc.) having jurisdiction over the project site.
- B. Utility structures located within areas subject to vehicular traffic shall be designed to withstand the loading from the heaviest vehicle expected to impact that structure. At a minimum, the design shall meet AASHTO HS-20 loading.
- C. Utility structures located in areas not normally subject to vehicular traffic but which could be impacted by occasional maintenance vehicles shall be designed to meet AASHTO HS-20 loading.

330526 Utility Identification

- A. Detectable warning tape or trace wire shall be installed above all below grade utilities.

330900– Instrumentation and Control for Utilities

- A. Instrumentation and controls for utilities shall meet the requirements of the local utility companies having jurisdiction over the project site.

331000– Water Utilities**331100 Water Utility Distribution Piping**

- A. Water utility distribution piping shall meet the requirements of the local Water Authority, Health Department and the local Fire Marshal office having jurisdiction over the project site.
- B. Water supply for fire protection shall meet the requirements of Chapter 4 of the SI Office of Safety, Health and Environmental Management (OSHEM) Fire Protection and Life Safety Design Manual. Specifically, private service mains shall conform to NFPA 24, private distribution mains must be no smaller than 12 inches in diameter, and building/facility water distribution loops must be 8 inches in diameter or larger.

331200 Water Utility Distribution Equipment

- A. Water utility distribution equipment shall meet the requirements of the local water authority and the local fire marshal office having jurisdiction over the project site.

331300 Water Utility Distribution Piping

- A. Disinfection of water utility distribution piping shall meet the requirements of the local Water Authority, Health Department and the local Fire Marshal office having jurisdiction over the project site.

332000– Wells**332400 Monitoring Wells**

- A. Existing groundwater monitoring wells which are impacted as a result of construction activities shall be reset, relocated or abandoned in accordance with the Federal, State or local jurisdiction having authority.

333000– Sanitary Sewerage Utilities**333100 Sanitary Utility Sewerage Piping**

- A. Sanitary utility sewerage piping shall meet the requirements of the local sewer authority having jurisdiction over the project site.

333300 Low Pressure Utility Sewerage

- A. Low pressure utility sewerage shall meet the requirements of the local sewer authority having jurisdiction over the project site.

333400 Sanitary Utility Sewerage Force Mains

- A. Sanitary utility sewerage force mains shall meet the requirements of the local sewer authority having jurisdiction over the project site.

333900 Sanitary Utility Sewerage Structures

- A. Sanitary utility sewerage structures shall meet the requirements of the local sewer authority having jurisdiction over the project site.

334000– Storm Drainage Utilities**334100 Storm Drainage Utility Piping**

- A. Storm drainage utility piping shall meet the requirements of the local Department of Transportation or other authority having jurisdiction over the project site.

334200 Culverts

- A. Culverts shall meet the requirements of the local Department of Transportation having authority over the project site.

334400 Storm Utility Water Drains

- A. Storm drains shall meet the requirements of the local Department of Transportation having authority over the project site.

334700 Ponds and Reservoirs

- A. Stormwater management ponds shall be designed and constructed in accordance with the local authority having jurisdiction over the project site.

334900 Storm Drainage Structures

- A. Storm drainage structures shall meet the requirements of the local Department of Transportation or other authority having jurisdiction over the project site.

Appendix

Smithsonian Institution
Facilities Design Standards

Appendix A

Smithsonian Sustainability Requirements Related to Design and Construction

SMITHSONIAN SUSTAINABILITY REQUIREMENTS RELATED TO DESIGN AND CONSTRUCTION* 2011-03-09

SMITHSONIAN INSTITUTION OFFICE OF ENGINEERING DESIGN AND CONSTRUCTION (OEDC)

Smithsonian Sustainable Buildings Policy

Although the Smithsonian is not an Executive Branch of the U.S. Government, the Institution is committed to constructing and managing its buildings and facilities operations consistent with related Federal environmental and energy management policies and legislative mandates to the maximum extent practical. As of March 2011, these include:

- *Energy Policy Act (EPAAct) 2005*
- *High Performance and Sustainable Buildings Memorandum of Understanding (HPSB MOU or MOU) 2006, 01/24/2006*
- *Executive Order (EO) 13423: Strengthening Federal Environmental, Energy and Transportation Management, 01/26/2007*
- *Energy Independence and Security Act (EISA) 2007*
- *Executive Order (EO) 13514: Federal Leadership in Environmental, Energy and Economic Performance, 10/08/2009*

In addition, the Smithsonian has set goals consistent with the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating systems for eligible new construction, major renovation and interior renovation projects (LEED-NC OR LEED-CI), as well as selected existing buildings, (LEED EB: O&M), inclusive of the LEED points that correspond to the Federal environmental and energy management requirements in the documents listed above:

Projects with construction budgets less than \$2.5 million:

- *LEED certification*

Projects with construction budgets greater than or equal to \$2.5 million, but less than \$5 million:

- *LEED Silver certification*

Projects with construction budgets greater than or equal to \$5 million:

- *LEED Gold certification*

Where projects are not eligible for LEED certification, the LEED system may be used to select strategies that address the Federal environmental and energy management requirements that are applicable to a specific project.

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Abbreviations and Acronyms

Abbreviation	Definition
EPAct 2005	Energy Policy Act 2005
HPSB MOU	High Performance and Sustainable Buildings Memorandum of Understanding, 2006, 01/24/2006
EO 13423	Executive Order 13423: Strengthening Federal Environmental, Energy and Transportation Management, 01/26/2007
EISA 2007	Energy Independence and Security Act, 2007
EO 13514	Executive Order 13514: Federal Leadership in Environmental, Energy and Economic Performance, 10/08/2009
LEED NCv3	LEED for New Construction version 3 rating system
LEED CIv3	LEED for Commercial Interiors version 3 rating system
LEED EB:O&M	LEED for Existing Buildings: Operations & Maintenance rating system
SS	Sustainable Sites credit category, LEED rating systems
WE	Water Efficiency credit category, LEED rating systems
EA	Energy and Atmosphere credit category, LEED rating systems
MR	Materials and Resources credit category, LEED rating systems
EQ	Indoor Environmental Quality credit category, LEED rating systems
ID	Innovation in Design credit category, LEED for New Construction rating system
IO	Innovation in Operations credit category, LEED for Existing Buildings: Operations & Maintenance rating system

Legend
V denotes voluntary standard (not mandate)

Please note that, as of March 2011, the next iteration of LEED, LEED 2012, is under public review. Citations included here indicate upcoming changes or additions to LEED scope and requirements of potential significance to the Smithsonian. For the New Construction (NC), Commercial Interiors (CI) and the Existing Buildings: Operations & Maintenance (EB: O&M) Rating Systems, LEED 2012 will contain three new, additional credit categories: Integrated Process, Location and Transportation and Performance.

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
Site Planning and Project Management	Integrated Management	HPSB MOU; LEED 2012	I. Employ Integrated Design Principles: Integrated Design. Use a collaborative, integrated planning and design process that initiates and maintains an integrated project team in all stages of a project's planning and delivery; Establishes performance goals for siting, energy, water, materials and indoor environmental quality along with other comprehensive design goals; and ensures incorporation of these goals throughout the design and lifecycle of the building; and considers all stages of the building's lifecycle, including deconstruction.	LEED 2012 Integrated Process credit category
	Environmental Management Systems	EO 13423 LEED 2012	E.O. 13423, Sec. 3(b), excerpted: In implementing the policy set forth in section 1 of this order, the head of each agency shall: (b) implement, within the agency, environmental management systems (EMS) at all appropriate organizational levels to ensure (i) use of EMS as the primary management approach for addressing the environmental aspects of internal agency operations and activities, including environmental aspects of energy and transportation functions, (ii) establishment of agency objectives and targets to ensure implementation of this order and (iii) collection, analysis and reporting of information to measure performance in the implementation of this order.	Executive Level to decide scope and timing; LEED 2012 Performance credit category
	Historic Building Preservation	EO 13514	Sec.2g (vii) ensuring that rehabilitation of federally owned historic buildings utilizes best practices and technologies in retrofitting to promote long-term viability of the buildings.	
	Brownfield Redevelopment	V, LEED NCv3	SSc3 - Brownfield Redevelopment	
		V, LEED Clv3	SSc1, Option 2, Path 1 –Brownfield Redevelopment	Points for selecting or occupying a base building classified as a Brownfield
	Regional Environmental Priorities	V, LEED NCv3	USGBC Regional Priority credits spreadsheet (US only)	
	Site Selection And Sustainable Communities	EO 13514 LEED 2012	Sec.2(f): advance regional and local integrated planning by: (i) participating in regional transportation planning and recognizing existing community transportation infrastructure; (ii) aligning Federal policies to increase the effectiveness of local planning for energy choices such as locally generated renewable energy; (iii) ensuring that planning for new Federal facilities or new leases includes consideration of sites that are pedestrian friendly, near existing employment centers and accessible to public transit and emphasizes existing central cities and, in rural communities, existing or planned town centers. (Park authority projects are exempt).	Executive level to decide. Note; future LEED 2012 Location and Transportation credit category
		V,	SS c2: Development Density and Community Connectivity	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
		LEED NCv3	SSc4.1: Public Transportation Access	
		V, LEED Civ3	SSc2: Development Density and Community Connectivity SSc3.1: Alternative Transportation – Public Transportation Access	
	Leasing and Renovations to Leased Space	EISA 2007	SEC. 435. LEASING. (a) IN GENERAL — Except as provided in subsection (b), effective beginning on the date that is 3 years after the date of enactment of this Act, no Federal agency shall enter into a contract to lease space in a building that has not earned the Energy Star label in the most recent year. (b) EXCEPTION — (1) APPLICATION — This subsection applies if — (A) no space is available in a building described in subsection (a) that meets the functional requirements of an agency, including locational needs; (B) the agency proposes to remain in a building that the agency has occupied previously; (C) the agency proposes to lease a building of historical, architectural, or cultural significance (as defined in section 3306(a)(4) of title 40, United States Code) or space in such a building; or (D) the lease is for not more than 10,000 gross square feet of space. (2) BUILDINGS WITHOUT ENERGY STAR LABEL — If one of the conditions described in paragraph (2) is met, the agency may enter into a contract to lease space in a building that has not earned the Energy Star label in the most recent year if the lease contract includes provisions requiring that, prior to occupancy or, in the case of a contract described in paragraph (1)(B), not later than 1 year after signing the contract, the space will be renovated for all energy efficiency and conservation improvements that would be cost effective over the life of the lease, including improvements in lighting, windows and heating, ventilation and air conditioning systems.	
	Innovative Green Building Strategies	V, HPSB MOU, EOs 13423 + 13514	EO 13514: . . . the Presidential leadership awards program, established under subsection 4(c) of Executive Order 13423, to recognize exceptional and outstanding agency performance with respect to achieving the goals of this order and to recognize extraordinary innovation, technologies and practices employed to achieve the goals of this order.	
		V, LEED EB: O&M	IO: Credits 1-4 – Innovation in Operations	
		V, LEED NCv3	ID: Credits 1-5 – Innovation in Design	
		V, LEED Civ3	ID: Credits 1-5 – Innovation in Design	
	Light Pollution Reduction	LEED EB: O&M	SSc8 – Light Pollution Reduction	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
		V, LEED NCv3	SSc8 - Light Pollution Reduction	
		V, LEED Civ3	SSc1, Option 2, Path 6: Light Pollution Reduction	Points for selecting or occupying a base building that reduces light pollution
	Stormwater Quality	HPSB MOU	HPSB MOU: III. Protect and Conserve Water. Outdoor Water. Use water efficient landscape and irrigation strategies, including water reuse and recycling, to reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means (plant species and plant densities). Employ design and construction strategies that reduce storm water runoff and polluted site water runoff.	
		V, LEED NCv3	SSc6.2: Stormwater Design - Quality Control	
	Stormwater Quantity	EISA 2007	EISA 2007, TITLE IV, SUBTITLE C, SEC. 438. STORM WATER RUNOFF REQUIREMENTS FOR FEDERAL DEVELOPMENT PROJECTS. The sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume and duration of flow.	
		V, LEED NCv3	SSc6.1: Stormwater Design - Quantity Control	
		V, LEED EB: O&M	SSc6: Stormwater Quantity Control	
	Vegetated Roofs	V, EO 13514	Section 2, (G), (g) implement high performance sustainable Federal building design, construction, operation and management, maintenance and deconstruction including by: (iv) pursuing cost-effective, innovative strategies, such as highly reflective and vegetated roofs, to minimize consumption of energy, water and materials;	
		V, LEED NCv3	SSc7.2 - Heat Island Effect — Roof	
		V, LEED Civ3	SSc1, Option 2, Path 5 – Heat Island Effect – Roof	Points for selecting or occupying a base building with a vegetated roof
		V, EB: O&M	SS c7.2 - Heat Island Reduction — Roof	
	Community Connectivity	EO 13514	Sec.2(f): advance regional and local integrated planning by: (i) participating in regional transportation planning and	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
			recognizing existing community transportation infrastructure; (ii) aligning Federal policies to increase the effectiveness of local planning for energy choices such as locally generated renewable energy; (iii) ensuring that planning for new Federal facilities or new leases includes consideration of sites that are pedestrian friendly, near existing employment centers and accessible to public transit and emphasizes existing central cities and, in rural communities, existing or planned town centers.	
	Alternative Commuting	EO 13514 LEED 2012	Sec.2 (b) (ii) In establishing the target, the agency head shall consider reductions associated with . . . implementing strategies and accommodations for transit, travel, training and conferencing that actively support lower-carbon commuting and travel by agency staff.	LEED 2012 credit category "Location and Transportation"
Water Use	Drought- Resistant Plants	V, HPSB MOU	III. Protect and Conserve Water. Outdoor Water. Use water efficient landscape and irrigation strategies such as water reuse, recycling and the use of harvested rainwater, to reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means (plant species and plant densities).	
		V, LEED NCv3	WEc1 - Water Use Reduction	
		V, LEED Civ3	SSc1, Option 2, Path 7 – Water Efficient Landscaping – Reduce by 50% SSc1, Option 2, Path 8 – Water Efficient Landscaping – No Potable Water Use or No Irrigation	Points for selecting or occupying a base building with water efficient land-scaping
	Efficient Irrigation	HPSB MOU	HPSB MOU Section III. Protect and Conserve Water. Outdoor Water. Use water efficient landscape and irrigation strategies, including water reuse and recycling, to reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means (plant species and plant densities). Employ design and construction strategies that reduce storm water runoff and polluted site water runoff.	
		LEED NCv3	WEp1- Water Use Reduction – 20% Reduction WEc1 - Water Efficient Landscaping	
		LEED Civ3	SSc1, Option 2, Path 7 – Water Efficient Landscaping – Reduce by 50% SSc1, Option 2, Path 8 – Water Efficient Landscaping – No Potable Water Use or No Irrigation	Points for selecting or occupying a base building with water efficient land-scaping
		LEED EB: O&M	WEc3: Water Efficient Landscaping	
	Indoor Fixture Efficiency	HPSB MOU	Water-Efficient Products. Specify EPA's WaterSense-labeled products or other water conserving products, where available. Choose irrigation contractors who are certified through a WaterSense labeled program.	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
		LEED NCv3	WEp1, c3: Water Use Reduction	
		LEED CIv3	WE p1, c1: Water Use Reduction	
		LEED EB: O&M	WEp1: Minimum Indoor Plumbing Fixture and Fitting Efficiency WEc3: Additional Indoor Plumbing Fixture and Fitting Efficiency	
	Non-Potable Water Use, Reuse	V, EO 13514	Sec. 2, (d) improve water use efficiency and management by: (iii) consistent with State law, identifying, promoting and implementing water reuse strategies that reduce potable water consumption.	
		V, LEED NCv3	WEc2 - Innovative Wastewater Technologies	LEED 2012 NC, CI, EB: Sustain-able Waste- water Mgmt
	Water Metering	LEED EB: O&M	WEc1.1 - Water Performance Measurement	LEED NC 2012 WEp3
		V, HPSB MOU	Indoor Water. The installation of water meters is encouraged to allow for the management of water use during occupancy. Outdoor Water. The installation of water meters for locations with significant outdoor water use is encouraged.	
	Cooling Tower Management	V, EO 13514 LEED 2012	Sec.2, (d) improve water use efficiency and management by: (i) reducing potable water consumption intensity by 2 percent annually through fiscal year 2020 or 26 percent by the end of fiscal year 2020, relative to a baseline of the agency's water consumption in fiscal year 2007, by implementing water management strategies including water-efficient and low-flow fixtures and efficient cooling towers.	LEED 2012 WE c4
		LEED EB: O&M	WEc4: Cooling Tower Water Management	LEED 2012 WE c4
	Energy and Atmosphere	Basic Commissioning	EISA 2007	Title IV, Subtitle C, Section 432 “(B) RECOMMISSIONING AND RETROCOMMISSIONING — As part of the evaluation under subparagraph (A), the energy manager shall identify and assess recommissioning measures (or, if the facility has never been commissioned, retrocommissioning measures) for each such facility.
LEED NCv3			EAp1: Fundamental Commissioning	
LEED CIv3			EAp1: Fundamental Commissioning of Building Energy Systems	
Enhanced Commissioning		V, EISA	HPSB MOU: Commissioning. Employ commissioning practices tailored to	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
		2007, HPSB MOU	the size and complexity of the building and its system components in order to verify performance of building components and systems and help ensure that design requirements are met. This should include an experienced commissioning provider, inclusion of commissioning requirements in construction documents, a commissioning plan, verification of the installation and performance of systems to be commissioned and a commissioning report.	
		LEED NCv3	EAc3: Enhanced Commissioning	
		LEED Civ3	EAc2: Enhanced Commissioning	
		V, LEED EB: O&M	EA Credit 2.1: Existing Building Commissioning — Investigation and Analysis EA Credit 2.2: Existing Building Commissioning — Implementation EA Credit 2.3: Existing Building Commissioning — Ongoing Commissioning	
	Refrigerant Management	LEED NCv3	EAp3: Fundamental Refrigerant Management	
		LEED Civ3	EAp3: Fundamental Refrigerant Management	
		LEED EB: O&M	EA p3: Fundamental Refrigerant Management	
	Energy Meters	EPAct 2005, LEED 2012	EPAct 2005: SEC. 103. ENERGY USE MEASUREMENT AND ACCOUNTABILITY. Section 543 of the National Energy Conservation Policy Act (42 U.S.C. 8253) is further amended by adding at the end the following: “(e) METERING OF ENERGY USE — “(1) DEADLINE —By October 1, 2012, in accordance with guidelines established by the Secretary under paragraph (2), all Federal buildings shall, for the purposes of efficient use of energy and reduction in the cost of electricity used in such buildings, be metered. Each agency shall use, to the maximum extent practicable, advanced meters or advanced metering devices that provide data at least daily and that measure at least hourly consumption of electricity in the Federal buildings of the agency. Such data shall be incorporated into existing Federal energy tracking systems and made available to Federal facility managers. “(2) GUIDELINES — “(A) IN GENERAL — Not later than 180 days after the date of enactment of this subsection, the Secretary, in consultation with the Department of Defense, the General Services Administration, representatives from the metering industry, utility industry, energy services industry, energy efficiency industry, energy efficiency advocacy organizations, national laboratories, universities and Federal facility managers, shall	LEED 2012 p1, Performance credit category

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
			establish guidelines for agencies to carry out paragraph (1). “(B) REQUIREMENTS FOR GUIDELINES — The guidelines shall — “(i) take into consideration — “(I) the cost of metering and the reduced cost of operation and maintenance expected to result from metering; “(II) the extent to which metering is expected to result in increased potential for energy management, increased potential for energy savings and energy efficiency improvement and cost and energy savings due to utility contract aggregation; and “(III) the measurement and verification protocols of the Department of Energy; “(ii) include recommendations concerning the amount of funds and the number of trained personnel necessary to gather and use the metering information to track and reduce energy use; “(iii) establish priorities for types and locations of buildings to be metered based on cost-effectiveness and a schedule of one or more dates, not later than 1 year after the date of issuance of the guidelines, on which the requirements specified in paragraph (1) shall take effect; and “(iv) establish exclusions from the requirements specified in paragraph (1) based on the de minimis quantity of energy use of a Federal building, industrial process or structure. “(3) PLAN — Not later than 6 months after the date guidelines are established under paragraph (2), in a report submitted by the agency under section 548(a), each agency shall submit to the Secretary a plan describing how the agency will implement the requirements of paragraph (1), including (A) how the agency will designate personnel primarily responsible for achieving the requirements and (B) demonstration by the agency, complete with documentation, of any finding that advanced meters or advanced metering devices, as defined in paragraph (1), are not practicable.”	
		V, LEED EB: O&M	EA Credit 3.2: Performance Measurement — System-Level Metering	LEED 2012 p1, Performance credit category
	Minimum Energy Performance	EPA 2005	SEC. 109. FEDERAL BUILDING PERFORMANCE STANDARDS. “(3)(A) Not later than 1 year after the date of enactment of this paragraph, the Secretary shall establish, by rule, revised Federal building energy efficiency performance standards that require that - “(i) if lifecycle cost-effective for new Federal buildings - “(I) the buildings be designed to achieve energy consumption levels that are at least 30 percent below the levels established in the version of the ASHRAE Standard or the International Energy Conservation Code, as appropriate, that is in effect as of the date of enactment of this paragraph; and “(II) sustainable design principles are applied to the siting, design and construction of all new and replacement buildings; and “(ii) if water is used to achieve energy efficiency, water conservation technologies shall be applied to the extent that the technologies are lifecycle cost-effective.	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
		EISA 2007	Sec. 433 (a) (D) “(i) For new Federal buildings and Federal buildings undergoing major renovations, with respect to which the Administrator of General Services is required to transmit a prospectus to Congress under section 3307 of title 40, United States Code, in the case of public buildings (as defined in section 3301 of title 40, United States Code), or of at least \$2,500,000 in costs adjusted annually for inflation for other buildings: “(I) The buildings shall be designed so that the fossil fuel-generated energy consumption of the buildings is reduced, as compared with such energy consumption by a similar building in fiscal year 2003 (as measured by Commercial Buildings Energy Consumption Survey or Residential Energy Consumption Survey data from the Energy Information Agency), by the percentage specified in the following table: “Fiscal Year Percentage Reduction 2010.....55 2015..... 65 2020..... 80 2025..... 90 2030.....100“ (II) Upon petition by an agency subject to this subparagraph, the Secretary may adjust the applicable numeric requirement under subclause (I) downward with respect to a specific building, if the head of the agency designing the building certifies in writing that meeting such requirement would be technically impracticable in light of the agency’s specified functional needs for that building and the Secretary concurs with the agency’s conclusion.	
	Renewable Energy Use	EPAct 2005	EPAct 2005: SEC. 203. FEDERAL PURCHASE REQUIREMENT. (a) REQUIREMENT — The President, acting through the Secretary, shall seek to ensure that, to the extent economically feasible and technically practicable, of the total amount of electric energy the Federal Government consumes during any fiscal year, the following amounts shall be renewable energy: (1) Not less than 3 percent in fiscal years 2007 through 2009. (2) Not less than 5 percent in fiscal years 2010 through 2012. (3) Not less than 7.5 percent in fiscal year 2013 and each fiscal year thereafter.	
		V, LEED NCv3	EAc6: Green Power	
		V, LEED	EAc4: Green Power	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
		Clv3		
		V, LEED EB: O&M	EAc4: On-site and Off-site Renewable Energy	
	Renewable Energy Generation	EO 13423	E.O. 13423, sec. 2 (b): In implementing the policy set forth in section 1 of this order, the head of each agency shall: (b) ensure that (i) at least half of the statutorily required renewable energy consumed by the agency in a fiscal year comes from new renewable sources and (ii) to the extent feasible, the agency implements renewable energy generation projects on agency property for agency use.	
		V, LEED NCv3	EA Credit 2: On-site Renewable Energy	
		V, LEED EB: O&M	EA Credit 4: On-site and Off-site Renewable Energy	
	GHG Emissions: Scopes 1 and 2	EO 13423	E.O. 13423, sec. 2(a), (b) and (c): In implementing the policy set forth in section 1 of this order, the head of each agency shall: (a) improve energy efficiency and reduce greenhouse gas emissions of the agency, through reduction of energy intensity by (i) 3 percent annually through the end of FY 2015 or (ii) 30 percent by the end of FY 2015, relative to the baseline of the agency's energy use in FY 2003; (b) ensure that (i) at least half of the statutorily required renewable energy consumed by the agency in a fiscal year comes from new renewable sources and (ii) to the extent feasible, the agency implements renewable energy generation projects on agency property for agency use; (c) beginning in FY 2008, reduce water consumption intensity, relative to the baseline of the agency's water consumption in FY 2007, through lifecycle cost-effective measures by 2 percent annually through the end of FY 2015 or 16 percent by the end of FY 2015.	
	GHG Emissions: Scope 3	EO 13514	Sec.2 (b) within 240 days of the date of this order and concurrent with submission of the Strategic Sustainability Performance Plan as described in section 8 of this order, establish and report to the CEQ Chair and the OMB Director a percentage reduction target for reducing agency-wide scope 3 greenhouse gas emissions in absolute terms by fiscal year 2020, relative to a fiscal year 2008 baseline of agency scope 3 emissions. This target shall be subject to review and approval by the CEQ Chair in consultation with the OMB Director under section 5 of this order. In establishing the target, the agency head shall consider reductions associated with: (i) pursuing opportunities with vendors and contractors to address and incorporate incentives to reduce greenhouse gas emissions (such as changes to manufacturing, utility or delivery services, modes of transportation used or other changes in supply chain activities); (ii) implementing strategies and accommodations for transit,	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
			travel, training and conferencing that actively support lower-carbon commuting and travel by agency staff; (iii) greenhouse gas emission reductions associated with pursuing other relevant goals in this section; and (iv) developing and implementing innovative policies and practices to address scope 3 greenhouse gas emissions unique to agency operations.	
	Net-Zero Buildings	EO 13514	Sec.2g (1): (i) beginning in 2020 and thereafter, ensuring that all new Federal buildings that enter the planning process are designed to achieve zero-net-energy by 2030.	
		LEED NCv3	EAp2 - Minimum Energy Efficiency Performance EAc1 – Optimize Energy Performance	Federal net-zero goals assist with LEED achieve-ment Federal net-zero goals assist with LEED achieve-ment
		LEED Civ3	EAp2 - Minimum Energy Efficiency Performance EAc1 – Optimize Energy Performance	
		LEED EB: O&M	EAp2/c1 – Minimum Energy Efficiency Performance	
	Energy Efficient Lighting	EISA 2007	“§ 3313. Use of energy efficient lighting fixtures and bulbs “(a) CONSTRUCTION, ALTERATION AND ACQUISITION OF PUBLIC BUILDINGS — Each public building constructed, altered or acquired by the Administrator of General Services shall be equipped, to the maximum extent feasible as determined by the Administrator, with lighting fixtures and bulbs that are energy efficient. “(b) MAINTENANCE OF PUBLIC BUILDINGS — Each lighting fixture or bulb that is replaced by the Administrator in the normal course of maintenance of public buildings shall be replaced, to the maximum extent feasible, with a lighting fixture or bulb that is energy efficient. “(c) CONSIDERATIONS — In making a determination under this section concerning the feasibility of installing a lighting fixture or bulb that is energy efficient, the Administrator shall consider – “(1) the lifecycle cost effectiveness of the fixture or bulb; “(2) the compatibility of the fixture or bulb with existing equipment; “(3) whether use of the fixture or bulb could result in interference with productivity; “(4) the aesthetics relating to use of the fixture or bulb; and “(5) such other factors as the Administrator determines appropriate. “(d) ENERGY STAR — A lighting fixture or bulb shall be treated as being energy efficient for purposes of this section if — “(1) the fixture or bulb is certified under the Energy Star program established by section 324A of the Energy Policy and Conservation Act (42 U.S.C. 6294a); “(2) in the case of all light-emitting diode (LED) luminaires, lamps and systems whose efficacy (lumens per watt) and Color Rendering Index (CRI) meet the Department of Energy requirements for minimum luminaire efficacy and CRI for the	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
			Energy Star certification, as verified by an independent third-party testing laboratory that the Administrator and the Secretary H. R. 6 — 100 of Energy determine conducts its tests according to the procedures and recommendations of the Illuminating Engineering Society of North America, even if the luminaires, lamps and systems have not received such certification; or “(3) the Administrator and the Secretary of Energy have otherwise determined that the fixture or bulb is energy efficient. “(e) ADDITIONAL ENERGY EFFICIENT LIGHTING DESIGNATIONS — The Administrator of the Environmental Protection Agency and the Secretary of Energy shall give priority to establishing Energy Star performance criteria or Federal Energy Management Program designations for additional lighting product categories that are appropriate for use in public buildings. “(f) GUIDELINES — The Administrator shall develop guidelines for the use of energy efficient lighting technologies that contain mercury in child care centers in public buildings. “(g) APPLICABILITY OF BUY AMERICAN ACT — Acquisitions carried out pursuant to this section shall be subject to the requirements of the Buy American Act (41 U.S.C. 10c et seq.).	
			EAc1.1: Optimize Energy Performance – Lighting Power	
	Progressive Energy Use Reduction	EPAct 2005	(a) ENERGY REDUCTION GOALS — (1) AMENDMENT — Section 543(a)(1) of the National Energy Conservation Policy Act (42 U.S.C. 8253(a)(1)) is amended by striking “its Federal buildings so that” and all that follows through the end and inserting “the Federal buildings of the agency (including each industrial or laboratory facility) so that the energy consumption per gross square foot of the Federal buildings of the agency in fiscal years 2006 through 2015 is reduced, as compared with the energy consumption per gross square foot of the Federal buildings of the agency in fiscal year 2003, by the percentage specified in the following table: “Fiscal Year Percentage reduction 2006 2 2007 4 2008 6 2009 8 2010 10 2011 12 2012 14 2013 16	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
			2014 18 2015 20" (c) EXCLUSIONS — Section 543(c)(1) of the National Energy Conservation Policy Act (42 U.S.C. 8253(c)(1)) is amended by striking "An agency may exclude" and all that follows through the end and inserting "(A) An agency may exclude, from the energy performance requirement for a fiscal year established under subsection (a) and the energy management requirement established under subsection (b), any Federal building or collection of Federal buildings, if the head of the agency finds that — "(i) compliance with those requirements would be impracticable; "(ii) the agency has completed and submitted all federally required energy management reports; "(iii) the agency has achieved compliance with the energy efficiency requirements of this Act, the Energy Policy Act of 1992, Executive orders and other Federal law; and "(iv) the agency has implemented all practicable, lifecycle cost-effective projects with respect to the Federal building or collection of Federal buildings to be excluded. "(B) A finding of impracticability under subparagraph (A)(i) shall be based on — "(i) the energy intensiveness of activities carried out in the Federal building or collection of Federal buildings; or "(ii) the fact that the Federal building or collection of Federal buildings is used in the performance of a national security function."	
	Benchmark Energy Use	HPSB MOU	II. Optimize Energy Performance Energy Efficiency. Establish a whole building performance target that takes into account the intended use, occupancy, operations, plug loads, other energy demands and design to earn the Energy Star7 targets for new construction and major renovation where applicable. For new construction, reduce the energy cost budget by 30 percent compared to the baseline building performance rating per the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., (ASHRAE) and the Illuminating Engineering Society of North America (IESNA) Standard 90.1-2004, Energy Standard for Buildings Except Low-Rise Residential. For major renovations, reduce the energy cost budget by 20 percent below pre-renovations 2003 baseline.	LEED 2012 NC, CI, EB Performance credit category

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
Indoor Environment and Materials Management	Low-Emitting Materials	HPSB MOU	HPSB Section IV. Enhance Indoor Environmental Quality. Low-Emitting Materials. Specify materials and products with low pollutant emissions, including adhesives, sealants, paints, carpet systems and furnishings.	
		V, LEED NCv3	EQc4.1: Low-Emitting Materials —Adhesives and Sealants EQc4.2: Low-Emitting Materials — Paints and Coatings EQc4.3: Low-Emitting Materials —Flooring Systems EQc4.4: Low-Emitting Materials – Composite Wood and Agrifiber Products	
		V, LEED Clv3	EQ c4.1: Low-Emitting Materials —Adhesives and Sealants EQ c4.2: Low-Emitting Materials — Paints and Coatings EQ c4.3: Low-Emitting Materials —Flooring Systems EQ c4.4: Low-Emitting Materials – Composite Wood and Agrifiber Products EQ c4.5: Low-Emitting Materials – Systems Furniture and Seating	
	Construction Waste Diversion	HPSB MOU	HPSB Section V. Reduce Environmental Impact of Materials Construction Waste. During a project's planning stage, identify local recycling and salvage operations that could process site related waste. Program the design to recycle or salvage at least 50 percent construction, demolition and land clearing waste, excluding soil, where markets or on-site recycling opportunities exist.	
		V, LEED NCv3	MRc2: Construction Waste Management	
		V, LEED Clv3	MRc2: Construction Waste Management	
		V, LEED EB: O&M	MRc9: Solid Waste Management – Facility Alterations and Additions	
	Ventilation Performance	HPSB MOU	HPSB Section IV. Enhance Indoor Environmental Quality Ventilation and Thermal Comfort. Meet the current ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone and ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality.	
		LEED NCv3	EQc7.1: Thermal Comfort — Design	
		LEED Clv3	EQc7.1: Thermal Comfort – Design	
	Thermal Comfort	HPSB MOU	HPSB Section IV. Enhance Indoor Environmental Quality Ventilation and Thermal Comfort. Meet the current ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy, including continuous humidity control within established ranges per climate zone and ASHRAE	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
			Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality. See above: LEED NCv3 and Clv3, EQc7.1: Thermal Comfort — Design	
	Construction Indoor Air Quality	HPSB MOU	HPSB MOU section IV. Enhance Indoor Environmental Quality Protect Indoor Air Quality during Construction. Follow the recommended approach of the Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction, 1995. After construction and prior to occupancy, conduct a minimum 72-hour flush out with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent. After occupancy, continue flush out as necessary to minimize exposure to contaminants from new building materials.	
		V, LEED NCv3	EQc3.1: Construction Indoor Air Quality Management Plan — During Construction EQc3.2: Construction Indoor Air Quality Management Plan — Before Occupancy	
		V, LEED Clv3	EQc3.1: Construction Indoor Air Quality Management Plan — During Construction EQc3.2: Construction Indoor Air Quality Management Plan — Before Occupancy	
		V, LEED EB: O&M	EQc1.5: Construction Indoor Air Quality Management Plan — IAQ Management for Facility Alterations and Additions	
	Daylighting and Views	HPSB MOU	HPSB Section IV. Enhance Indoor Environmental Quality Daylighting. Achieve a minimum of daylight factor of 2 percent (excluding all direct sunlight penetration) in 75 percent of all space occupied for critical visual tasks. Provide automatic dimming controls or accessible manual lighting controls and appropriate glare control.	
		V, LEED NCv3	EQc8.1: Daylight and Views — Daylight	
		V, LEED Clv3	EQc8.1: Daylight and Views — Daylight	
		V, LEED EB: O&M	EB:O&M EQc2.4: Daylight and Views —Daylight	
	Air Delivery Monitoring	V, LEED NCv3	EQc1: Outdoor Air Delivery Monitoring	
		V, LEED Clv3	EQc1: Outdoor Air Delivery Monitoring	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
		V, LEED EB: O&M	EQc1.2: Indoor Air Quality Best Management Practices — Outdoor Air Delivery Monitoring	
	Electronic Stewardship and Purchasing	EPAct 2005	SEC. 104. PROCUREMENT OF ENERGY EFFICIENT PRODUCTS. “(b) PROCUREMENT OF ENERGY EFFICIENT PRODUCTS — “(1) REQUIREMENT — To meet the requirements of an agency for an energy consuming product, the head of the agency shall, except as provided in paragraph (2), procure — “(A) an Energy Star product; or “(B) a FEMP designated product. “(2) EXCEPTIONS — The head of an agency is not required to procure an Energy Star product or FEMP designated product under paragraph (1) if the head of the agency finds in writing that — “(A) an Energy Star product or FEMP designated product is not cost-effective over the life of the product taking energy cost savings into account; or “(B) no Energy Star product or FEMP designated product is reasonably available that meets the functional requirements of the agency. “(3) PROCUREMENT PLANNING — The head of an agency shall incorporate into the specifications for all procurements involving energy consuming products and systems, including guide specifications, project specifications and construction, renovation and services contracts that include provision of energy consuming products and systems and into the factors for the evaluation of offers received for the procurement, criteria for energy efficiency that are consistent with the criteria used for rating Energy Star products and for rating FEMP designated products.	
	Green Purchasing	EPAct 2005	EPAct 2005: SEC. 104. PROCUREMENT OF ENERGY EFFICIENT PRODUCTS. “(b) PROCUREMENT OF ENERGY EFFICIENT PRODUCTS — “(1) REQUIREMENT — To meet the requirements of an agency for an energy consuming product, the head of the agency shall, except as provided in paragraph (2), procure — “(A) an Energy Star product; or “(B) a FEMP designated product. “(2) EXCEPTIONS — The head of an agency is not required to procure an Energy Star product or FEMP designated product under paragraph (1) if the head of the agency finds in writing that — “(A) an Energy Star product or FEMP designated product is not cost-effective over the life of the product taking energy cost savings into account; or “(B) no Energy Star product or FEMP designated product is reasonably available that meets the functional requirements of the agency. “(3) PROCUREMENT PLANNING — The head of an agency shall incorporate into the specifications for all procurements	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
			involving energy consuming products and systems, including guide specifications, project specifications and construction, renovation and services contracts that include provision of energy consuming products and systems and into the factors for the evaluation of offers received for the procurement, criteria for energy efficiency that are consistent with the criteria used for rating Energy Star products and for rating FEMP designated products. “(d) SPECIFIC PRODUCTS — (1) In the case of electric motors of 1 to 500 horsepower, agencies shall select only premium efficient motors that meet a standard designated by the Secretary. The Secretary shall designate such a standard not later than 120 days after the date of the enactment of this section, after considering the recommendations of associated electric motor manufacturers and energy efficiency groups.	
		LEED Civ3	EAc1.4: Optimize Energy Performance – Equipment and Appliances	
		LEED EB: O&M	MR Prerequisite 1: Sustainable Purchasing Policy MR Credit 2: Sustainable Purchasing —Durable Goods MR Credit 3: Sustainable Purchasing —Facility Alterations and Additions MR Credit 4: Sustainable Purchasing —Reduced Mercury in Lamps	
	Green Cleaning (Green Purchasing)	V, LEED EB: O&M	EQc3.1: Green Cleaning — High Performance Cleaning Program EQc3.2: Green Cleaning — Custodial Effectiveness Assessment EQc3.3: Green Cleaning — Purchase of Sustainable Cleaning Products and Materials EQc3.4: Green Cleaning — Sustainable Cleaning Equipment EQc3.5: Green Cleaning — Indoor Chemical and Pollutant Source Control	
	Integrated Pest Management	EO 13514	EO 13514 (e) promote pollution prevention and eliminate waste by: (vii) implementing integrated pest management and other appropriate landscape management practices.	
		V, LEED EB: O&M	SSc3: Integrated Pest Management, Erosion Control and Landscape Management Plan EQc3.6: Green Cleaning — Indoor Integrated Pest Management	
	Chemical Use Reduction	EO 13423	Sec.2 (e) promote pollution prevention and eliminate waste by: (i) minimizing the generation of waste and pollutants through source reduction... CL6B1PROD with MISCELLANEOUS (v) reducing and minimizing the quantity of toxic and hazardous chemicals and materials acquired, used or	

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Topic Area (from LEED or Five Guiding Principles)	Sustainability requirement	Source	Citation	Notes
			disposed of... (viii) increasing agency use of acceptable alternative chemicals and processes in keeping with the agency's procurement policies; (ix) decreasing agency use of chemicals where such decrease will assist the agency in achieving greenhouse gas emission reduction targets under section 2(a) and (b) of this order.	
	Ongoing Waste Stream Management	EO 13423	E.O. 13423, Sec. 2(e): In implementing the policy set forth in section 1 of this order, the head of each agency shall: (e) ensure that the agency... (ii) increases diversion of solid waste as appropriate and (iii) maintains cost-effective waste prevention and recycling programs in its facilities. Sec. 3(a), excerpted, (e), and (f): In implementing the policy set forth in section 1 of this order, the head of each agency shall: (a) implement within the agency sustainable practices for... (v) pollution and waste prevention and recycling... (e) ensure that contracts entered into after the date of this order for contractor operation of government-owned facilities or vehicles require the contractor to comply with the provisions of this order with respect to such facilities or vehicles to the same extent as the agency would be required to comply if the agency operated the facilities or vehicles; (f) ensure that agreements, permits, leases, licenses or other legally-binding obligations between the agency and a tenant or concessionaire entered into after the date of this order require, to the extent the head of the agency determines appropriate, that the tenant or concessionaire take actions relating to matters within the scope of the contract that facilitate the agency's compliance with this order.	
		LEED EB: O&M	MR Prerequisite 2: Solid Waste Management Policy MR Credit 7: Solid Waste Management — Ongoing Consumables MR Credit 8: Solid Waste Management — Durable Goods MR Credit 9: Solid Waste Management — Facility Alterations and Additions	
	Environmental Tobacco Smoke	LEED NCv3	EQp2: Environmental Tobacco Smoke (ETS) Control	
		LEED Clv3	EQp2: Environmental Tobacco Smoke (ETS) Control	
		LEED EB: O&M	EQp2: Environmental Tobacco Smoke (ETS) Control	
	Low-Emitting Vehicle Purchasing and Infrastructure	EISA 2007	Subtitle C — Federal Vehicle Fleets SEC. 141. FEDERAL VEHICLE FLEETS. "(A) IN GENERAL — Except as provided in subparagraph (B), no Federal agency shall acquire a light duty motor vehicle or medium duty passenger vehicle that is not a low greenhouse gas emitting vehicle. . . "SEC. 400FF. FEDERAL FLEET CONSERVATION REQUIREMENTS.	

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			“(a) MANDATORY REDUCTION IN PETROLEUM CONSUMPTION — “(1) IN GENERAL — Not later than 18 months after the date of enactment of this section, the Secretary shall issue regulations for Federal fleets subject to section 400AA to require that, beginning in fiscal year 2010, each Federal agency shall reduce petroleum consumption and increase alternative fuel consumption each year by an amount necessary to meet the goals described in paragraph (2). “(2) GOALS — The goals of the requirements under paragraph (1) are that not later than October 1, 2015 and for each year thereafter, each Federal agency shall achieve at least a 20 percent reduction in annual petroleum consumption and a 10 percent increase in annual alternative fuel consumption, as calculated from the baseline established by the Secretary for fiscal year 2005. “(3) MILESTONES — The Secretary shall include in the regulations described in paragraph (1) — “(A) interim numeric milestones to assess annual agency progress towards accomplishing the goals described in that paragraph; and “(B) a requirement that agencies annually report on progress towards meeting each of the milestones and the 2015 goals. “(b) PLAN — “(1) REQUIREMENT — “(A) IN GENERAL — The regulations under subsection (a) shall require each Federal agency to develop a plan and implement the measures specified in the plan by dates specified in the plan, to meet the required petroleum reduction levels and the alternative fuel consumption increases, including the milestones specified by the Secretary. “(B) INCLUSIONS — The plan shall — “(i) identify the specific measures the agency will use to meet the requirements of subsection (a)(2); and “(ii) quantify the reductions in petroleum consumption or increases in alternative fuel consumption projected to be achieved by each measure each year. “(2) MEASURES — The plan may allow an agency to meet the required petroleum reduction level through — “(A) the use of alternative fuels; “(B) the acquisition of vehicles with higher fuel economy, including hybrid vehicles, neighborhood electric vehicles, electric vehicles and plug-in hybrid vehicles if the vehicles are commercially available; “(C) the substitution of cars for light trucks; “(D) an increase in vehicle load factors; “(E) a decrease in vehicle miles traveled; “(F) a decrease in fleet size; and “(G) other measures.” SEC. 246. FEDERAL FLEET FUELING CENTERS. (a) IN GENERAL — Not later than January 1, 2010 the head of each Federal agency shall install at least 1 renewable fuel pump at each Federal fleet fueling center in the United States under the jurisdiction of the head of the Federal agency.	

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Appendix B

Smithsonian Master Specifications for Vertical Transportation

SECTION 14210 – ELECTRIC TRACTION ELEVATOR

I. PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope: Provide materials, labor, and services necessary for the complete installation of one traction passenger elevator, designed for Class A loading and designed to Smithsonian standards as shown and specified. To ensure that elevators comply with specifications and installation procedures in the standards, the A/E shall retain the services of an elevator consulting firm to provide design, specification and construction/inspection services.
- B. Related work by other trades:
 - 1. Hoistway, pit and machine room modifications and construction.
 - 2. Lighting and ventilation of pit, hoistway and machine room of a minimum level of 100 lx (10 fc) in the hoistway and 200 lx (19 fc) in the machine room.
 - 3. Access ladder and guards.
 - 4. Supports for guide rail brackets, buffers and entrance installation.
 - 5. Installation of pipe sleeves.
 - 6. Installation of guide rail mounting.
 - 7. Electric feeders to fused lockable disconnect switches to elevator starter or control panels, electric circuits to disconnect switches and to elevator relay panels. Circuit breakers are unacceptable for use as disconnect switches.
 - 8. Conduit to remote locations for elevator intercommunication and alarm systems.
 - 9. Indicated or required chases and openings.
 - 10. Finish painting except as noted.
 - 11. Guarding and protecting hoistway during construction.
 - 12. Storage space for tools and materials.
 - 13. Electric power for testing and adjusting equipment.
 - 14. Telephone wiring to control panels.
 - 15. Signal from fire alarm system.
 - 16. Installation of elevator pit sump pump, sump pump crock and all necessary piping and

wiring. The use of drains shall not be acceptable.

1.02 REFERENCES

A. Applicable Codes (Latest Edition)

1. American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.1).
2. International Building Code (IBC)
3. American National Standard Specification for Making Buildings and Facilities Accessible to and Usable By Physically Handicapped People (ANSI A117.1).
4. GSA "Facilities Standards for the Public Buildings Service – PBS P-100. Latest edition as accepted by GSA.
5. National Elevator Industry, Incorporated (NEII) Building Transportation Standards and Guidelines.
6. National Electric Code (NFPA 70).
7. United States Department of Labor – Occupational Safety & Health Administration (OSHA).
8. Local codes.

1.03 DEFINITIONS

- A. "Provide": to furnish and install, complete for safe operation, unless specifically indicated otherwise.
- B. "Install": to erect, mount and connect complete with related accessories.
- C. "Supply": to purchase, procure, acquire and deliver complete with related accessories.
- D. "Work": labor and materials required for proper and complete installation.
- E. "Wiring": raceway, fittings, wire, boxes, and related items.
- F. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions or above hung ceilings, in trenches, in crawl spaces or in enclosures.
- G. "Exposed": not installed underground or "concealed" as defined above.
- H. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or as specified.
- I. "Similar," or "equal": to base bid manufacturer, equal in materials, weight, size, design and efficiency of specified product, conforming to "Acceptable manufacturers."

- J. "Reviewed," "satisfactory," "accepted," "or" "directed": as reviewed, satisfactory, accepted or directed, by or to SI.

1.04 OPERATION PERFORMANCE

- A. The control system shall provide smooth acceleration and deceleration with 1/8" leveling accuracy at all landings from no load to full rated load in the elevator.
- B. The door open time shall be ____ seconds measured from start of door open to fully open.
- C. The speed of the elevator shall not vary +/- 5% under loading conditions.
- D. Prior to final acceptance and prior to the termination of the maintenance period, the elevators shall be adjusted as required to meet these performance requirements.

1.05 SUBMITTALS

- A. Shop Drawings and Samples:
1. Shop Drawings: Provide complete shop drawings, to scale. Include layouts of pits, machine rooms, overhead requirements, power and heat data for all equipment, static and impact loads, reaction points and required clearances. Provide manufacturers standard catalog literature and brochures of all components scheduled for use as part of this project. Provide cab and fixture drawings.
 2. Samples: Materials and finishes exposed to public view, 6" by 6" panels or 12" lengths as applicable.
 3. Partial or incomplete submittal packages will be rejected and returned without comment.
 4. Provide a standard submittal register that identifies all items scheduled for submittal and required by this section. Arrange register by specification section and item number for project tracking and coordination. Contractor should provide a submittal package with tabs or notes that clearly identify the information submitted, where it is located and whether that information has been modified and/or updated since the previous submissions in order to expedite the review process and to encourage a collaborative effort.
 5. LEED Submittals
 - a. Product data for EQ 4.1: For adhesives and sealants applied within the building waterproofing envelope, documentation indicating VOC content in g/L.2. Product data for Credit EQ 4.
 - b. For paints and coatings applied within the building waterproofing membrane, documentation indicating VOC content in g/L.
 - c. Product data for Credit EQ 4.4: For composite wood and laminating adhesives, documentation indicating no urea formaldehyde.
- B. Equipment Brochure and Service Manuals:
1. Before acceptance of work, furnish three sets of manufacturer's equipment brochures and

service manuals. Assemble manuals in chronological order according to the specification alpha-numerical system. Provide manufacturer's standard binders consisting of:

- a. Equipment and components, descriptive literature.
 - b. Performance data, model number.
 - c. Installation instructions.
 - d. Operating instructions and technical field adjustment manuals.
 - e. Maintenance and repair instructions.
 - f. Spare parts lists.
 - g. Lubrication instructions.
 - h. Detailed, record and as-built layout drawings.
 - i. Detailed, simplified, one line, wiring diagrams. Provide one complete set per manual.
 - j. Field test reports.
 - k. Submit valve tag chart indicating size, type, location, system and number of all valves.
- C. Machine Room Prints. Provide three complete sets of "as-built" field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway as well as the machine room. One set of these diagrams shall be laminated and mounted in the elevator machine room as directed.
- D. Keys: Five (5) sets of keys and key tags to operate all key switches and locks shall be furnished upon completion of work. All keys shall be designed to work with the SI's in house key system.

1.06 QUALITY ASSURANCE

- A. Quality and gauges of materials:
1. New, best of their respective kinds, free from defects.
 2. Materials, equipment of similar application; same manufacturer, unless otherwise noted.
 3. Gauges as noted.
 4. Steel
 - a) Commercial-quality carbon steel that is stretcher-leveled and cold rolled shall be used for exposed work. Such steel must comply with ASTM 366.

- b) Commercial-quality carbon steel that is hot-rolled shall be used for concealed work. Such steel must comply with ASTM 568 and ASTM 569.
- 5. Stainless steel: Type 302 or Type 304 that complies with ASTM 167 shall be chosen as follows:
 - a) No. 4 finish: Satin finish.
 - b) No. 8 finish: Mirror finish.
 - c) Textured: Patterned type with .050-inch mean pattern depth with satin finish.
- 6. Bronze materials shall be constructed of stretcher-leveled sheets with 60 percent copper and 40 percent zinc that are similar to Muntz Metal, Alloy Group #2. After cleaning, spray with one coat of clear lacquer.
- 7. Aluminum extrusions shall comply with ASTM B221 requirements. Sheet and plate shall comply with ASTM B209 requirements.
- 8. Plastic laminate shall comply with ASTM E 84 Class A fire-rated grade (GP- 50), and as follows:
 - a) The COTR shall select the appropriate color for exposed surfaces.
 - b) Use the manufacturer's standard for plastic laminate on non-exposed surfaces.
- 9. Fire retardant particleboard panels shall have a minimum of 3/4-inch thick backup for natural veneer or plastic laminated panels.
- 10. Paint
 - a) Clean exposed surface of oil, grease and scale.
 - b) Apply one coat of rust-resistant mineral paint and one coat of finish enamel.
 - c) Paint pit floor and machine floor room with a water based epoxy Rust-Oleum Concrete Saver Water-Based Epoxy (6000 System) or approved equal.
- 11. Laminated safety glass shall comply with ANSI Z.97.1 and CPSC 16 CFR, part 1201.
- 12. Non-Shrink Grout: Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 4000 PSI at 28 days.
- 13. Fire Resistance: Treat wood components with fire-retardant treatment conforming to requirements of authorities having jurisdiction and to achieve flame spread rating of 25, ASTM E84.
 - a) Protect electric wiring with flame retardant and moisture resistant outer covering, run in conduit, tubing or electrical wire ways.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship in original crated sections of a size to permit passage through available space.
- B. Obtain approval and schedule delivery of material to meet SI's requirements.
- C. Storage of equipment and materials shall be coordinated with SI.

1.08 WARRANTY

- A. The elevators and associated equipment shall be free of defective material, imperfect work and faulty operation not due to ordinary wear and tear or improper use or care, for a period of one year from final acceptance and substantial completion of the project. Defective work shall be repaired or replaced at no additional cost to the SI.

1.09 MAINTENANCE SERVICE

Maintenance service shall be performed in accordance with the requirements listed below for the duration of warranty period and then the units shall be placed under the existing master maintenance agreement currently in place:

- A. It is the intent of the Smithsonian Institution to provide the best possible coverage to maximize equipment up-time during the hours that the Museums are open to the public and staff, and to correct, repair and minimize interruptions to normal Smithsonian Institution business. The Contractor shall arrange their work hours and schedules to meet the performance requirements of this contract. Museums are generally open to the public seven days a week from 10:00 AM to 6:00 PM, excluding Christmas Day. Museum hours will vary seasonally with extended summer hours that occasionally keep the Museums open later during the evening. Museum and Administration staff office hours are generally from 6:00 AM to 6:00 PM Monday through Friday, except holidays. Holidays for Smithsonian Institution employees include New Years Day, Martin Luther King Day, Presidents Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, and Christmas Day.
- B. Routine, Emergency and Entrapment Callbacks.
 - 1. The Contractor shall provide seven (7) days a week, twenty-four (24) hour callback service consisting of a prompt response to requests from designated Smithsonian Institution representatives including the COTR or their designated representative and on-site OPS Security personnel at any hour, any day, including weekends and holidays. Callback services are defined as any request for repairs, inspections, adjustments, and entrapment calls for equipment. The Callback Responder shall acknowledge the request by returning the call within ten (10) minutes of receipt, and provide an estimated time of arrival.
 - 2. The Contractor shall ensure that the responding technician is qualified, trained, certified and has the ability to repair and correct the inventory equipment for which the callback was placed.
 - 3. All Entrapment Callbacks shall be treated as an emergency and shall be responded to immediately to extricate passengers. All callbacks for equipment within the Museums

during museum and staff hours shall be considered an Emergency Callback and shall be responded to immediately including all Special Events. Emergency Callbacks shall also include safety related concerns and be responded to immediately to correct hazardous situations and prevent further damage to the equipment inventory and/or facilities.

4. Routine Callbacks shall include responding to non-safety, or after hour repairs or outages.
5. The Contractor shall respond to all callbacks to ensure the condition that caused the callback is corrected as quickly as possible and the unit is returned back to service prior to the departure of the responding technician. No equipment shall be left out of service unless due to the repair being beyond the ability of the responding technician for reasons such as; an after hour call where there is a lack of additional and available personnel to assist in the completion of the repair or the lack of parts or material available to complete the repair.
6. In the event of these circumstances, the responding technician shall Lock Out/Tag Out (LO/TO) the out of service equipment until the repairs can be made. The responding technician shall report all findings, corrections or deficiencies to the on-site OPS Security personnel in accordance with the contract reporting requirements as soon as possible and prior to departure. The responding technician shall also immediately report all such findings, deficiencies and/or corrective actions to the Project Manager. The Project Manager shall report to the COTR the status of the findings, deficiencies and corrections. If the equipment is left out of service, the Project Manager shall report the findings, a schedule for repair and duration of the outage to the COTR immediately (if during normal business hours) or by the close of the following business day and no longer than twenty-four (24) hours of the callback, in order to allow the COTR to inform the Museum/Building occupants. The Project Manager shall also report to the COTR any change of status of such accordingly.
7. It is the intent of the Smithsonian Institution to insure that the responding callback technician arrives within the times that are listed below:
 - Entrapment Callback: Within thirty (30) minutes of receipt of call during working hours and one (1) hour during non working hours.
 - Emergency Callback (non-entrapment): Within one (1) hour during the regular working hours as determined by this Contract, and within two (2) hours after the regular working hours as determined by this Contract.
 - Routine, After Hours Callback: Sufficient time to place the unit back in service by the start of business the next day.

The response times required above shall be from the time the contractor receives initial notification to the time the responding technician arrives on-site.

8. When a callback is placed after regular work hours as defined by this contract, a time ticket/log shall be signed by the on-site OPS Security personnel or a designated Smithsonian Institution Representative. The time ticket/log shall be provided by the Contractor and shall include but not be limited to the time the callback was placed, the time of the technician's arrival, the time of the technician's departure, a description of the complaint/deficiency, a description of correction or service provided, date, equipment number and building/facility. A copy of the time ticket/log must be provided to the on-site OPS Security personnel or a designated Smithsonian Institution Representative. A copy shall be provided to the COTR upon request.

C. Maintenance Requirements:

1. On a monthly basis, regularly and systematically examine, adjust, lubricate, clean and, when conditions warrant, repair or replace the following items and all other mechanical or electrical equipment including but not limited to:
 - a. Hydraulic power unit and accessories: pump, motor, valves, operating valves, pulleys, drive belts, flexible hose and fitting assemblies, oil tank, muffler, strainer, sound isolating coupling, plunger, packing gland, scavenger system, piping and other components.
 - b. Controller, selector, and dispatching equipment: All components including all relays, solid state components, resistors, condensers, transformers, contacts, leads, computer devices, selector switches, mechanical or electrical driving equipment, coils, magnet frames, contact switch assemblies, springs, solenoids, resistance grids, hoistway vanes, magnets and inductors.
 - c. Hoistway door interlocks or locks and contacts, hoistway door hangers, tracks, bottom door gibs, cams, rollers and auxiliary door closing devices for power operated doors. Chains, tracks, cams, interlocks, sheaves for vertical bi-parting doors.
 - d. Hoistway limit switches, slowdown switches, leveling switches and associated cams, vanes and electronic components.
 - e. Guide shoes including rollers or replaceable guides.
 - f. Automatic power operated door operators, door protective devices, car door hangers, tracks and car door contacts.
 - g. Traveling cables.
 - h. Elevator control wiring in hoistway and machine room.
 - i. Buffers.
 - j. Fixture contacts, pushbuttons, key switches, locks, lamps and sockets or button stations (car and hall), hall lanterns, position indicators (car and hall), direction indicators.
 - k. The guide rails shall be kept free of rust and dry.
 - l. Examine all safety devices, and conduct an annual no load test, and every fifth year perform a full load, full speed test of the buffers. The car balance shall be checked. All tests shall be performed in accordance with the provisions of the American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.2), current edition.
 - m. Furnish lubricants compounded specifically for elevator usage.

2. The Elevator Contractor shall not be required to install new attachments on the elevator whether or not recommended or directed by insurance companies or by governmental authorities, nor make any replacements with parts of a different design. The Contractor shall not be required to make renewals or repairs necessitated by reason of negligence or misuse of the equipment or by reason of any other cause beyond the Contractor's control except ordinary wear and tear unless the Contractor receives just compensation.
 3. The Contractor shall check the group dispatching systems and make necessary tests to insure that all circuits and time settings are properly adjusted, and that the system performs as designed and installed.
- D. Maintenance Responsibility:
1. The Contractor shall keep the elevator maintained to operate at the original contract speed, keeping the original performance times, including acceleration and retardation as designed and installed by the manufacturer. The door operation shall be adjusted as required to maintain the original door opening and door closing times, within legal limits.
 2. The COTR reserves the right to make inspections and tests as and when deemed advisable. If it is found that the elevator and associated equipment are deficient either electrically or mechanically, the Contractor will be notified of these deficiencies in writing, and it shall be his responsibility to make corrections within 30 days after his receipt of such notice. In the event that the deficiencies have not been corrected within 30 days, SI may terminate the contract and employ a Contractor to make the corrections at the original bidder's expense.
 3. Approximately three months prior to the end of the contract term, the COTR will make a through maintenance inspection of all elevators covered under the contract. At the conclusion of this inspection, the COTR shall give the Contractor written notice of any deficiencies found. The Contractor shall be responsible for correction of these deficiencies within 30 days after receipt of such notice.
- E. The COTR reserves the right to accept or reject any or all alternates.
- F. Diagnostic Tools and Spare Parts: At the completion of the work as specified, the Contractor shall provide items listed. The items shall become SI's property.
1. One complete set of all diagnostic tools and equipment required for the complete maintenance of all aspects of the control and dispatch system. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the serviceman and the controls. All such systems shall be free from secret codes and decaying circuits that must be periodically reprogrammed by the manufacturer.
 2. A list of vendors for all parts used in the installation.
 3. Technical field adjustment manuals with all faults, service codes and nomenclature.
- G. Machine Room Log. The Contractor shall provide, create, manage, update and maintain a Machine Room Log for the inventory equipment to include but be not limited to records, data, maintenance, callbacks, repairs, oil usage, etc. according to the most recent ASME A17 series code and any other standard, directive, law or code applicable. The log shall include the date the

service/inspection was performed, the technician that performed the work and any follow up requirements that were reported. The log shall remain in the Machine Rooms as required by applicable code. All required records and logs shall be the property of the Smithsonian Institution and shall be made available for examination on site at anytime by the COTR. Records and logs shall be maintained in a legible, complete, orderly, timely, and accurate manner at all times. The original records and logs shall be submitted to the COTR within 15 calendar days of expiration of the contract. Copies of the records and logs shall be provided to the COTR at anytime upon request.

1.10 ELECTRIC SERVICE

- A. Power: [TBD] volts, 3 phase, 60 hertz. Elevator Contractor to verify voltage.
- B. Lighting: 120 volts, 1 phase, 60 hertz.

II. PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Product of individuals, firms or corporations regularly engaged in manufacturing elevators comparable with the needs of this project and in satisfactory operation for a period of not less than five years.
- B. Qualified Bidders:
 - 1. Otis Elevator Company
 - 2. ThyssenKrupp Elevator Company
 - 3. KONE Elevator Company
 - 4. Schindler Elevator Company
 - 5. Independent installers of approved equal equipment.
- C. Approved Components:
 - 1. Elevator controller: Motion Control Engineering
 - 2. Elevator door operator (passenger): GAL MOVFR
 - 3. Elevator door operator (freight): Peele
 - 4. Fixtures: Innovation Industries, vandal resistant, Button style PB-23.
 - 5. Elevator emergency telephone: EMS.
 - 6. Infrared safety curtain: Janus Panachrome.

2.02 OUTLINE OF EQUIPMENT

- A. Elevator number: []
1. Elevator use: Passenger, Class A Loading
 2. Contract load, in pounds: []
 3. Contract speed, in fpm: []
 4. Travel distance: []
 5. Serves: []
 6. Number of stops: []
 7. Number of openings: [] – front, []- rear
 8. Machine location: Overhead
 9. Machine type: Geared.
 10. Operation: []
 11. Platform size: ___' - ___" wide by ___' - ___" deep
 12. Car and hoistway door size: ___' - ___" wide by ___' - ___" high
 13. Car and hoistway door type: Single Speed Side Slide
 14. Car and hoistway door operation: Power, heavy duty passenger
 15. Hoistway entrance: As specified.
 16. Cab enclosure: As specified.
 17. Door-reversal device: Electronic detector.
 18. Car operating panel. As specified
 19. Auxiliary car operating panel. [].
 20. Car position indicator (in car). As specified.
 21. Hall call stations. Single riser.
 22. Combination hall position indicator: As specified.
 23. Fire Control Panel: As specified.
 24. Self-Leveling. As specified.
 25. Communication system: Telephone.

- | | | |
|-----|-------------------------|--|
| 26. | Signage: | All signage and engraving to be Helvetica Medium font. |
| 27. | Counterweight Safeties: | [Required] [Not Required]. |
| 28. | Loadweighing: | Provide as specified. |

2.03 MACHINE ROOM EQUIPMENT

- A. Provide equipment to fit space conditions shown.
- B. Geared traction machine: Worm geared traction type with brake, worm, gear and sheave mounted on a common bedplate. Provide ball or roller type bearings arranged to eliminate backlash. Provide vibration isolation, of an approved type, which shall effectively prevent transmission of machine vibration to the building structure.[Provide "A" frame type mounting for the machine and deflector.]
- C. Motor: The hoisting motor shall be, Alternating current type, rated NEMA "D" and Type "F" insulation or better and designed to develop high starting torque with low starting current.
- D. Power Conversion and Regulation Unit: Provide solid state motor drive. Solid state units shall be designed to limit current, suppress airborne or structural noise, and shall limit the overall distortion factor at the point of connection of the elevator convertor feeders to the electrical distribution system to a maximum of 3 percent. This shall include compensation for harmonic distortion, power factor, flicker and line notching. The elevator contractor shall be responsible for furnishing any electrical changes or upgrades required if power conversion system other than specified is provided.
- E.. Isolation Transformer: Provide necessary isolation transformers, reactors, capacitors and other devices to limit the overall Distortion Factor at the point of connection of the elevator converter feeders to the electrical distribution system to a maximum of 3 percent. This shall include compensation for the following:
 - 1. Harmonic Distortion
 - 2. Power Factor
 - 3. Flicker
 - 4. Line Notching
- F. Controller: Provide enclosed controller panels with ventilated cabinets and hinged or removable doors. Provide permanently marked symbols or letters identical to those on wiring diagrams adjacent to each component. Cabinets shall be designed for wall or machine mounting.
- G. Selectors: Relay, solid state or moving crosshead type electrically or mechanically coupled to car.
- H. Encoder: Provide solid-state, optical, digital-count type, mechanically coupled to car via a slotted tape with drive sheaves and a pit-tensioning sheave or driven from the car governor. Optical, inductive pulse or mechanical target-type tape encoder mounted in the hoistway is acceptable.

- I. Machine Beams: Provide steel beams, channels and bearing plates to support machine, governors and rope hitches. Include any required clip angles, tie rods, etc. as required.

NOTE: INCLUDE "K" WHERE OFFSET OR BASEMENT APPLICATION.

- K. Foundation bolts and templates: Provide template, foundation bolts and hardware for foundation mounting.
- L. [Deflector Sheaves: Provide steel machined and grooved for diameter of ropes and supported by an "A Frame" type mounting. Provide cable guards designed to withstand shock and prevent ropes from leaving their proper grooves. All bearings are to be shielded or sealed.]
- M. Sleeves and Guards: Provide sleeves projecting 4" above concrete slabs for holes in machine room floor. Provide guards for sheaves, ropes and selector tape.

2.04 OPERATING SYSTEMS

A. Elevator Control System:

- 1. Provide a solid state microprocessor system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands, manufactured by Motion Control Engineering.

Control system shall be non-proprietary in all respects. Technical support shall be available to without cost, regardless of who is providing ongoing maintenance support. System shall incorporate on-board diagnostics as part of the standard control design. Use of portable or removal diagnostic equipment is unacceptable.

No specifications, drawings, sketches, models, samples, tools, computer programs, technical information or data, written, oral or otherwise, furnished by Contractor to SI as part of this proposed project or in contemplation hereof shall be considered by Seller to be confidential or proprietary.

Nothing in this specification is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability and safety over those prescribed in this specification. Technical documentation shall be submitted to OEDC/OFMR and Elevator staff to determine equivalency. The system, method, or device shall be approved for the intended purpose by the OEDC/OFMR Engineering and Elevator staff prior to being utilized.

- a. Elevator shall operate as simplex selective collective.
 - (1) Momentary pressure of car or hall button, other than landing at which car is parked, shall automatically start car and dispatch the car to the corresponding floor for which that call was registered. If a call is registered at the floor when the car is idle, the doors shall automatically open.
 - (2) When the direction of travel has been established, the car shall answer all calls corresponding to the direction of travel and shall not reverse direction until all car and hall calls, in that direction, have been

answered.

- (3) Calls registered for the opposite direction of car travel shall remain registered and shall be answered after car has completed its calls in the direction of travel.
- (4) If no car buttons are pressed, and car starts up in response to several down calls. The car shall answer highest down call first and then reverse to collect other down calls.
- (5) The car shall remain at the arrival floor for an adjustable interval to permit passenger transfer. Doors shall close after a predetermined interval after opening unless closing is interrupted by car door reversal device or door open button in car.

NOTE: USE WITH TWO ENTRANCES AT THE SAME FLOOR.

- (6) Where two entrances are provided at any one landing door operation shall be selective.
- b) Duplex Selective Collective:
- (1) With two cars in service, one car shall normally park at the main floor ("home car") with doors closed. The other car ("free car") shall park at landing last served with doors closed.
 - (2) The free car shall answer hall calls above or below the landing at which the car is standing, except main floor hall calls.
 - (3) When the free car is clearing calls, the home car shall respond to:
 - (a) A call registered on the home car buttons.
 - (b) An up hall call from the landing below the free car while the free car is traveling up.
 - (c) An up or down call registered from the landing above the free car while it is traveling down.
 - (d) Inability of the free car to clear all hall calls within approximately 40 seconds.
 - (4) Registration of car call button shall cause the car to start. The car shall respond to its own car calls and corridor calls, in the direction of travel, and in order in which the landings are reached.
 - (5) Only one car shall stop in response to any one hall call. The first car to complete all calls shall return to the main floor.
 - (6) The car shall remain at the arrival floor for an adjustable interval to permit passenger transfer. Doors shall close after a predetermined interval, unless the car is parked at the main floor, after opening, unless closing is interrupted by car door reversal device or door open button in

car.

NOTE: USE WITH TWO ENTRANCES AT THE SAME FLOOR

- (7) Where two entrances are provided at any one landing, door operation shall be selective.
- c) Group Supervisory System:
 - (1) Provide a closed loop, solid state microprocessor dispatch system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands:
 - (a) It shall provide for a continuously changing program of varying combinations when there are landing calls registered. These shall include components of incoming, outgoing, interfloor and special traffic in varying intensities.
 - (b) The main floor up call is to be given priority.
 - (c) The system shall have forecasting capabilities which will assign the desired degree of priority to any additional entrance floor.
 - (d) The system shall measure the call waiting times on all floors, and determine through forecasting whether the elevator on becoming vacant shall continue in the previous running direction or reverse and assist in concentrated interfloor traffic in specific areas of the building.
 - (e) The system shall constantly evaluate the service quality of all forecasted waiting times. The landing calls will be allocated by the process of optimization with no final assignment established until the total quality of passenger service is assessed.
 - (f) A light traffic mode is assumed when there are no registered landing calls within a preset time. During periods of traffic, elevators shall be parked in anticipation of new landing calls. At least one elevator is to be parked at the main floor. Other elevators can be parked at upper or lower floors, as previously stated. The elevators shall be parked with the doors closed. The need for parking shall be checked by the system at frequent intervals.
 - (g) With the increasing traffic intensity, a priority method of call assignments shall be initiated. Priority of service for landing calls is determined by the call waiting time in relation to the prevailing traffic condition. The system shall prevent waiting times that are excessive as compared to the traffic intensity.
 - (h) Peak type of demands shall be recognized by monitoring the total traffic flow including a predominance of car calls in one direction, a high intensity of landing calls in one direction, a

sudden high percentage of load increase when answering landing calls, main floor landing hall call intensities and departure of elevators from a designated floor with a predetermined load several times in a preset time.

- (i) When an up peak type of demand is recognized, the main floor up call is immediately classified as priority call. The first vacant elevator is always dispatched to the main floor, the dispatch of another vacant elevator to the main floor is subject to optimization by the computer and decisions depending on the degree of up intensity and the amount of traffic flow against main floor. When passengers enter the elevator, the elevator can start as the first car call has been registered. The doors shall, however, stay open as long as further passengers are detected entering the elevator. Once the car call has been registered, the control system shall dispatch another vacant elevator to the main floor, unless a vacant elevator is already there.
- (j) With an up peak traffic type of operation, the main traffic flow (incoming traffic) shall receive preferential service. The system shall continuously re-evaluate the traffic pattern, and adjust the group operation. If it detects a sudden simultaneous intensive down demand, it shall cancel the automatic return to the main floor.
- (k) When a down peak condition is recognized, the down call shall be served through the optimization process to provide efficient traffic handling. In extremely intense down traffic situations, the priority of the up calls is decreased to a preset value according to the main traffic flow preference system. The system shall provide equal service to every floor, even during exceptionally heavy down traffic.
- (l) The system operation shall continuously change by demand and shall not require forced system changes to provide optimum operation and call response.
- (m) Dispatch Protection: The system shall automatically provide dispatching in the event of failure of the primary system. A visible and audible alarm shall be provided to indicate loss of the dispatching computer.
- (n) Delayed Car Protection: The system shall automatically disassociate a car from the Group System in the event the car is delayed for a predetermined time. The car shall be automatically restored to the Group System when the cause of the delay has been eliminated.
- (o) Programmed Door Control: Separate adjustable times shall be provided for each car to establish minimum passenger transfer time for car stops, intermediate floor hall call stops and lobby floor stops. All timing shall be computerized to coincide with traffic demands.

- (p) Designated Parking: The system shall provide for cars to park as designated by the Group Controller or park at its last call.
- (q) Next Car: The car selected as next up at the lobby floor shall park with its door open. If an absence of calls exists, the door shall close automatically as commanded by the Group Controller.
- d) Swing Service Operation:
 - (1) Provide an inconspicuous jamb-mounted hall pushbutton for Elevator No. ____ at each floor.
 - (2) Provide a two-position key switch within the elevator service cabinet or within the Lobby Control Panel which activates the operation.
 - (a) This switch shall have its "OFF" and "ON" positions identified. The key shall be removable in both positions.
 - (3) The key switch in the "ON" position activates the swing service hall station and operation as follows:
 - (a) Elevator shall operate as simplex selective collective.
 - 1) Momentary pressure of car or hall button, other than landing at which car is parked, shall automatically start car and dispatch the car to the corresponding floor for which that call was registered. If a call is registered at the floor when the car is idle, the doors shall automatically open.
 - 2) When the direction of travel has been established, the car shall answer all calls corresponding to the direction of travel and shall not reverse direction until all car and hall calls, in that direction, have been answered.
 - 3) Calls registered for the opposite direction of car travel shall remain registered and shall be answered after car has completed its calls in the direction of travel.
 - 4) If no car buttons are pressed, and car starts up in response to several down calls, the car shall answer highest down call first and then reverse to collect other down calls.
 - 5) The car shall remain at the arrival floor for an adjustable interval to permit passenger transfer. Doors shall close after a predetermined interval after opening unless closing is interrupted by car door reversal device or door open button in car.

NOTE: USE WITH TWO ENTRANCES AT THE SAME FLOOR.

- 6) Where two entrances are provided at any one landing, door operation shall be selective.

- (b) The elevator shall only respond to the swing service hall station and not the group hall stations.
- 7) The key switch in the "OFF" position deactivates the swing service hall station and operation and returns the elevator to group operation.
- 8) Fire Service and Earthquake Operation override the swing service operation.

B. Tenant Security Operation:

- 1. Provide a card reader or proximity reader located adjacent to each hall pushbutton and the car pushbutton control panel or other location, as designated by COTR.
- 2. The insertion of a magnetic reader card or indication of a proximity reader card allows operation of the elevator system or pushbutton operation.
- 3. Fire Service and Earthquake Operation override the Security Service Operation.

C. Independent Service: Provide controls to remove elevator from normal operation and provide control of the elevator from car buttons only. Car shall travel at contract speed and shall not respond to corridor calls.

D. Car Top Operation: Provide per Code requirements.

E. Fire Service Emergency Recall Operation:

Phase I automatic recall of all elevator will only occur upon activation of smoke detectors in elevator lobbies, elevator machine rooms, and elevator hoistways. No other fire alarm initiating devices will cause elevator recall. The elevator will be recalled to either the primary or alternate floor upon activation of a smoke detector in an elevator machine room, hoistway, or lobby. All elevators in other elevator banks will remain operable. Additional feature of Phase I Emergency Recall Operation will include a three-position switch that shall be:

- 1. Provided only at the designated level for single elevators or for each group of elevators.
- 2. Labeled "Fire Recall" and its positions marked "Reset", "Off", and "On" (in that order) with the "Off" position as the center position.
- 3. Located in the lobby within sight of the elevators in that group and shall be readily accessible.

Phase II Emergency In-Car Operation shall be provided by installing a three-position ("off", "hold", and "on") fire service switch in each car. The switch shall be labeled and provided in the operating panel of each car and shall function in accordance with ASME A17.1 requirements.

The elevator cab shall be provided with a Fire Alarm speaker. The speaker will only be capable of broadcasting a live voice message from the building's fire alarm control panel.

A member of the OSHM fire protection engineer and OFMR Elevator Inspector shall witness the

final tests. Coordinate all testing with the required personnel. Each group of elevators shall be tested for phase I & II recall features. Both primary and alternate floor capture features will be tested for each group of elevators. All elevator lobby, machine room, and hoistway smoke detectors will be tested. Shunt trip test in each elevator machine room shall be tested by activation of the dedicated activation device. Any such repeated tests as required by the AHJ shall be done at no additional expense to the government.

F. Standby Power Panel and Operation:

1. Elevator Contractor shall provide all control wiring for automatic sequential lowering and emergency power operation of all elevators. At least one passenger and the service elevators will operate simultaneously at contract speed. Elevators shall automatically return to and park at main lobby with doors open. In the event an elevator is out of service, after a predetermined time, emergency power shall automatically switch to the next elevator in sequence. After all elevators have returned to the main lobby, the preselected elevators shall remain on emergency power. In the event a preselected elevator is out of service, the next available elevator shall automatically be selected to remain on emergency power operation.
2. Include all relays, auxiliary contacts and selector switches for emergency operation control and for motor starters in machine room.
3. Power wiring from emergency source and pre-signal wiring to emergency operating control provided by Electrical Contractor.
4. All relays shall automatically reset as emergency supply becomes available for each car.
5. Submit wiring diagrams for coordination.
6. Emergency operation shall be arranged such that the elevator system shall sense a loss of normal power at each automatic transfer switch on an individual basis. Upon power loss at one transfer switch (partial power failure), no more than one elevator served by that transfer switch shall be capable of operating at one time. Upon loss of power at more than one elevator transfer switch, the elevators shall be interlocked such that no more than the selected elevators may operate simultaneously from the emergency power system. Sensing contacts at each transfer switch and related wiring to each elevator machine room shall be by the Electrical Contractor. The Elevator Contractor shall coordinate with the Electrical Contractor to determine the type of sensing contacts required (normally open or normally closed) and the contact rating. Refer to the electrical drawings for number of transfer switches and elevators served.
7. Install panel as directed.
8. Machine Room Monitor: Provide a color monitor in each machine room capable of displaying status, position and critical items for trouble shooting the equipment.

G. Load Weighing: Provide automatic load weighing device set at approximately 80% of full load. The device when activated shall cause the elevator to bypass corridor calls and shall initiate dispatch of car at main terminal prior to elapse of normal dispatching interval. Provide adjustable setting from 50 - 80% of full load. Cross head deflection type is unacceptable.

H. False Call Canceling: Provide device to cancel all car calls when car loading is not equal to the number of calls registered.

- I. Door Hold Operation: Provide controls and a button within operating panel which shall hold the doors open for an adjustable period of 30 to 90 seconds.
- J. The following shall resume normal door operation:
 - 1. Activation of door close button.
 - 2. Activation of any floor button within the elevator.
 - 3. Expiration of time period.

2.05 HOISTWAY EQUIPMENT

- A. Guide Rails: Planed steel, standard T-sections. Extend rails from pit floor to underside of concrete slab or grating at top of hoistway.
- B. Buffer: Oil type with spring or gravity return. Provide struts, braces, inspection ladder and platform where needed.
- C. Sheaves: Provide steel machined and grooved for diameter of ropes and supported by steel beams or channels. Provide cable guards designed to withstand shock and prevent ropes from leaving their proper grooves. All bearings are to be shielded or sealed. Provide drip pans under deflector sheaves.

NOTE: FOR SPEEDS 450 FPM OR LESS WITH RISE 100 FEET OR MORE, USE CHAIN. FOR SPEEDS GREATER THAN 450 FPM, USE ROPE. FOR SPEEDS GREATER THAN 700 FPM, USE ROPE WITH TIE DOWN.

- D. Compensation: Encapsulated chain type. Provide pit guide rollers. Pad areas where chains may strike car or hoistway items.
- E. Compensation Sheaves: Machined grooved sheave assembly adequately secured to pit floor or buffer channels when required.
- F. Counterweights: Structural steel channel frame with metal filler weights. [Counterweight safeties required.] Provide metal guard as required by Code.
- G. Hoist and Governor Ropes: Provide 8 x 19 sealed construction traction steel type for the hoist ropes and 8 x 25 filler wire type for governor rope; fasten with adjustable shackles.
- H. Governor: Overhead centrifugal type, car [and counterweight] driven, with electrical shutdown switches.
- I. Safety: Flexible guide clamp, Type B. car [and counterweight].
- J. Automatic Terminal Stopping Device: Per Code.
- K. Wiring:
 - 1. Conductors: Provide copper insulated wiring with flame retarding and moisture resisting

- outer cover. Install in galvanized metal wireways and raceways. Conductors from shaft riser to door interlocks shall be SF-2 type or equal, maximum operating temperature 392 degrees F. All terminations shall be insulated to maintain integrity of wiring. Flexible conduit may be used for short connections. Provide at a minimum at least two RG59 coaxial cables and six twisted shielded pair. Provide 10% spare conductors throughout.
2. Trail Cables: UL labeled fire and moisture resistant outer braid and steel supporting strand. Provide four parts of shielded communication wires, coaxial cable and necessary car lighting circuits. Prevent cables from rubbing or chafing against hoistway or car items.
 3. Remote Wiring: Provide wiring between machine room, hoistway and remote locations of guard, security, and fire control panels.
 4. Work Light and Plug Receptacles: Provide on top and bottom of car with lamp guards.
- J. Provide fluorescent type convenience lighting mounted throughout the hoistway including the top and bottom of the elevator hoistway.

2.06 DOOR AND ENTRANCE EQUIPMENT

- A. General: Provide entrance assembly sub-frame at main lobby and standard entrances at all other landings with UL 1 1/2 hour rating.
- B. Frames: Fabricate frames from 12 gauge cold rolled furniture steel with bolted type construction at intermediate floors. A fireproof and sound-deadening material shall be applied to the unexposed side of each frame. Finish shall be no. 4 stainless steel above the lobby and baked enamel below the main lobby as selected by Architect. Provide entrances that are 8' – 0" high.
- C. Provide handicapped designations at a height of 60" above the floor.
 1. The plaques shall have light colored numerals on a black background. The numeral color is to be eggshell finish (11 to 19 degree gloss).
 2. Designations shall be flush with inconspicuous mechanical mounting.
- D. Provide elevator identification numbers on entrance at lobby.
- E. Sills: Provide nickel silver sills with a non-slip surface at all landings. The use of aluminum sills is not acceptable.
- F. Struts: Minimum 3 inch continuous hot rolled or formed steel angle with secure fastening to sill and floor beam above.
- G. Header: Minimum 3/16 inch thick formed steel designed to support hangers. Header shall be bolted to supporting struts.
- H. Hanger Cover Plates: Removable, full length No. 14 gauge steel. Covers shall be made in sections for convenient access to hangers.
- I. Fascia: No. 14 gauge steel plates extending from top of header to sill of door above, or beam above if there is no door opening. Provide continuous fascia if front hoistway walls are not built out where openings do not exist.

- J. Toe Guard: No. 14 gauge sheet steel.
- K. Dust Cover: No. 14 gauge sheet steel.
- L. Door Bumpers: Provide on vertical struts at top and bottom.
- M. Doors: Door panels shall be hollow metal flush door construction, 14 gauge furniture steel. Fill with fireproof, sound deadening material. Provide reinforcement by formed vertical sections running full height of door. Doors shall be provided with two removable, non-metallic gibs, located at the leading and trailing edge of the door panel. [Center opening doors shall be provided with full length rubber astragal at leading edge of each door.] Finish shall match entrance frames. There shall be no visible exposed or protruding fasteners. Door roller and mounting assemblies shall be detachable and/or removable from the door panels. Doors shall also be provided with a secondary retention means as required by ASME A17.1m, rule 2.11.11.8.
- N. Sight guards: Provide for each landing door panel, constructed of No. 14 gauge furniture steel. Finish to match doors. Landing designations shall be permanently applied to the inside of each door panel.
- O. Transom: Provide special transom assembly as shown on the architectural drawings for the main lobby and flush type transoms at all other landings. Material, construction and finish to match hoistway doors.
- P. Hanger: Provide two-point suspension sheave type with provisions for vertical and lateral adjustments. Sheaves shall be minimum 2 1/4 inch in diameter with sealed ball or roller bearings.
- Q. Tracks: Cold drawn steel shaped and finished to permit free movement of sheaves. Bottom of track shall be in contact with upthrust roller.
- R. Closer: Spring or spirator type.

2.7 CAR EQUIPMENT

- A. Car Frame: Welded or bolted steel channel construction.
- B. Platform: Isolated type, steel frame with steel or wood subfloor, fireproof on underside.
- C. Guide Shoes: Roller type with three or more sound-deadening rollers with adjustable springs or other method to maintain rail contact.
- D. Sill: Provide new, nickel silver type car sills with a non-slip surface.
- E. Toe Guard: Per Code.
- F. Hangers and tracks: Same as hoistway entrance doors hangers and tracks.
- G. Floor covering: Prepare for 3" flooring thickness and 10# per square foot. If final cab flooring is less than 3" then void shall be filled to allow for future changes without modifying the car sill height.
- H. Door Protection: The leading edge of the electronic detector device shall illuminate GREEN

when opening, RED when closing and flash 5 seconds prior to closing.

1. Electronic Entrance Detector Screen: Provide an electronic door edge device which projects an infrared curtain of light guarding the door opening. Arrange to reopen doors if one beam of the curtain is penetrated. Unit shall have Transmitters and Receivers spaced at a minimum distance to provide the maximum amount of protection within the height of the doorway. Systems which have the availability to turn Off or On individual zones within the curtain will not be allowed.
 2. Differential door timing feature: Provide adjustable timers to vary the time that the doors remain open in response to a car or hall call. The doors shall remain open for one second in response to a car call and five to eight seconds for a hall call. This time shall be reduced to 1/2 second if the proximity detector is interrupted. The doors shall remain open as long as passengers are crossing the threshold.
 3. Nudging: When doors are prevented from closing for 20 seconds due to failure of the entrance detector or obstruction, the doors shall close at reduced speed and a buzzer shall sound.
- I. Door Operator: Provide a high speed, heavy duty, closed loop type master electric power door operator to automatically open and close the car and hoistway doors. The doors shall be capable of smooth and quiet operation without slam or shock.
1. Opening speed shall not be less than 3.0 f.p.s. with reversal in no more than 2 1/2 inches.
 2. Hoistway doors shall be automatically closed by an auxiliary closing device if car leaves the landing zone.
 3. In case of power interruption, it shall be possible to manually operate car and hoistway doors from inside the cab.
 4. Provide door safety retainers and restricted opening of car doors in accordance with Code requirements.
- J. Car Door Contacts: Electrical contacts shall prevent the operation of the elevator by normal operating devices unless car doors are closed or within tolerances allowed by Code.
- K. Car Enclosure: Car enclosure shall be manufactured by a SI approved company. Cab finishes shall be designed with heavy duty and durable finishes. Provide the following features:
1. General: The enclosure shall be adequately reinforced and ventilated to meet all the Code requirements. Provide sound-deadening mastic to exterior. Provide manufacturer's standard steel shell.
 2. Shell: Sides and back shall be 14 gauge sheet steel with baked enamel interior finish. Baked enamel color as selected by the Architect. Arrange shell to accept interior panels as noted in Architectural Drawings.
 3. Canopy: Provide 9'-4" clear height under canopy. Reinforced 12 gauge furniture steel. Underside painted baked enamel reflective white. Arrange for hinged top emergency exit including lock as required by Code.
 4. Front return panels and entrance columns: 14 gauge sheet steel Return panel shall be

swing type to allow access to car station wiring and fixtures. Provide cabinets for special operating features and telephone required by these specifications. Finish shall be as noted in Architectural Drawings.

5. Transom: 14 gauge sheet steel finish to match front return panels and entrance columns. Finish shall be as noted in Architectural Drawings.
6. Car door panels: Same construction as hoistway door panel. Finish shall be as noted in Architectural Drawings.
7. Pads and Hooks: Provide pad hooks and pads. Pad hooks shall be conspicuous type (buttons) at front return panels and at sides and rear walls. Mount pad hooks at sides and rear above suspended ceiling line. Pads shall cover all walls and front return panels.
8. Ventilation: Two-speed exhaust fan.

2.08 SIGNALS AND FIXTURES

- A. Provide "Vandal Resistant" custom signal fixtures. The intent is not to furnish the new state-of-the-art plastic bezel mounting design. Provide vandal resistant type pushbutton modules manufactured by Innovation Industries push button style PB-23. Provide LED type illumination in all pushbuttons.
- B. Car Operating Panels:
 1. Provide two car operating panels. The use of swing return panels shall not be permitted. Panels shall have vandal resistant type LED illuminating pushbuttons numbered to conform to floors served. Buttons shall light to show registration and extinguish when car stops in response to a call. The panels shall include an emergency stop switch, alarm bell button, DOOR OPEN and DOOR CLOSE and DOOR HOLD button. All operating controls shall be located no higher than 54" for side approach and 48" for front approach above the car floor, (35" for stop switch and alarm button). Provide fire service operating cabinet and all required control features within the main car panel in accordance with Code requirements. Braille/Arabic designations shall be flush with inconspicuous mechanical mounting.

Provide an Independent service key switch within the face of the car pushbutton station.
 2. All fire service key switches shall utilize a FEOK1 key switch and all other keying for equipment shall utilize a "J Series" key switch. Cabinet shall contain the following key type controls:
 - a. A light switch.
 - b. Two speed fan switch.
 - c. Inspection switch, conforming to ASME Code.
 - d. Emergency Stop switch.
 - e. Emergency Light Test Switch

3. Engrave the car operating panels with the following:
 - a. No Smoking.
 - b. Elevator Number over operating buttons.
 - c. Elevator Capacity.
 - d. Fire Service Instructions
- C. Car Position Indicator: Provide digital readout type with 2" high (minimum) indications over each operating panel.
- D. Hall Buttons: Provide one riser of hall pushbuttons. Station shall include flush mounted faceplate. Centerline of riser to be at 3'-6" above the finished floor. Finish shall be stainless steel No. 4 satin finish. Fire signs shall be integral within the faceplate. Provide vandal resistant type pushbuttons and incorporate fire service devices and signage in lobby stations.
- E. Combination Hall Position Indicators and Direction Lanterns: Provide UP and DOWN lanterns with digital readout type position indicator with 2" high (minimum) indications at intermediate landings, single lantern at terminal landings. Gongs for each lantern shall sound once for the up direction of travel and twice for the down direction of travel. The lantern shall illuminate for corresponding direction of car travel and the gong shall sound when the elevator is at a predetermined distance from the scheduled floor stop. The design and location of the hall lanterns shall be as selected. Faceplate material to be identical to hall button faceplate.
- F. Hoistway Access Switch: Mount with faceplate adjacent to entrance frame side jamb at all top and bottom terminal landings. Activation of the hoistway access switch shall initiate a call to feature that allowing the elevator mechanic to call the car directly from either landing. Faceplate to match hall button finish.
- G. Emergency Car Lighting and Alarm System: Provide in each car station an Emergency Light Unit consisting of two (2) LED type units. Unit shall provide emergency light in car upon failure or interruption of normal car lighting. Emergency lighting unit shall provide a minimum illumination of 0.2 foot-candle at 4 feet above car floor approximately 1 foot in front of car operating panel for not less than 4 hours. Battery shall be 6 volt minimum, sealed rechargeable lead acid or equal. Battery charger shall be capable of restoring battery to full charge within 16 hours after resumption of normal power. Provide an external means for testing battery, lamps, and alarm bell.
- H. Building Lobby Control Panel: Provide digital readout type traffic direction, key switches and special operation devices for each elevator. Panel shall contain position and direction indicators, corridor call indicator for each direction and shall be located at the main lobby entrance desk.
- I. Elevator Fire Control Panel: Provide a common control panel for all elevators, locate as directed. Panel to contain a digital readout type position and direction indicator per elevator; Fireman's return switch per group or individual elevator as required; a jewel to indicate if doors are open at the fire egress floor per elevator; in car fire service jewel per elevator; space for fireman's phone jack; a cabinet containing the in car fire service keys with instructions for fire service operation and emergency power selector switches and status indicators. Use of CRT monitors is unacceptable.
- J. Machine Room Monitors: Provide a monitor in each machine room capable of displaying status,

position and critical items for trouble shooting the equipment.

- K. Voice Annunciator: Provide a new voice annunciator manufactured by CE Electronics, Inc. Provide a unit with the following voice messages in a female voice.
1. Name of floor and direction of travel. *"Second Floor, Going Up"*.
 2. This elevator is now in fire return. When the doors open, please exit the building in a safe and orderly manner.
 3. Please stand clear of the closing doors.
 4. This elevator is on independent service.
 5. This car is in overload status. Please remove part of the load to resume service.
 6. This elevator is now on emergency power and the car is returning to the main level.
 7. This car is now on inspection service.
 8. The seismic sensor has been activated. Please exit the elevator when the doors open.
 9. This elevator is needed because of an emergency. Please exit the elevator when the doors open.

2.09 COMMUNICATION SYSTEM:

- A. Telephone System: Provide telephone integral with car operating panel. Provide automatic dial telephone station located in the car station. Activation of auto dialer shall be by a button suitably identified for the visually impaired. Speaker shall be mounted without faceplate or visible fasteners and located behind the control station. Communication shall be capable of being heard from any location within the car enclosure. The telephone should be programmed to automatically dial the Building's OPS Security Office.
1. Provide a telephone symbol minimum 2 inch high, and raised 1/32 inch with Braille indications adjacent to a separate activation button mounted on the control panel.
 2. Provide engraved emergency instructions above the activation button. Instructions shall read: "TO USE EMERGENCY TELEPHONE, PRESS BUTTON BELOW. DIALING WILL OCCUR AUTOMATICALLY. Identical instructions in Braille shall be provide below the engraved instructions.
 3. Provide a visual indication, approximately 3/4 inch in diameter, or a jewel that illuminates once a call has been received by the master station. Instructions under the visual indicator or within the lighted jewel shall read: "CALL HAS BEEN RECEIVED".
- B. Provide wiring from car to telephone terminal box in elevator machine room.
- C. Provide installation of Fire alarm speaker provided by others within the elevator cab. Provide wiring from car to Fire alarm junction box in machine room.

- D. Provide a system that allows for two way communication between the elevator car and machine room in accordance with ASME A17.1, rule 2.27.1.1.4.

III. PART 3 - EXECUTION

3.01 EXAMINATION

- A. The elevator contractor shall examine the supporting structure and the conditions under which the work shall be installed and notify the COTR of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected and are acceptable.
- B. Verify dimensions of supporting structure at the site by accurate field measurements. The work shall be accurately fabricated and fitted to the structure. Elevator contractor shall confirm by review of the working drawings and field observation that the clearances and the alignments are proper for the installation of this work.
- C. Coordinate work with the work of other trades, and provide items to be placed during the installation at the proper time to avoid delays in the overall work. Use bench marks where necessary.

3.02 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Perform as required by Code and as required by authorities having jurisdiction.
 - 2. Provide labor, materials, equipment and connections.
 - 3. Repair or replace defective work as required.
 - 4. Pay for restoring or replacing damaged work due to tests.
- B. Final Inspection: When all work is completed, and tested, notify the COTR in writing that the elevator is ready for final inspection and acceptance test. A testing and inspection date shall then be arranged. The proper operation of every part of the elevator system and compliance with contract requirements of the Code, shall be demonstrated to the COTR. Furnish all test instruments, weights, and materials, required at the time of final inspection.
 - 1. Final System Tests for Smoke Detection/Fire Elevator Recall: After work is completed, conduct a final test of entire system. Submit results on approved test report forms.
 - 2. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected the COTR shall be notified and the elevator shall be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

If deficiencies are found, or if the consultant/COTR deems it to be necessary the contractor shall

perform the following tests at no additional charge immediately following the final inspection.

3. Test Period: The elevator shall be subjected to a test for a period of one hour continuous run, with full specified load in the car. During the test run, the car shall be stopped at all floors in both directions of travel for a standing period of 10 seconds per floor.
4. Speed Load Tests: The actual speed of the elevator car shall be determined in both directions of travel with full contract load and with no load in the elevator car. Speed shall be determined by a tachometer. The actual measured speed of elevator car with full load shall be within 5% of rated speed. The maximum difference in actual measured speeds obtained under the various conditions outlined between the "UP" and the "DOWN" directions shall be checked.
5. Floor-to-floor times with no load in the car, balanced load in the car and full load in the car shall be checked.
6. Car Leveling Tests: Elevator car leveling devices shall be tested for accuracy of landing at all floors with no load in the car, balanced load in the car and full load in the car, in both directions of travel. Accuracy of floor landing (plus or minus 1/4 inch) shall be determined both before and after the full-load run test.
7. Insulation Resistance Tests: The complete wiring systems of the elevator shall be free from short circuits and grounds, and the insulation resistance shall be determined by use of a "Megger." Conductors shall have a insulation resistance of not less than one megohm between each conductor and ground and between each conductor and all other conductors.
8. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected. The COTR shall be notified and the elevator shall be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

3.04 ADJUSTING, PAINTING AND CLEANING

- A. All equipment shall be adjusted prior to final testing and acceptance.
- B. Paint exposed work soiled or damaged during installation. Repair to match adjoining work prior to final acceptance. At a minimum all hoistway and machine room components shall be painted in the field with at least one coat of machine grade enamel. The intent is to provide a complete final product that is neat, clean and painted.
- C. Contractor shall clean and paint the machine room walls and floor with an epoxy based paint as selected by the Contracting Officer.
- D. Contractor shall patch any and all damage to the hoistway walls after demolition. Hoistway shall be painted white to improve effectiveness of lighting when working in the hoistway.

3.05 INSTRUCTIONS

Upon completion of all work, the Elevator Contractor shall provide a training session. Instructions shall be given by competent supervisory personnel and shall apply to actual field conditions. The instructions shall cover, but shall not be limited to the following:

- A. Operation of elevators under emergency conditions.
- B. Operation and maintenance of smoke detector and elevator fire recall system.
- C. Operation of elevator communication, electronic entrance detector, hoistway access devices, etc.

END OF SECTION

SECTION 14215 – ELECTRIC TRACTION FREIGHT ELEVATOR

I. PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope: Provide materials, labor, and services necessary for the complete installation of one heavy duty traction freight elevator, designed for Class C-1 loading and designed to Smithsonian standards as shown and specified. To ensure that elevators comply with specifications and installation procedures in the standards, the A/E shall retain the services of an elevator consulting firm to provide design, specification and construction/inspection services.
- B. Related work by other trades:
 - 1. Hoistway, pit and machine room modifications and construction.
 - 2. Lighting and ventilation of pit, hoistway and machine room of a minimum level of 100 lx (10 fc) in the hoistway and 200 lx (19 fc) in the machine room.
 - 3. Access ladder and guards.
 - 4. Supports for guide rail brackets, buffers and entrance installation.
 - 5. Installation of pipe sleeves.
 - 6. Installation of guide rail mounting.
 - 7. Electric feeders to fused lockable disconnect switches to elevator starter or control panels, electric circuits to disconnect switches and to elevator relay panels. Circuit breakers are unacceptable for use as disconnect switches.
 - 8. Conduit to remote locations for elevator intercommunication and alarm systems.
 - 9. Indicated or required chases and openings.
 - 10. Finish painting except as noted.
 - 11. Guarding and protecting hoistway during construction.
 - 12. Storage space for tools and materials.
 - 13. Electric power for testing and adjusting equipment.
 - 14. Telephone wiring to control panels.
 - 15. Signal from fire alarm system.
 - 16. Installation of elevator pit sump pump, sump pump crock and all necessary piping and

wiring. The use of drains shall not be acceptable.

1.02 REFERENCES

A. Applicable Codes (Latest Edition)

1. American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.1).
2. International Building Code (IBC)
3. American National Standard Specification for Making Buildings and Facilities Accessible to and Usable By Physically Handicapped People (ANSI A117.1).
4. GSA "Facilities Standards for the Public Buildings Service – PBS P-100. Latest edition as accepted by GSA.
5. National Elevator Industry, Incorporated (NEII) Building Transportation Standards and Guidelines.
6. National Electric Code (NFPA 70).
7. United States Department of Labor – Occupational Safety & Health Administration (OSHA).
8. Local codes.

1.03 DEFINITIONS

- A. "Provide": to furnish and install, complete for safe operation, unless specifically indicated otherwise.
- B. "Install": to erect, mount and connect complete with related accessories.
- C. "Supply": to purchase, procure, acquire and deliver complete with related accessories.
- D. "Work": labor and materials required for proper and complete installation.
- E. "Wiring": raceway, fittings, wire, boxes, and related items.
- F. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions or above hung ceilings, in trenches, in crawl spaces or in enclosures.
- G. "Exposed": not installed underground or "concealed" as defined above.
- H. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or as specified.
- I. "Similar," "or" "equal": to base bid manufacturer, equal in materials, weight, size, design and efficiency of specified product, conforming to "Acceptable manufacturers."

- J. "Reviewed," "satisfactory," "accepted," "or" "directed": as reviewed, satisfactory, accepted or directed, by or to SI.

1.04 OPERATION PERFORMANCE

- A. The control system shall provide smooth acceleration and deceleration with 1/8" leveling accuracy at all landings from no load to full rated load in the elevator.
- B. The door open time shall be ____ seconds measured from start of door open to fully open.
- C. The speed of the elevator shall not vary +/- 5% under loading conditions.
- D. Prior to final acceptance and prior to the termination of the maintenance period, the elevators shall be adjusted as required to meet these performance requirements.

1.05 SUBMITTALS

- A. Shop Drawings and Samples:
1. Shop Drawings: Provide complete shop drawings, to scale. Include layouts of pits, machine rooms, overhead requirements, power and heat data for all equipment, static and impact loads, reaction points and required clearances. Provide manufacturers standard catalog literature and brochures of all components scheduled for use as part of this project. Provide cab and fixture drawings.
 2. Samples: Materials and finishes exposed to public view, 6" by 6" panels or 12" lengths as applicable.
 3. Partial or incomplete submittal packages will be rejected and returned without comment.
 4. Provide a standard submittal register that identifies all items scheduled for submittal and required by this section. Arrange register by specification section and item number for project tracking and coordination. Contractor should provide a submittal package with tabs or notes that clearly identify the information submitted, where it is located and whether that information has been modified and/or updated since the previous submissions in order to expedite the review process and to encourage a collaborative effort.
 5. LEED Submittals
 - a. Product data for EQ 4.1: For adhesives and sealants applied within the building waterproofing envelope, documentation indicating VOC content in g/L.
 - b. Product data for Credit EQ 4.2: For paints and coatings applied within the building waterproofing membrane, documentation indicating VOC content in g/L.
 - c. Product data for Credit EQ 4.4: For composite wood and laminating adhesives, documentation indicating no urea formaldehyde.
- B. Equipment Brochure and Service Manuals:

1. Before acceptance of work, furnish three sets of manufacturer's equipment brochures and service manuals. Assemble manuals in chronological order according to the specification alpha-numerical system. Provide manufacturer's standard binders consisting of:
 - a. Equipment and components, descriptive literature.
 - b. Performance data, model number.
 - c. Installation instructions.
 - d. Operating instructions and technical field adjustment manuals.
 - e. Maintenance and repair instructions.
 - f. Spare parts lists.
 - g. Lubrication instructions.
 - h. Detailed, record and as-built layout drawings.
 - i. Detailed, simplified, one line, wiring diagrams. Provide one complete set per manual.
 - j. Field test reports.
 - k. Submit valve tag chart indicating size, type, location, system and number of all valves.
- C. Machine Room Prints. Provide three complete sets of "as-built" field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway as well as the machine room. One set of these diagrams shall be laminated and mounted in the elevator machine room as directed.
- D. Keys: Five (5) sets of keys and key tags to operate all key switches and locks shall be furnished upon completion of work. All keys shall be designed to work with the SI's in house key system.

1.06 QUALITY ASSURANCE

- A. Quality and gauges of materials:
 1. New, best of their respective kinds, free from defects.
 2. Materials, equipment of similar application; same manufacturer, unless otherwise noted.
 3. Gauges as noted.
 4. Steel

- a) Commercial-quality carbon steel that is stretcher-leveled and cold rolled shall be used for exposed work. Such steel must comply with ASTM 366.
 - b) Commercial-quality carbon steel that is hot-rolled shall be used for concealed work. Such steel must comply with ASTM 568 and ASTM 569.
5. Stainless steel: Type 302 or Type 304 that complies with ASTM 167 shall be chosen as follows:
 - a) No. 4 finish: Satin finish.
 - b) No. 8 finish: Mirror finish.
 - c) Textured: Patterned type with .050-inch mean pattern depth with satin finish.
6. Bronze materials shall be constructed of stretcher-leveled sheets with 60 percent copper and 40 percent zinc that are similar to Muntz Metal, Alloy Group #2. After cleaning, spray with one coat of clear lacquer.
7. Aluminum extrusions shall comply with ASTM B221 requirements. Sheet and plate shall comply with ASTM B209 requirements.
8. Plastic laminate shall comply with ASTM E 84 Class A fire-rated grade (GP- 50), and as follows:
 - a) The COTR shall select the appropriate color for exposed surfaces.
 - b) Use the manufacturer's standard for plastic laminate on non-exposed surfaces.
9. Fire retardant particleboard panels shall have a minimum of 3/4-inch thick backup for natural veneer or plastic laminated panels.
10. Paint
 - a) Clean exposed surface of oil, grease and scale.
 - b) Apply one coat of rust-resistant mineral paint and one coat of finish enamel.
 - c) Paint pit floor and machine floor room with a water based epoxy Rust-Oleum Concrete Saver Water-Based Epoxy (6000 System) or approved equal.
11. Laminated safety glass shall comply with ANSI Z.97.1 and CPSC 16 CFR, part 1201.
12. Non-Shrink Grout: Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 4000 PSI at 28 days.
13. Fire Resistance: Treat wood components with fire-retardant treatment conforming to requirements of authorities having jurisdiction and to achieve flame spread rating of 25, ASTM E84.

- a) Protect electric wiring with flame retardant and moisture resistant outer covering, run in conduit, tubing or electrical wire ways.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship in original crated sections of a size to permit passage through available space.
- B. Obtain approval and schedule delivery of material to meet SI's requirements.
- C. Storage of equipment and materials shall be coordinated with COTR.

1.08 WARRANTY

- A. The elevators and associated equipment shall be free of defective material, imperfect work and faulty operation not due to ordinary wear and tear or improper use or care, for a period of one year from final acceptance and substantial completion of the project. Defective work shall be repaired or replaced at no additional cost to SI.

1.09 MAINTENANCE SERVICE

Maintenance service shall be performed in accordance with the requirements listed below for the duration of warranty period and then the units shall be placed under the existing master maintenance agreement currently in place:

- A. It is the intent of the Smithsonian Institution to provide the best possible coverage to maximize equipment up-time during the hours that the Museums are open to the public and staff, and to correct, repair and minimize interruptions to normal Smithsonian Institution business. The Contractor shall arrange their work hours and schedules to meet the performance requirements of this contract. Museums are generally open to the public seven days a week from 10:00 AM to 6:00 PM, excluding Christmas Day. Museum hours will vary seasonally with extended summer hours that occasionally keep the Museums open later during the evening. Museum and Administration staff office hours are generally from 6:00 AM to 6:00 PM Monday through Friday, except holidays. Holidays for Smithsonian Institution employees include New Years Day, Martin Luther King Day, Presidents Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, and Christmas Day
- B. Routine, Emergency and Entrapment Callbacks.
 - 1. The Contractor shall provide seven (7) days a week, twenty-four (24) hour callback service consisting of a prompt response to requests from designated Smithsonian Institution representatives including the COTR or their designated representative and on-site OPS Security personnel at any hour, any day, including weekends and holidays. Callback services are defined as any request for repairs, inspections, adjustments, and entrapment calls for equipment. The Callback Responder shall acknowledge the request by returning the call within ten (10) minutes of receipt, and provide an estimated time of arrival.

2. The Contractor shall ensure that the responding technician is qualified, trained, certified and has the ability to repair and correct the inventory equipment for which the callback was placed.
3. All Entrapment Callbacks shall be treated as an emergency and shall be responded to immediately to extricate passengers. All callbacks for equipment within the Museums during museum and staff hours shall be considered an Emergency Callback and shall be responded to immediately including all Special Events. Emergency Callbacks shall also include safety related concerns and be responded to immediately to correct hazardous situations and prevent further damage to the equipment inventory and/or facilities.
4. Routine Callbacks shall include responding to non-safety, or after hour repairs or outages.
5. The Contractor shall respond to all callbacks to ensure the condition that caused the callback is corrected as quickly as possible and the unit is returned back to service prior to the departure of the responding technician. No equipment shall be left out of service unless due to the repair being beyond the ability of the responding technician for reasons such as; an after hour call where there is a lack of additional and available personnel to assist in the completion of the repair or the lack of parts or material available to complete the repair.
6. In the event of these circumstances, the responding technician shall Lock Out/Tag Out (LO/TO) the out of service equipment until the repairs can be made. The responding technician shall report all findings, corrections or deficiencies to the on-site OPS Security personnel in accordance with the contract reporting requirements as soon as possible and prior to departure. The responding technician shall also immediately report all such findings, deficiencies and/or corrective actions to the Project Manager. The Project Manager shall report to the COTR the status of the findings, deficiencies and corrections. If the equipment is left out of service, the Project Manager shall report the findings, a schedule for repair and duration of the outage to the COTR immediately (if during normal business hours) or by the close of the following business day and no longer than twenty-four (24) hours of the callback, in order to allow the COTR to inform the Museum/Building occupants. The Project Manager shall also report to the COTR any change of status of such accordingly.
7. It is the intent of the Smithsonian Institution to insure that the responding callback technician arrives within the times that are listed below:
 - Entrapment Callback: Within thirty (30) minutes of receipt of call during working hours and one (1) hour during non working hours.
 - Emergency Callback (non-entrapment): Within one (1) hour during the regular working hours as determined by this Contract, and within two (2) hours after the regular working hours as determined by this Contract.
 - Routine, After Hours Callback: Sufficient time to place the unit back in service by the start of business the next day.

The response times required above shall be from the time the contractor receives initial notification to the time the responding technician arrives on-site.

8. When a callback is placed after regular work hours as defined by this contract, a time ticket/log shall be signed by the on-site OPS Security personnel or a designated

Smithsonian Institution Representative. The time ticket/log shall be provided by the Contractor and shall include but not be limited to the time the callback was placed, the time of the technician's arrival, the time of the technician's departure, a description of the complaint/deficiency, a description of correction or service provided, date, equipment number and building/facility. A copy of the time ticket/log must be provided to the on-site OPS Security personnel or a designated Smithsonian Institution Representative. A copy shall be provided to the COTR upon request.

C. Maintenance Requirements:

1. On a monthly basis, regularly and systematically examine, adjust, lubricate, clean and, when conditions warrant, repair or replace the following items and all other mechanical or electrical equipment including but not limited to:
 - a. Hydraulic power unit and accessories: pump, motor, valves, operating valves, pulleys, drive belts, flexible hose and fitting assemblies, oil tank, muffler, strainer, sound isolating coupling, plunger, packing gland, scavenger system, piping and other components.
 - b. Controller, selector, and dispatching equipment: All components including all relays, solid state components, resistors, condensers, transformers, contacts, leads, computer devices, selector switches, mechanical or electrical driving equipment, coils, magnet frames, contact switch assemblies, springs, solenoids, resistance grids, hoistway vanes, magnets and inductors.
 - c. Hoistway door interlocks or locks and contacts, hoistway door hangers, tracks, bottom door gibs, cams, rollers and auxiliary door closing devices for power operated doors. Chains, tracks, cams, interlocks, sheaves for vertical bi-parting doors.
 - d. Hoistway limit switches, slowdown switches, leveling switches and associated cams, vanes and electronic components.
 - e. Guide shoes including rollers or replaceable guides.
 - f. Automatic power operated door operators, door protective devices, car door hangers, tracks and car door contacts.
 - g. Traveling cables.
 - h. Elevator control wiring in hoistway and machine room.
 - i. Buffers.
 - j. Fixture contacts, pushbuttons, key switches, locks, lamps and sockets or button stations (car and hall), hall lanterns, position indicators (car and hall), direction indicators.
 - k. The guide rails shall be kept free of rust and dry.

- I. Examine all safety devices, and conduct an annual no load test, and every fifth year perform a full load, full speed test of the buffers. The car balance shall be checked. All tests shall be performed in accordance with the provisions of the American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.2), current edition.
 - m. Furnish lubricants compounded specifically for elevator usage.
 2. The Elevator Contractor shall not be required to install new attachments on the elevator whether or not recommended or directed by insurance companies or by governmental authorities, nor make any replacements with parts of a different design. The Contractor shall not be required to make renewals or repairs necessitated by reason of negligence or misuse of the equipment or by reason of any other cause beyond the Contractor's control except ordinary wear and tear unless the Contractor receives just compensation.
 3. The Contractor shall check the group dispatching systems and make necessary tests to insure that all circuits and time settings are properly adjusted, and that the system performs as designed and installed.
 - C. Maintenance Responsibility:
 1. The Contractor shall keep the elevator maintained to operate at the original contract speed, keeping the original performance times, including acceleration and retardation as designed and installed by the manufacturer. The door operation shall be adjusted as required to maintain the original door opening and door closing times, within legal limits.
 2. The COTR reserves the right to make inspections and tests as and when deemed advisable. If it is found that the elevator and associated equipment are deficient either electrically or mechanically, the Contractor will be notified of these deficiencies in writing, and it shall be his responsibility to make corrections within 30 days after his receipt of such notice. In the event that the deficiencies have not been corrected within 30 days, SI may terminate the contract and employ a Contractor to make the corrections at the original bidder's expense.
 3. Approximately three months prior to the end of the contract term, the COTR will make a through maintenance inspection of all elevators covered under the contract. At the conclusion of this inspection, the COTR shall give the Contractor written notice of any deficiencies found. The Contractor shall be responsible for correction of these deficiencies within 30 days after receipt of such notice.
 - D. The COTR reserves the right to accept or reject any or all alternates.
 - E. Diagnostic Tools and Spare Parts: At the completion of the work as specified, the Contractor shall provide items listed. The items shall become SI's property.
 1. One complete set of all diagnostic tools and equipment required for the complete maintenance of all aspects of the control and dispatch system. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the serviceman and the controls. All such systems shall be free from secret codes and decaying circuits that must be periodically reprogrammed by the manufacturer.

- I. A list of vendors for all parts used in the installation.
 - II. Technical field adjustment manuals with all faults, service codes and nomenclature.
- F. Machine Room Log. The Contractor shall provide, create, manage, update and maintain a Machine Room Log for the inventory equipment to include but not be limited to records, data, maintenance, callbacks, repairs, oil usage, etc. according to the most recent ASME A17 series code and any other standard, directive, law or code applicable. The log shall include the date the service/inspection was performed, the technician that performed the work and any follow up requirements that were reported. The log shall remain in the Machine Rooms as required by applicable code. All required records and logs shall be the property of the Smithsonian Institution and shall be made available for examination on site at anytime by the COTR. Records and logs shall be maintained in a legible, complete, orderly, timely, and accurate manner at all times. The original records and logs shall be submitted to the COTR within 15 calendar days of expiration of the contract. Copies of the records and logs shall be provided to the COTR at anytime upon request.

1.10 ELECTRIC SERVICE

- A. Power: [TBD] volts, 3 phase, 60 hertz. Elevator Contractor to verify voltage.
- B. Lighting: 120 volts, 1 phase, 60 hertz.

II. PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Product of individuals, firms or corporations regularly engaged in manufacturing elevators comparable with the needs of this project and in satisfactory operation for a period of not less than five years.
- B. Qualified Bidders:
 - 1. Otis Elevator Company
 - 2. ThyssenKrupp Elevator Company
 - 3. KONE Elevator Company
 - 4. Schindler Elevator Company
 - 5. Independent installers of approved equal equipment.
- C. Approved Components:
 - 1. Elevator controller: Motion Control Engineering
 - 2. Elevator door operator (passenger): GAL MOVFR

3. Elevator door operator (freight): Peele
4. Fixtures: Innovation Industries, vandal resistant, Button style PB-23.
5. Elevator emergency telephone: EMS.
6. Infrared safety curtain: Janus Panachrome.

2.02 OUTLINE OF EQUIPMENT

- A. Elevator number: []
1. Elevator use: Freight, Class C-1 Loading
 2. Contract load, in pounds: []
 3. Contract speed, in fpm: [].
 4. Travel distance: [].
 5. Serves: []
 6. Number of stops: []
 7. Number of openings: [] – front, []- rear
 8. Machine location: Overhead
 9. Machine type: Geared.
 10. Operation: []
 11. Platform size: ___' - ___" wide by ___' - ___" deep
 12. Car and hoistway door size: ___' - ___" wide by ___' - ___" high
 13. Car and hoistway door type: Bi-Parting Freight
 14. Car and hoistway door operation: Power, heavy duty freight
 15. Hoistway entrance: As specified.
 16. Cab enclosure: As specified.
 17. Door-reversal device: Electronic detector and safe edge
 18. Car operating panel. As specified
 19. Auxiliary car operating panel. [].

- | | | |
|-----|--------------------------------------|--|
| 20. | Car position indicator (in car). | As specified. |
| 21. | Hall call stations. | Single riser. |
| 22. | Combination hall position indicator: | As specified. |
| 23. | Fire Control Panel: | As specified. |
| 24. | Self-Leveling. | As specified. |
| 25. | Communication system: | Telephone. |
| 26. | Signage: | All signage and engraving to be Helvetica Medium font. |
| 27. | Counterweight Safeties: | [Required] [Not Required]. |
| 28. | Loadweighing: | Provide as specified. |

2.03 MACHINE ROOM EQUIPMENT

- A. Provide equipment to fit space conditions shown.
- B. Geared traction machine: Worm geared traction type with brake, worm, gear and sheave mounted on a common bedplate. Provide ball or roller type bearings arranged to eliminate backlash. Provide vibration isolation, of an approved type, which shall effectively prevent transmission of machine vibration to the building structure.[Provide "A" frame type mounting for the machine and deflector.]
- C. Motor: The hoisting motor shall be, Alternating current type, rated NEMA "D" and Type "F" insulation or better and designed to develop high starting torque with low starting current.
- D. Power Conversion and Regulation Unit: Provide solid state motor drive. Solid state units shall be designed to limit current, suppress airborne or structural noise, and shall limit the overall distortion factor at the point of connection of the elevator converter feeders to the electrical distribution system to a maximum of 3 percent. This shall include compensation for harmonic distortion, power factor, flicker and line notching. The elevator contractor shall be responsible for furnishing any electrical changes or upgrades required if power conversion system other than specified is provided.
- E.. Isolation Transformer: Provide necessary isolation transformers, reactors, capacitors and other devices to limit the overall Distortion Factor at the point of connection of the elevator converter feeders to the electrical distribution system to a maximum of 3 percent. This shall include compensation for the following:
 - 1. Harmonic Distortion
 - 2. Power Factor
 - 3. Flicker

4. Line Notching

- F. Controller: Provide enclosed controller panels with ventilated cabinets and hinged or removable doors. Provide permanently marked symbols or letters identical to those on wiring diagrams adjacent to each component. Cabinets shall be designed for wall or machine mounting.
- G. Selectors: Relay, solid state or moving crosshead type electrically or mechanically coupled to car.
- H. Encoder: Provide solid-state, optical, digital-count type, mechanically coupled to car via a slotted tape with drive sheaves and a pit-tensioning sheave or driven from the car governor. Optical, inductive pulse or mechanical target-type tape encoder mounted in the hoistway is acceptable.
- I. Machine Beams: Provide steel beams, channels and bearing plates to support machine, governors and rope hitches. Include any required clip angles, tie rods, etc. as required.

NOTE: INCLUDE "K" WHERE OFFSET OR BASEMENT APPLICATION.

- K. Foundation bolts and templates: Provide template, foundation bolts and hardware for foundation mounting.
- L. [Deflector Sheaves: Provide steel machined and grooved for diameter of ropes and supported by an "A Frame" type mounting. Provide cable guards designed to withstand shock and prevent ropes from leaving their proper grooves. All bearings are to be shielded or sealed.]
- M. Sleeves and Guards: Provide sleeves projecting 4" above concrete slabs for holes in machine room floor. Provide guards for sheaves, ropes and selector tape.

2.04 OPERATING SYSTEMS

A. Elevator Control System:

1. Provide a solid state microprocessor system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands, manufactured by Motion Control Engineering.

Control system shall be non-proprietary in all respects. Technical support shall be available to without cost, regardless of who is providing ongoing maintenance support. System shall incorporate on-board diagnostics as part of the standard control design. Use of portable or removal diagnostic equipment is unacceptable.

No specifications, drawings, sketches, models, samples, tools, computer programs, technical information or data, written, oral or otherwise, furnished by Contractor to SI as part of this proposed project or in contemplation hereof shall be considered by Seller to be confidential or proprietary.

Nothing in this specification is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability and safety over those prescribed in this specification. Technical documentation shall be submitted to OEDC/OFMR and Elevator staff to determine equivalency. The system, method, or device shall be approved for the intended purpose by the OEDC/OFMR Engineering and Elevator staff prior to being utilized.

- a. Elevator shall operate as simplex selective collective.
 - (1) Momentary pressure of car or hall button, other than landing at which car is parked, shall automatically start car and dispatch the car to the corresponding floor for which that call was registered. If a call is registered at the floor when the car is idle, the doors shall automatically open.
 - (2) When the direction of travel has been established, the car shall answer all calls corresponding to the direction of travel and shall not reverse direction until all car and hall calls, in that direction, have been answered.
 - (3) Calls registered for the opposite direction of car travel shall remain registered and shall be answered after car has completed its calls in the direction of travel.
 - (4) If no car buttons are pressed, and car starts up in response to several down calls. The car shall answer highest down call first and then reverse to collect other down calls.
 - (5) The car shall remain at the arrival floor for an adjustable interval to permit passenger transfer. Doors shall close after a predetermined interval after opening unless closing is interrupted by car door reversal device or door open button in car.

NOTE: USE WITH TWO ENTRANCES AT THE SAME FLOOR.

- (6) Where two entrances are provided at any one landing door operation shall be selective.
- a) Duplex Selective Collective:
 - (1) With two cars in service, one car shall normally park at the main floor ("home car") with doors closed. The other car ("free car") shall park at landing last served with doors closed.
 - (2) The free car shall answer hall calls above or below the landing at which the car is standing, except main floor hall calls.
 - (3) When the free car is clearing calls, the home car shall respond to:
 - (a) A call registered on the home car buttons.
 - (b) An up hall call from the landing below the free car while the free car is traveling up.
 - (c) An up or down call registered from the landing above the free car while it is traveling down.
 - (d) Inability of the free car to clear all hall calls within approximately

40 seconds.

- (4) Registration of car call button shall cause the car to start. The car shall respond to its own car calls and corridor calls, in the direction of travel, and in order in which the landings are reached.
- (5) Only one car shall stop in response to any one hall call. The first car to complete all calls shall return to the main floor.
- (6) The car shall remain at the arrival floor for an adjustable interval to permit passenger transfer. Doors shall close after a predetermined interval, unless the car is parked at the main floor, after opening, unless closing is interrupted by car door reversal device or door open button in car.

NOTE: USE WITH TWO ENTRANCES AT THE SAME FLOOR

- (7) Where two entrances are provided at any one landing, door operation shall be selective.
- b) Group Supervisory System:
- (1) Provide a closed loop, solid state microprocessor dispatch system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands:
 - (a) It shall provide for a continuously changing program of varying combinations when there are landing calls registered. These shall include components of incoming, outgoing, interfloor and special traffic in varying intensities.
 - (b) The main floor up call is to be given priority.
 - (c) The system shall have forecasting capabilities which will assign the desired degree of priority to any additional entrance floor.
 - (d) The system shall measure the call waiting times on all floors, and determine through forecasting whether the elevator on becoming vacant shall continue in the previous running direction or reverse and assist in concentrated interfloor traffic in specific areas of the building.
 - (e) The system shall constantly evaluate the service quality of all forecasted waiting times. The landing calls will be allocated by the process of optimization with no final assignment established until the total quality of passenger service is assessed.
 - (f) A light traffic mode is assumed when there are no registered landing calls within a preset time. During periods of traffic, elevators shall be parked in anticipation of new landing calls. At least one elevator is to be parked at the main floor. Other elevators can be parked at upper or lower floors, as previously

stated. The elevators shall be parked with the doors closed. The need for parking shall be checked by the system at frequent intervals.

- (g) With the increasing traffic intensity, a priority method of call assignments shall be initiated. Priority of service for landing calls is determined by the call waiting time in relation to the prevailing traffic condition. The system shall prevent waiting times that are excessive as compared to the traffic intensity.
- (h) Peak type of demands shall be recognized by monitoring the total traffic flow including a predominance of car calls in one direction, a high intensity of landing calls in one direction, a sudden high percentage of load increase when answering landing calls, main floor landing hall call intensities and departure of elevators from a designated floor with a predetermined load several times in a preset time.
- (i) When an up peak type of demand is recognized, the main floor up call is immediately classified as priority call. The first vacant elevator is always dispatched to the main floor, the dispatch of another vacant elevator to the main floor is subject to optimization by the computer and decisions depending on the degree of up intensity and the amount of traffic flow against main floor. When passengers enter the elevator, the elevator can start as the first car call has been registered. The doors shall, however, stay open as long as further passengers are detected entering the elevator. Once the car call has been registered, the control system shall dispatch another vacant elevator to the main floor, unless a vacant elevator is already there.
- (j) With an up peak traffic type of operation, the main traffic flow (incoming traffic) shall receive preferential service. The system shall continuously re-evaluate the traffic pattern, and adjust the group operation. If it detects a sudden simultaneous intensive down demand, it shall cancel the automatic return to the main floor.
- (k) When a down peak condition is recognized, the down call shall be served through the optimization process to provide efficient traffic handling. In extremely intense down traffic situations, the priority of the up calls is decreased to a preset value according to the main traffic flow preference system. The system shall provide equal service to every floor, even during exceptionally heavy down traffic.
- (l) The system operation shall continuously change by demand and shall not require forced system changes to provide optimum operation and call response.
- (m) Dispatch Protection: The system shall automatically provide dispatching in the event of failure of the primary system. A visible and audible alarm shall be provided to indicate loss of the

dispatching computer.

- (n) Delayed Car Protection: The system shall automatically disassociate a car from the Group System in the event the car is delayed for a predetermined time. The car shall be automatically restored to the Group System when the cause of the delay has been eliminated.
 - (o) Programmed Door Control: Separate adjustable times shall be provided for each car to establish minimum passenger transfer time for car stops, intermediate floor hall call stops and lobby floor stops. All timing shall be computerized to coincide with traffic demands.
 - (p) Designated Parking: The system shall provide for cars to park as designated by the Group Controller or park at its last call.
 - (q) Next Car: The car selected as next up at the lobby floor shall park with its door open. If an absence of calls exists, the door shall close automatically as commanded by the Group Controller.
- c) Swing Service Operation:
- (1) Provide an inconspicuous jamb-mounted hall pushbutton for Elevator No. ____ at each floor.
 - (2) Provide a two-position key switch within the elevator service cabinet or within the Lobby Control Panel which activates the operation.
 - (a) This switch shall have its "OFF" and "ON" positions identified. The key shall be removable in both positions.
 - (3) The key switch in the "ON" position activates the swing service hall station and operation as follows:
 - (a) Elevator shall operate as simplex selective collective.
 - (i) Momentary pressure of car or hall button, other than landing at which car is parked, shall automatically start car and dispatch the car to the corresponding floor for which that call was registered. If a call is registered at the floor when the car is idle, the doors shall automatically open.
 - (ii) When the direction of travel has been established, the car shall answer all calls corresponding to the direction of travel and shall not reverse direction until all car and hall calls, in that direction, have been answered.
 - (iii) Calls registered for the opposite direction of car travel shall remain registered and shall be answered after car has completed its calls in the direction of travel.
 - (iv) If no car buttons are pressed, and car starts up in response to

several down calls, the car shall answer highest down call first and then reverse to collect other down calls.

- (v) The car shall remain at the arrival floor for an adjustable interval to permit passenger transfer. Doors shall close after a predetermined interval after opening unless closing is interrupted by car door reversal device or door open button in car.

NOTE: USE WITH TWO ENTRANCES AT THE SAME FLOOR.

- (vi) Where two entrances are provided at any one landing, door operation shall be selective.
- (b) The elevator shall only respond to the swing service hall station and not the group hall stations.
- (4) The key switch in the "OFF" position deactivates the swing service hall station and operation and returns the elevator to group operation.
- (5) Fire Service and Earthquake Operation override the swing service operation.

B. Tenant Security Operation:

1. Provide a card reader or proximity reader located adjacent to each hall pushbutton and the car pushbutton control panel or other location, as designated by COTR.
2. The insertion of a magnetic reader card or indication of a proximity reader card allows operation of the elevator system or pushbutton operation.
3. Fire Service and Earthquake Operation override the Security Service Operation.

C. Independent Service: Provide controls to remove elevator from normal operation and provide control of the elevator from car buttons only. Car shall travel at contract speed and shall not respond to corridor calls.

D. Car Top Operation: Provide per Code requirements.

E. Fire Service Emergency Recall Operation:

Phase I automatic recall of all elevator will only occur upon activation of smoke detectors in elevator lobbies, elevator machine rooms, and elevator hoistways. No other fire alarm initiating devices will cause elevator recall. The elevator will be recalled to either the primary or alternate floor upon activation of a smoke detector in an elevator machine room, hoistway, or lobby. All elevators in other elevator banks will remain operable. Additional feature of Phase I Emergency Recall Operation will include a three-position switch that shall be:

1. Provided only at the designated level for single elevators or for each group of elevators.
2. Labeled "Fire Recall" and its positions marked "Reset", "Off", and "On" (in that order) with

the "Off" position as the center position.

3. Located in the lobby within sight of the elevators in that group and shall be readily accessible.

Phase II Emergency In-Car Operation shall be provided by installing a three-position ("off", "hold", and "on") fire service switch in each car. The switch shall be labeled and provided in the operating panel of each car and shall function in accordance with ASME A17.1 requirements.

The elevator cab shall be provided with a Fire Alarm speaker. The speaker will only be capable of broadcasting a live voice message from the building's fire alarm control panel.

A member of the OSHM fire protection engineer and OFMR Elevator Inspector shall witness the final tests. Coordinate all testing with the required personnel. Each group of elevators shall be tested for phase I & II recall features. Both primary and alternate floor capture features will be tested for each group of elevators. All elevator lobby, machine room, and hoistway smoke detectors will be tested. Shunt trip test in each elevator machine room shall be tested by activation of the dedicated activation device. Any such repeated tests as required by the AHJ shall be done at no additional expense to the government.

F. Standby Power Panel and Operation:

1. Elevator Contractor shall provide all control wiring for automatic sequential lowering and emergency power operation of all elevators. At least one passenger and the service elevators will operate simultaneously at contract speed. Elevators shall automatically return to and park at main lobby with doors open. In the event an elevator is out of service, after a predetermined time, emergency power shall automatically switch to the next elevator in sequence. After all elevators have returned to the main lobby, the preselected elevators shall remain on emergency power. In the event a preselected elevator is out of service, the next available elevator shall automatically be selected to remain on emergency power operation.
2. Include all relays, auxiliary contacts and selector switches for emergency operation control and for motor starters in machine room.
3. Power wiring from emergency source and pre-signal wiring to emergency operating control provided by Electrical Contractor.
4. All relays shall automatically reset as emergency supply becomes available for each car.
5. Submit wiring diagrams for coordination.
6. Emergency operation shall be arranged such that the elevator system shall sense a loss of normal power at each automatic transfer switch on an individual basis. Upon power loss at one transfer switch (partial power failure), no more than one elevator served by that transfer switch shall be capable of operating at one time. Upon loss of power at more than one elevator transfer switch, the elevators shall be interlocked such that no more than the selected elevators may operate simultaneously from the emergency power system. Sensing contacts at each transfer switch and related wiring to each elevator machine room shall be by the Electrical Contractor. The Elevator Contractor shall coordinate with the Electrical Contractor to determine the type of sensing contacts required (normally open or normally closed) and the contact rating. Refer to the electrical

drawings for number of transfer switches and elevators served.

7. Install panel as directed.
8. Machine Room Monitor: Provide a color monitor in each machine room capable of displaying status, position and critical items for trouble shooting the equipment.
- G. Load Weighing: Provide automatic load weighing device set at approximately 80% of full load. The device when activated shall cause the elevator to bypass corridor calls and shall initiate dispatch of car at main terminal prior to elapse of normal dispatching interval. Provide adjustable setting from 50 - 80% of full load. Cross head deflection type is unacceptable.
- H. False Call Canceling: Provide device to cancel all car calls when car loading is not equal to the number of calls registered.
- I. Door Hold Operation: Provide controls and a button within operating panel which shall hold the doors open for an adjustable period of 30 to 90 seconds.
- J. The following shall resume normal door operation:
 1. Activation of door close button.
 2. Activation of any floor button within the elevator.
 3. Expiration of time period.

2.05 HOISTWAY EQUIPMENT

- A. Guide Rails: Planed steel, standard T-sections. Extend rails from pit floor to underside of concrete slab or grating at top of hoistway.
- B. Buffer: Oil type with spring or gravity return. Provide struts, braces, inspection ladder and platform where needed.
- C. Sheaves: Provide steel machined and grooved for diameter of ropes and supported by steel beams or channels. Provide cable guards designed to withstand shock and prevent ropes from leaving their proper grooves. All bearings are to be shielded or sealed. Provide drip pans under deflector sheaves.

NOTE: FOR SPEEDS 450 FPM OR LESS WITH RISE 100 FEET OR MORE, USE CHAIN. FOR SPEEDS GREATER THAN 450 FPM, USE ROPE. FOR SPEEDS GREATER THAN 700 FPM, USE ROPE WITH TIE DOWN.

- D. Compensation: Encapsulated chain type. Provide pit guide rollers. Pad areas where chains may strike car or hoistway items.
- E. Compensation Sheaves: Machined grooved sheave assembly adequately secured to pit floor or buffer channels when required.
- F. Counterweights: Structural steel channel frame with metal filler weights. [Counterweight safeties required.] Provide metal guard as required by Code.

- G. Hoist and Governor Ropes: Provide 8 x 19 sealed construction traction steel type for the hoist ropes and 8 x 25 filler wire type for governor rope; fasten with adjustable shackles.
- H. Governor: Overhead centrifugal type, car [and counterweight] driven, with electrical shutdown switches.
- I. Safety: Flexible guide clamp, Type B. car [and counterweight].
- J. Automatic Terminal Stopping Device: Per Code.
- K. Wiring:
 - 1. Conductors: Provide copper insulated wiring with flame retarding and moisture resisting outer cover. Install in galvanized metal wireways and raceways. Conductors from shaft riser to door interlocks shall be SF-2 type or equal, maximum operating temperature 392 degrees F. All terminations shall be insulated to maintain integrity of wiring. Flexible conduit may be used for short connections. Provide at a minimum at least two RG59 coaxial cables and six twisted shielded pair. Provide 10% spare conductors throughout.
 - 2. Trail Cables: UL labeled fire and moisture resistant outer braid and steel supporting strand. Provide four parts of shielded communication wires, coaxial cable and necessary car lighting circuits. Prevent cables from rubbing or chafing against hoistway or car items.
 - 3. Remote Wiring: Provide wiring between machine room, hoistway and remote locations of guard, security, and fire control panels.
 - 4. Work Light and Plug Receptacles: Provide on top and bottom of car with lamp guards.
- I. Provide fluorescent type convenience lighting mounted throughout the hoistway including the top and bottom of the elevator hoistway.

2.06 DOOR AND ENTRANCE EQUIPMENT

- A. General: Provide entrance assembly with UL 1 1/2 hour rating.
- B. Frames: Provide new steel channel entrance frames. Finish shall be epoxy type. Color as selected by Contracting Officer.
- C. Provide handicapped designations at a height of 60" above the floor.
 - 1. The plaques shall have light colored numerals on a black background. The numeral color is to be eggshell finish(11 to 19 degree gloss).
 - 2. Designations shall be flush with inconspicuous mechanical mounting.
- D. Provide entrance threshold or walk on plate as may be required at each entrance to the elevator. Sill plates shall be level and adjusted to match elevator car platform.
- E. Toe Guard: No. 14 gauge sheet steel.
- F. Doors: Provide new vertically sliding freight elevator doors at each landing entrance. Doors shall

have required fire labeling and shall be flush finish on the room side. Door panels shall be one piece, welded 12 gauge construction and have shoe angles with solid precision grooves and vision panels at each landing. Provide door panels with epoxy finish as selected by the Contracting Officer. There shall be no visible exposed or protruding fasteners. Door roller and mounting assemblies shall be detachable and/or removable from the door panels. The lower edge of each door panel shall have a safety astragal. Landing designations shall be permanently applied to the inside of each door panel. Construction of the door panels shall be in accordance with ASME A17.1 requirements.

- G. Rails and Hardware: All rails and guides shall be steel. Door panels shall be connected to each other or to counterweights with suitable roller chain running over grooved ball bearing sheaves. Chains and rods shall be connected to panels with steel or malleable iron connectors. All chains and hardware shall be removable and adjustable.
- H. Tracks: Cold drawn steel shaped and finished to permit free movement of door guides.
- I. Interlocks and Retiring Cam: Each hoistway landing door shall be equipped with an interlock. Each interlock shall have all required labels. Provide a motor operated retiring cam mounted on the car sides facing the interlocks. The retiring cam and interlock shall work in conjunction with the elevator control, to prevent normal operation of the elevator unless all doors are closed and locked.
- J. Door Operation and Motors: Each door shall be electrically operated with two closed loop type power door operators mounted on each side of the door assembly. Each motor shall be two speed. Door travel shall be determined by limit switch control and each motor shall provide smooth and consistent operation with immediate reversal. All operating mechanisms shall be located entirely within the elevator hoistway. Manual operation shall be available in the event of power failure.
- K. Car Gates: Gates shall be solid panel, counter weighted, vertical slide-up single section type. Provide gate panels with epoxy finish as selected by the Contracting Officer. Each gate shall have shoe angles, guide shoes, guide rails, suitable roller chains with adjustable connectors, power operated gate sheaves, two speed gate motor and required electrical contact.
- L. Door Protection:
 - 1. Electronic Entrance Protection: Provide entrances to car with full height protective device which projects infrared light beams across the entire opening and beyond the leading edge of the door and gate panels. Doors shall automatically return to open position if any light beam is blocked or obstructed. Doors shall not be required to contact an obstruction to initiate the reopening process. Provide onboard automatic diagnostic circuits. Electronic device shall illuminate GREEN when opening, RED when closing and flash 5 seconds prior to closing.
 - 2. Safety Edges: Provide car gates with full width protective device which projects beyond the leading edge of the gate. Gate shall automatically return to open position if it touches a person or object while closing.
- M. Door Operation: Provide door operating controls panels mounted in cabinets in the machine room for control of the doors and gates. Doors and gates shall be arranged to open automatically as the elevator arrives at a floor and to close by continuous pressure push button operation. Door and gate shall reopen automatically if not closed to the full limit switch activation. Provide automatic closing operation and all required signaling lights and alarms for future use. Doors shall be capable

of smooth and quiet operation without slam or shock.

- N. Provide signage that encourages the riding public to close the doors when they are through using the elevator.
- O. All hoistway doors shall be equipped with a new electro mechanical interlock, designed to prevent the starting of the car until the doors are closed and locked. The interlock shall be of a type to meet all requirements of the Code. Engaging components of the mechanical-locking device shall be free of noises. At each landing, provide heavy duty emergency unlocking device and box.
- P. Car Gate Contacts: Electrical contacts shall prevent the operation of the elevator by normal operating devices unless car doors are closed or within tolerances allowed by Code.

2.7 CAR EQUIPMENT

- A. Car Frame: Welded or bolted steel channel construction. Formed construction is unacceptable.
- B. Platform: Steel frame with welded channel cross members and steel or wood subfloor, fireproof on underside. Platform shall be designed for Class C-1 loading.
- C. Guide shoes: Slide type with removable inserts with method to maintain rail contact.
- D. Toe Guard: Per Code.
- E. Hangers and tracks: Same as hoistway entrance doors hangers and tracks.
- F. Provide welded steel or aluminum diamond plate flooring.
- G. Car Enclosure: Car enclosure shall be manufactured by a SI approved company. Provide the following features:
 - 1. General: The enclosure shall be adequately reinforced and ventilated to meet all the Code requirements. Provide sound-deadening mastic to exterior.
 - 2. Shell: Provide new standard metal cab manufactured from 12 gauge sheet steel and painted with epoxy based paint. Properly brace and support cab walls. Width and length of the cab shall be designed to match the existing platform. Design fronts to match hoistway entrances. Design cab for maximum allowable height under crosshead. Color as selected by the Contracting Officer. Provide sound-deadening mastic to exterior.
 - 3. Ceiling: Provide new 12 gauge sheet steel. Arrange for hinged top emergency exit per Code requirements. Paint canopy reflective white color.
 - 4. Protective Rails: Provide two rows of 2" by 12" oak bumper rails on the side and rear walls to protect the elevator walls.
 - 5. Lighting: Provide recessed lighting mounted in the ceiling. Lighting fixtures shall be constructed of (12 gauge) steel housing and door. Light shall have a full length piano hinge and be retained by recesses center pinned tamper-proof screws. Standard shielding shall be a minimum of 3/8" clear polycarbonate with a 1/8" acrylic prismatic lens overlay or

approved equal. All wiring shall be concealed in the walls or ceiling.

6. Pads and Hooks: Provide pad hooks and pads. Pad hooks shall be conspicuous type. Pads shall cover all walls and front return panels.
7. Ventilation: Provide new two-speed exhaust fan.

2.08 SIGNALS AND FIXTURES

- A. Provide "Vandal Resistant" custom signal fixtures. The intent is not to furnish the new state-of-the-art plastic bezel mounting design. Provide vandal resistant type pushbutton modules manufactured by Innovation Industries push button style PB-23. Provide LED type illumination in all pushbuttons.
- B. Car Operating Panels:
 1. Provide two car operating panels. The use of swing return panels shall not be permitted. Panels shall have vandal resistant type LED illuminating pushbuttons numbered to conform to floors served. Buttons shall light to show registration and extinguish when car stops in response to a call. The panels shall include an emergency stop switch, alarm bell button, DOOR OPEN and DOOR CLOSE and DOOR HOLD button. All operating controls shall be located no higher than 54" for side approach and 48" for front approach above the car floor, (35" for stop switch and alarm button). Provide fire service operating cabinet and all required control features within the main car panel in accordance with Code requirements. Braille/Arabic designations shall be flush with inconspicuous mechanical mounting.

Provide an Independent service key switch within the face of the car pushbutton station.
 2. All fire service key switches shall utilize a FEOK1 key switch and all other keying for equipment shall utilize a "J Series" key switch. Cabinet shall contain the following key type controls:
 - a. A light switch.
 - b. Two speed fan switch.
 - c. Inspection switch, conforming to ASME Code.
 - d. Emergency Stop switch.
 - e. Emergency Light Test Switch
 3. Engrave the car operating panels with the following:
 - a. No Smoking.
 - b. Elevator Number over operating buttons.
 - c. Elevator Capacity.

d. Fire Service Instructions

- C. Car Position Indicator: Provide digital readout type with 2" high (minimum) indications over each operating panel.
- D. Hall Buttons: Provide one riser of hall pushbuttons. Station shall include flush mounted faceplate. Centerline of riser to be at 3'-6" above the finished floor. Finish shall be stainless steel No. 4 satin finish. Fire signs shall be integral within the faceplate. Provide vandal resistant type pushbuttons and incorporate fire service devices and signage in lobby stations.
- E. Combination Hall Position Indicators and Direction Lanterns: Provide UP and DOWN lanterns with digital readout type position indicator with 2" high (minimum) indications at intermediate landings, single lantern at terminal landings. Gongs for each lantern shall sound once for the up direction of travel and twice for the down direction of travel. The lantern shall illuminate for corresponding direction of car travel and the gong shall sound when the elevator is at a predetermined distance from the scheduled floor stop. The design and location of the hall lanterns shall be as selected. Faceplate material to be identical to hall button faceplate.
- F. Hoistway Access Switch: Mount with faceplate adjacent to entrance frame side jamb at all top and bottom terminal landings. Activation of the hoistway access switch shall initiate a call to feature that allowing the elevator mechanic to call the car directly from either landing. Faceplate to match hall button finish.
- G. Emergency Car Lighting and Alarm System: Provide in each car station an Emergency Light Unit consisting of two (2) LED type units. Unit shall provide emergency light in car upon failure or interruption of normal car lighting. Emergency lighting unit shall provide a minimum illumination of 0.2 foot-candle at 4 feet above car floor approximately 1 foot in front of car operating panel for not less than 4 hours. Battery shall be 6 volt minimum, sealed rechargeable lead acid or equal. Battery charger shall be capable of restoring battery to full charge within 16 hours after resumption of normal power. Provide an external means for testing battery, lamps, and alarm bell.
- H. Building Lobby Control Panel: Provide digital readout type traffic direction, key switches and special operation devices for each elevator. Panel shall contain position and direction indicators, corridor call indicator for each direction and shall be located at the main lobby entrance desk.
- I. Elevator Fire Control Panel: Provide a common control panel for all elevators, locate as directed. Panel to contain a digital readout type position and direction indicator per elevator; Fireman's return switch per group or individual elevator as required; a jewel to indicate if doors are open at the fire egress floor per elevator; in car fire service jewel per elevator; space for fireman's phone jack; a cabinet containing the in car fire service keys with instructions for fire service operation and emergency power selector switches and status indicators. Use of CRT monitors is unacceptable.
- J. Machine Room Monitors: Provide a monitor in each machine room capable of displaying status, position and critical items for trouble shooting the equipment.
- K. Voice Annunciator: Provide a new voice annunciator manufactured by CE Electronics, Inc. Provide a unit with the following voice messages in a female voice.

- 1. Name of floor and direction of travel. "Second Floor, Going Up".

2. This elevator is now in fire return. When the doors open, please exit the building in a safe and orderly manner.
3. Please stand clear of the closing doors.
4. This elevator is on independent service.
5. This car is in overload status. Please remove part of the load to resume service.
6. This elevator is now on emergency power and the car is returning to the main level.
7. This car is now on inspection service.
8. The seismic sensor has been activated. Please exit the elevator when the doors open.
9. This elevator is needed because of an emergency. Please exit the elevator when the doors open.

2.09 COMMUNICATION SYSTEM:

- A. Telephone System: Provide telephone integral with car operating panel. Provide automatic dial telephone station located in the car station. Activation of auto dialer shall be by a button suitably identified for the visually impaired. Speaker shall be mounted without faceplate or visible fasteners and located behind the control station. Communication shall be capable of being heard from any location within the car enclosure. The telephone should be programmed to automatically dial the Building's OPS Security Office.
 1. Provide a telephone symbol minimum 2 inch high, and raised 1/32 inch with Braille indications adjacent to a separate activation button mounted on the control panel.
 2. Provide engraved emergency instructions above the activation button. Instructions shall read: "TO USE EMERGENCY TELEPHONE, PRESS BUTTON BELOW. DIALING WILL OCCUR AUTOMATICALLY. Identical instructions in Braille shall be provide below the engraved instructions.
 3. Provide a visual indication, approximately 3/4 inch in diameter, or a jewel that illuminates once a call has been received by the master station. Instructions under the visual indicator or within the lighted jewel shall read: "CALL HAS BEEN RECEIVED".
- B. Provide wiring from car to telephone terminal box in elevator machine room.
- C. Provide installation of Fire alarm speaker provided by others within the elevator cab. Provide wiring from car to Fire alarm junction box in machine room.
- D. Provide a system that allows for two way communication between the elevator car and machine room in accordance with ASME A17.1, rule 2.27.1.1.4.

III. PART 3 - EXECUTION

3.01 EXAMINATION

- A. The elevator contractor shall examine the supporting structure and the conditions under which the work shall be installed and notify the COTR of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected and are acceptable.
- B. Verify dimensions of supporting structure at the site by accurate field measurements. The work shall be accurately fabricated and fitted to the structure. Elevator contractor shall confirm by review of the working drawings and field observation that the clearances and the alignments are proper for the installation of this work.
- C. Coordinate work with the work of other trades, and provide items to be placed during the installation at the proper time to avoid delays in the overall work. Use bench marks where necessary.

3.02 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Perform as required by Code and as required by authorities having jurisdiction.
 - 2. Provide labor, materials, equipment and connections.
 - 3. Repair or replace defective work as required.
 - 4. Pay for restoring or replacing damaged work due to tests.
- B. Final Inspection: When all work is completed, and tested, notify the COTR in writing that the elevator is ready for final inspection and acceptance test. A testing and inspection date shall then be arranged. The proper operation of every part of the elevator system and compliance with contract requirements of the Code, shall be demonstrated to the COTR. Furnish all test instruments, weights, and materials, required at the time of final inspection.
 - 1. Final System Tests for Smoke Detection/Fire Elevator Recall: After work is completed, conduct a final test of entire system. Submit results on approved test report forms.
 - 2. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected the COTR shall be notified and the elevator shall be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

If deficiencies are found, or if the consultant/COTR deems it to be necessary the contractor shall perform the following tests at no additional charge immediately following the final inspection.

- 3. Test Period: The elevator shall be subjected to a test for a period of one hour continuous run, with full specified load in the car. During the test run, the car shall be stopped at all floors in both directions of travel for a standing period of 10 seconds per floor.

2. Speed Load Tests: The actual speed of the elevator car shall be determined in both directions of travel with full contract load and with no load in the elevator car. Speed shall be determined by a tachometer. The actual measured speed of elevator car with full load shall be within 5% of rated speed. The maximum difference in actual measured speeds obtained under the various conditions outlined between the "UP" and the "DOWN" directions shall be checked.
3. Floor-to-floor times with no load in the car, balanced load in the car and full load in the car shall be checked.
4. Car Leveling Tests: Elevator car leveling devices shall be tested for accuracy of landing at all floors with no load in the car, balanced load in the car and full load in the car, in both directions of travel. Accuracy of floor landing (plus or minus 1/4 inch) shall be determined both before and after the full-load run test.
5. Insulation Resistance Tests: The complete wiring systems of the elevator shall be free from short circuits and grounds, and the insulation resistance shall be determined by use of a "Megger." Conductors shall have a insulation resistance of not less than one megohm between each conductor and ground and between each conductor and all other conductors.
6. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected. The COTR shall be notified and the elevator shall be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

3.04 ADJUSTING, PAINTING AND CLEANING

- A. All equipment shall be adjusted prior to final testing and acceptance.
- B. Paint exposed work soiled or damaged during installation. Repair to match adjoining work prior to final acceptance. At a minimum all hoistway and machine room components shall be painted in the field with at least one coat of machine grade enamel. The intent is to provide a complete final product that is neat, clean and painted.
- C. Contractor shall clean and paint the machine room walls and floor with an epoxy based paint as selected by the Contracting Officer.
- D. Contractor shall patch any and all damage to the hoistway walls after demolition. Hoistway shall be painted white to improve effectiveness of lighting when working in the hoistway.

3.05 INSTRUCTIONS

Upon completion of all work, the Elevator Contractor shall provide a training session. Instructions shall be given by competent supervisory personnel and shall apply to actual field conditions. The instructions shall cover, but shall not be limited to the following:

- A. Operation of elevators under emergency conditions.
- B. Operation and maintenance of smoke detector and elevator fire recall system.
- C. Operation of elevator communication, electronic entrance detector, hoistway access devices, etc.

END OF SECTION

SECTION 14240 – HYDRAULIC PASSENGER ELEVATOR

I. PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope: Provide materials, labor, and services necessary for the complete installation of one hydraulic passenger elevator, designed for Class A loading and designed to Smithsonian standards as shown and specified. To ensure that elevators comply with specifications and installation procedures in the standards, the A/E shall retain the services of an elevator consulting firm to provide design, specification and construction/inspection services.
- B. Related work by other trades:
 - 1. Hoistway, pit and machine room modifications and construction.
 - 2. Lighting and ventilation of pit, hoistway and machine room of a minimum level of 100 lx (10 fc) in the hoistway and 200 lx (19 fc) in the machine room.
 - 3. Access ladder and guards.
 - 4. Supports for guide rail brackets, buffers and entrance installation.
 - 5. Installation of pipe sleeves.
 - 6. Installation of guide rail mounting.
 - 7. Electric feeders to fused lockable disconnect switches to elevator starter or control panels, electric circuits to disconnect switches and to elevator relay panels. Circuit breakers are unacceptable for use as disconnect switches.
 - 8. Conduit to remote locations for elevator intercommunication and alarm systems.
 - 9. Indicated or required chases and openings.
 - 10. Finish painting except as noted.
 - 11. Guarding and protecting hoistway during construction.
 - 12. Storage space for tools and materials.
 - 13. Electric power for testing and adjusting equipment.
 - 14. Telephone wiring to control panels.
 - 15. Signal from fire alarm system.
 - 16. Installation of elevator pit sump pump, sump pump crock and all necessary piping and

wiring. The use of drains shall not be acceptable.

1.02 REFERENCES

A. Applicable Codes (Latest Edition)

1. American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.1).
2. International Building Code (IBC)
3. American National Standard Specification for Making Buildings and Facilities Accessible to and Usable By Physically Handicapped People (ANSI A117.1).
4. GSA "Facilities Standards for the Public Buildings Service – PBS P-100. Latest edition as accepted by GSA.
5. National Elevator Industry, Incorporated (NEII) Building Transportation Standards and Guidelines.
6. National Electric Code (NFPA 70).
7. United States Department of Labor – Occupational Safety & Health Administration (OSHA).
8. Local codes.

1.03 DEFINITIONS

- A. "Provide": to furnish and install, complete for safe operation, unless specifically indicated otherwise.
- B. "Install": to erect, mount and connect complete with related accessories.
- C. "Supply": to purchase, procure, acquire and deliver complete with related accessories.
- D. "Work": labor and materials required for proper and complete installation.
- E. "Wiring": raceway, fittings, wire, boxes, and related items.
- F. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions or above hung ceilings, in trenches, in crawl spaces or in enclosures.
- G. "Exposed": not installed underground or "concealed" as defined above.
- H. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or as specified.
- I. "Similar," "or" "equal": to base bid manufacturer, equal in materials, weight, size, design and efficiency of specified product, conforming to "Acceptable manufacturers."

- J. "Reviewed," "satisfactory," "accepted," "or" "directed": as reviewed, satisfactory, accepted or directed, by or to SI.

1.04 OPERATION PERFORMANCE

- A. The control system shall provide smooth acceleration and deceleration with 1/4" leveling accuracy at all landings from no load to full rated load in the elevator.
- B. The door open time shall be 3.0 seconds measured from start of door open to fully open.
- C. The speed of the elevator shall not vary +/- 10% under loading conditions.
- D. Prior to final acceptance and prior to the termination of the maintenance period, the elevators shall be adjusted as required to meet these performance requirements.

1.05 SUBMITTALS

- A. Shop Drawings and Samples:
1. Shop Drawings: Provide complete shop drawings, to scale. Include layouts of pits, machine rooms, overhead requirements, power and heat data for all equipment, static and impact loads, reaction points and required clearances. Provide manufacturers standard catalog literature and brochures of all components scheduled for use as part of this project. Provide cab and fixture drawings.
 2. Samples: Materials and finishes exposed to public view, 6" by 6" panels or 12" lengths as applicable.
 3. Partial or incomplete submittal packages will be rejected and returned without comment.
 4. Provide a standard submittal register that identifies all items scheduled for submittal and required by this section. Arrange register by specification section and item number for project tracking and coordination. Contractor should provide a submittal package with tabs or notes that clearly identify the information submitted, where it is located and whether that information has been modified and/or updated since the previous submissions in order to expedite the review process and to encourage a collaborative effort.
 5. LEED Submittals
 - a. Product data for EQ 4.1: For adhesives and sealants applied within the building waterproofing envelope, documentation indicating VOC content in g/L.2. Product data for Credit EQ 4.
 - b. For paints and coatings applied within the building waterproofing membrane, documentation indicating VOC content in g/L.
 - c. Product data for Credit EQ 4.4: For composite wood and laminating adhesives, documentation indicating no urea formaldehyde.
- B. Equipment Brochure and Service Manuals:

1. Before acceptance of work, furnish three sets of manufacturer's equipment brochures and service manuals. Assemble manuals in chronological order according to the specification alpha-numerical system. Provide manufacturer's standard binders consisting of:
 - a. Equipment and components, descriptive literature.
 - b. Performance data, model number.
 - c. Installation instructions.
 - d. Operating instructions and technical field adjustment manuals.
 - e. Maintenance and repair instructions.
 - f. Spare parts lists.
 - g. Lubrication instructions.
 - h. Detailed, record and as-built layout drawings.
 - i. Detailed, simplified, one line, wiring diagrams. Provide one complete set per manual.
 - j. Field test reports.
 - k. Submit valve tag chart indicating size, type, location, system and number of all valves.
- C. Machine Room Prints. Provide three complete sets of "as-built" field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway as well as the machine room. One set of these diagrams shall be laminated and mounted in the elevator machine room as directed.
- D. Keys: Five (5) sets of keys and key tags to operate all key switches and locks shall be furnished upon completion of work. All keys shall be designed to work with the SI's in house key system.

1.06 QUALITY ASSURANCE

- A. Quality and gauges of materials:
 1. New, best of their respective kinds, free from defects.
 2. Materials, equipment of similar application; same manufacturer, unless otherwise noted.
 3. Gauges as noted.
 4. Steel
 - a) Commercial-quality carbon steel that is stretcher-leveled and cold rolled shall be used for exposed work. Such steel must comply with ASTM 366.

- b) Commercial-quality carbon steel that is hot-rolled shall be used for concealed work. Such steel must comply with ASTM 568 and ASTM 569.
- 5. Stainless steel: Type 302 or Type 304 that complies with ASTM 167 shall be chosen as follows:
 - a) No. 4 finish: Satin finish.
 - b) No. 8 finish: Mirror finish.
 - c) Textured: Patterned type with .050-inch mean pattern depth with satin finish.
- 6. Bronze materials shall be constructed of stretcher-leveled sheets with 60 percent copper and 40 percent zinc that are similar to Muntz Metal, Alloy Group #2. After cleaning, spray with one coat of clear lacquer.
- 7. Aluminum extrusions shall comply with ASTM B221 requirements. Sheet and plate shall comply with ASTM B209 requirements.
- 8. Plastic laminate shall comply with ASTM E 84 Class A fire-rated grade (GP- 50), and as follows:
 - a) The COTR shall select the appropriate color for exposed surfaces.
 - b) Use the manufacturer's standard for plastic laminate on non-exposed surfaces.
- 9. Fire retardant particleboard panels shall have a minimum of 3/4-inch thick backup for natural veneer or plastic laminated panels.
- 10. Paint
 - a) Clean exposed surface of oil, grease and scale.
 - b) Apply one coat of rust-resistant mineral paint and one coat of finish enamel.
 - c) Paint pit floor and machine floor room with a water based epoxy Rust-Oleum Concrete Saver Water-Based Epoxy (6000 System) or approved equal.
- 11. Laminated safety glass shall comply with ANSI Z.97.1 and CPSC 16 CFR, part 1201.
- 12. Non-Shrink Grout: Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 4000 PSI at 28 days.
- 13. Fire Resistance: Treat wood components with fire-retardant treatment conforming to requirements of authorities having jurisdiction and to achieve flame spread rating of 25, ASTM E84.
 - a. Protect electric wiring with flame retardant and moisture resistant outer covering, run in conduit, tubing or electrical wire ways.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship in original crated sections of a size to permit passage through available space.
- B. Obtain approval and schedule delivery of material to meet SI's requirements.
- C. Storage of equipment and materials shall be coordinated with COTR.

1.08 WARRANTY

- A. The elevators and associated equipment shall be free of defective material, imperfect work and faulty operation not due to ordinary wear and tear or improper use or care, for a period of one year from final acceptance and substantial completion of the project. Defective work shall be repaired or replaced at no additional cost to SI.

1.09 MAINTENANCE SERVICE

Maintenance service shall be performed in accordance with the requirements listed below for the duration of warranty period and then the units shall be placed under the existing master maintenance agreement currently in place:

- A. It is the intent of the Smithsonian Institution to provide the best possible coverage to maximize equipment up-time during the hours that the Museums are open to the public and staff, and to correct, repair and minimize interruptions to normal Smithsonian Institution business. The Contractor shall arrange their work hours and schedules to meet the performance requirements of this contract. Museums are generally open to the public seven days a week from 10:00 AM to 6:00 PM, excluding Christmas Day. Museum hours will vary seasonally with extended summer hours that occasionally keep the Museums open later during the evening. Museum and Administration staff office hours are generally from 6:00 AM to 6:00 PM Monday through Friday, except holidays. Holidays for Smithsonian Institution employees include New Years Day, Martin Luther King Day, Presidents Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, and Christmas Day.
- B. Routine, Emergency and Entrapment Callbacks.
 - 1. The Contractor shall provide seven (7) days a week, twenty-four (24) hour callback service consisting of a prompt response to requests from designated Smithsonian Institution representatives including the COTR or their designated representative and on-site OPS Security personnel at any hour, any day, including weekends and holidays. Callback services are defined as any request for repairs, inspections, adjustments, and entrapment calls for equipment. The Callback Responder shall acknowledge the request by returning the call within ten (10) minutes of receipt, and provide an estimated time of arrival.
 - 2. The Contractor shall ensure that the responding technician is qualified, trained, certified and has the ability to repair and correct the inventory equipment for which the callback was placed.

3. All Entrapment Callbacks shall be treated as an emergency and shall be responded to immediately to extricate passengers. All callbacks for equipment within the Museums during museum and staff hours shall be considered an Emergency Callback and shall be responded to immediately including all Special Events. Emergency Callbacks shall also include safety related concerns and be responded to immediately to correct hazardous situations and prevent further damage to the equipment inventory and/or facilities.
4. Routine Callbacks shall include responding to non-safety, or after hour repairs or outages.
5. The Contractor shall respond to all callbacks to ensure the condition that caused the callback is corrected as quickly as possible and the unit is returned back to service prior to the departure of the responding technician. No equipment shall be left out of service unless due to the repair being beyond the ability of the responding technician for reasons such as; an after hour call where there is a lack of additional and available personnel to assist in the completion of the repair or the lack of parts or material available to complete the repair.
6. In the event of these circumstances, the responding technician shall Lock Out/Tag Out (LO/TO) the out of service equipment until the repairs can be made. The responding technician shall report all findings, corrections or deficiencies to the on-site OPS Security personnel in accordance with the contract reporting requirements as soon as possible and prior to departure. The responding technician shall also immediately report all such findings, deficiencies and/or corrective actions to the Project Manager. The Project Manager shall report to the COTR the status of the findings, deficiencies and corrections. If the equipment is left out of service, the Project Manager shall report the findings, a schedule for repair and duration of the outage to the COTR immediately (if during normal business hours) or by the close of the following business day and no longer than twenty-four (24) hours of the callback, in order to allow the COTR to inform the Museum/Building occupants. The Project Manager shall also report to the COTR any change of status of such accordingly.
7. It is the intent of the Smithsonian Institution to insure that the responding callback technician arrives within the times that are listed below:
 - Entrapment Callback: Within thirty (30) minutes of receipt of call during working hours and one (1) hour during non working hours.
 - Emergency Callback (non-entrapment): Within one (1) hour during the regular working hours as determined by this Contract, and within two (2) hours after the regular working hours as determined by this Contract.
 - Routine, After Hours Callback: Sufficient time to place the unit back in service by the start of business the next day.

The response times required above shall be from the time the contractor receives initial notification to the time the responding technician arrives on-site.

8. When a callback is placed after regular work hours as defined by this contract, a time ticket/log shall be signed by the on-site OPS Security personnel or a designated Smithsonian Institution Representative. The time ticket/log shall be provided by the Contractor and shall include but not be limited to the time the callback was placed, the time of the technician's arrival, the time of the technician's departure, a description of the complaint/deficiency, a description of correction or service provided, date, equipment

number and building/facility. A copy of the time ticket/log must be provided to the on-site OPS Security personnel or a designated Smithsonian Institution Representative. A copy shall be provided to the COTR upon request.

C. Maintenance Requirements:

1. On a monthly basis, regularly and systematically examine, adjust, lubricate, clean and, when conditions warrant, repair or replace the following items and all other mechanical or electrical equipment including but not limited to:
 - a. Hydraulic power unit and accessories: pump, motor, valves, operating valves, pulleys, drive belts, flexible hose and fitting assemblies, oil tank, muffler, strainer, sound isolating coupling, plunger, packing gland, scavenger system, piping and other components.
 - b. Controller, selector, and dispatching equipment: All components including all relays, solid state components, resistors, condensers, transformers, contacts, leads, computer devices, selector switches, mechanical or electrical driving equipment, coils, magnet frames, contact switch assemblies, springs, solenoids, resistance grids, hoistway vanes, magnets and inductors.
 - c. Hoistway door interlocks or locks and contacts, hoistway door hangers, tracks, bottom door gibs, cams, rollers and auxiliary door closing devices for power operated doors. Chains, tracks, cams, interlocks, sheaves for vertical bi-parting doors.
 - d. Hoistway limit switches, slowdown switches, leveling switches and associated cams, vanes and electronic components.
 - e. Guide shoes including rollers or replaceable guides.
 - f. Automatic power operated door operators, door protective devices, car door hangers, tracks and car door contacts.
 - g. Traveling cables.
 - h. Elevator control wiring in hoistway and machine room.
 - i. Buffers.
 - j. Fixture contacts, pushbuttons, key switches, locks, lamps and sockets or button stations (car and hall), hall lanterns, position indicators (car and hall), direction indicators.
 - k. The guide rails shall be kept free of rust and dry.
 - l. Examine all safety devices, and conduct an annual no load test, and every fifth year perform a full load, full speed test of the buffers. The car balance shall be checked. All tests shall be performed in accordance with the provisions of the American National Standard, Safety Code for Elevators and Escalators

(ANSI/ASME A17.2), current edition.

- m. Furnish lubricants compounded specifically for elevator usage.
 - 2. The Elevator Contractor shall not be required to install new attachments on the elevator whether or not recommended or directed by insurance companies or by governmental authorities, nor make any replacements with parts of a different design. The Contractor shall not be required to make renewals or repairs necessitated by reason of negligence or misuse of the equipment or by reason of any other cause beyond the Contractor's control except ordinary wear and tear unless the Contractor receives just compensation.
 - 3. The Contractor shall check the group dispatching systems and make necessary tests to insure that all circuits and time settings are properly adjusted, and that the system performs as designed and installed.
- C. Maintenance Responsibility:
- 1. The Contractor shall keep the elevator maintained to operate at the original contract speed, keeping the original performance times, including acceleration and retardation as designed and installed by the manufacturer. The door operation shall be adjusted as required to maintain the original door opening and door closing times, within legal limits.
 - 2. The COTR reserves the right to make inspections and tests as and when deemed advisable. If it is found that the elevator and associated equipment are deficient either electrically or mechanically, the Contractor will be notified of these deficiencies in writing, and it shall be his responsibility to make corrections within 30 days after his receipt of such notice. In the event that the deficiencies have not been corrected within 30 days, the COTR may terminate the contract and employ a Contractor to make the corrections at the original bidder's expense.
 - 3. Approximately three months prior to the end of the contract term, the COTR will make a through maintenance inspection of all elevators covered under the contract. At the conclusion of this inspection, the COTR shall give the Contractor written notice of any deficiencies found. The Contractor shall be responsible for correction of these deficiencies within 30 days after receipt of such notice.
- D. The COTR reserves the right to accept or reject any or all alternates.
- E. Diagnostic Tools and Spare Parts: At the completion of the work as specified, the Contractor shall provide items listed. The items shall become SI's property.
- 1. One complete set of all diagnostic tools and equipment required for the complete maintenance of all aspects of the control and dispatch system. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the serviceman and the controls. All such systems shall be free from secret codes and decaying circuits that must be periodically reprogrammed by the manufacturer.
 - I. A list of vendors for all parts used in the installation.

- II. Technical field adjustment manuals with all faults, service codes and nomenclature.
- F. Machine Room Log. The Contractor shall provide, create, manage, update and maintain a Machine Room Log for the inventory equipment to include but not be limited to records, data, maintenance, callbacks, repairs, oil usage, etc. according to the most recent ASME A17 series code and any other standard, directive, law or code applicable. The log shall include the date the service/inspection was performed, the technician that performed the work and any follow up requirements that were reported. The log shall remain in the Machine Rooms as required by applicable code. All required records and logs shall be the property of the Smithsonian Institution and shall be made available for examination on site at anytime by the COTR. Records and logs shall be maintained in a legible, complete, orderly, timely, and accurate manner at all times. The original records and logs shall be submitted to the COTR within 15 calendar days of expiration of the contract. Copies of the records and logs shall be provided to the COTR at anytime upon request.

1.10 ELECTRIC SERVICE

- A. Power: [TBD] volts, 3 phase, 60 hertz. Elevator Contractor to verify voltage.
- B. Lighting: 120 volts, 1 phase, 60 hertz.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Product of individuals, firms or corporations regularly engaged in manufacturing elevators comparable with the needs of this project and in satisfactory operation for a period of not less than five years.
- B. Qualified Bidders:
 - 1. Otis Elevator Company
 - 2. ThyssenKrupp Elevator Company
 - 3. KONE Elevator Company
 - 4. Schindler Elevator Company
 - 5. Independent installers of approved equal equipment.
- C. Approved Components:
 - 1. Elevator controller: Motion Control Engineering
 - 2. Elevator door operator (passenger): GAL MOVFR
 - 3. Elevator door operator (freight): Peele
 - 4. Fixtures: Innovation Industries, vandal resistant, Button style PB-23.

5. Elevator emergency telephone: EMS.
6. Infrared safety curtain: Janus Panachrome.

2.02 OUTLINE OF EQUIPMENT

- | | | |
|-----|----------------------------------|---|
| A. | Elevator number: | TBD. |
| 1. | Elevator use: | Passenger, Class A Loading |
| 2. | Contract load, in pounds: | TBD |
| 3. | Contract speed, in fpm: | 150 fpm (Maximum) |
| 4. | Travel distance: | Maximum 35' 0" |
| 5. | Serves: | _____ |
| 6. | Number of stops: | Maximum (4) |
| 7. | Number of openings: | ___ – front, ___ - rear |
| 8. | Machine location: | TBD |
| 9. | Machine type: | Oil hydraulic, direct plunger with PVC. |
| 10. | Operation: | _____ |
| 11. | Platform size: | ___' - ___" wide by ___' – ___" deep |
| 12. | Car and hoistway door size: | ___' - ___" wide by ___' - ___" high |
| 13. | Car and hoistway door type: | Single Speed Side Slide |
| 14. | Car and hoistway door operation: | Power, heavy duty passenger |
| 15. | Hoistway entrance: | As specified. |
| 16. | Cab enclosure: | As specified. |
| 17. | Door-reversal device: | Electronic detector. |
| 18. | Car operating panel. | As specified |
| 19. | Auxiliary car operating panel. | _____. |
| 20. | Car position indicator (in car). | As specified. |
| 21. | Hall call stations. | Single riser. |

- | | | |
|-----|--------------------------------------|--|
| 22. | Combination hall position indicator: | As specified. |
| 23. | Fire Control Panel: | As specified. |
| 24. | Self-Leveling. | As specified. |
| 25. | Communication system: | Telephone. |
| 26. | Signage: | All signage and engraving to be Helvetica Medium font. |

2.03 MACHINE ROOM EQUIPMENT

- A. Provide equipment to fit space conditions shown.
- B. Tank: Provide welded reinforced steel structure designed to support the tank. Tank shall have surge control to prevent oil leaving tank when elevator descends, protective vent opening and overflow connection. Provide oil heating and cooling device as may be required in tank or comparable means to ensure constant oil temperature and operation of elevator. Capacity of tank shall be sufficient to lift elevator to top landing plus minimum of 10 gallons. Provide a sight glass mounted in the side of the tank and appropriate marks for oil level.
- C. Pump: Provide positive displacement pump designed to give smooth and quiet operation. Mount pump and motor on common bedplate with sound and vibration absorbing devices. Submersible pumps are unacceptable.
- D. Motor: Provide alternate current induction type motor with solid state soft starting designed for hydraulic elevator starting and running requirements. The use of "Across the line" or "Wye-Delta" starters is unacceptable.
- E. Control Valves: Valves including main, leveling, safety check, up and down direction, lowering valve including down leveling and manual leveling shall be provided. Control valves shall be magnetic type and designed to open and close gradually to give smooth control. Manual shut off valve shall be in line adjacent to pump unit. Provide a permanent quick connect fitting on the valves for attachment of test pressure gauges.
- F. Piping: Provide approved steel or wrought iron piping tested for 500 PSI but not to operate beyond a working pressure of over 400 PSI. A blow-out proof oil line muffler and sound isolating coupling shall be provided in oil line near pump unit.
 - 1. A minimum of two gate valves, one in the pit and one in the machine room with oil pressure gauge.
 - 2. Sleeves, when passing through walls, shall have a minimum 1 inch clearance between piping and sleeve. All penetrations shall be fire stopped per the Firestopping specification section 07620. Sleeves shall be provided by the elevator contractor and installed by others.
 - 3. Provide oil tight enclosure from remote machine room to hoistway, pitched to machine

room.

- G. Controller: Provide enclosed controller panels with ventilated cabinets and hinged or removable doors. Cabinets shall be designed for wall or machine mounting.
 - 1. Pump motor shall be provided with solid state, soft start type reduced voltage starting in order to limit starting current of elevator motor.
 - 2. Provide automatic two-way leveling and releveling to maintain the leveling of the car within + or -1/4 inch of floor.
 - 3. Provide permanently marked symbols or letters identical to those on wiring diagrams adjacent to each component.
 - 4. If the pump motor should run continuously for 20 seconds longer than the period of time necessary to move the elevator (in normal operation) from the bottom floor to the top floor, a time protective device shall return the elevator to the lowest level and park. All control buttons, except car alarm, shall be inoperative.
- H. Selectors: Relay, solid state or moving crosshead type electrically or mechanically coupled to car.
- I. Pump Discharge Strainer: Provide strainer in pump discharge to prevent foreign materials from entering control system and cylinder-plunger unit (jack).
- J. Scavenger Pump Unit: Provide a scavenge oil reservoir, an electrically operated oil transfer pump, scavenge oil lines, a strainer, and pump controls. Connect the scavenge oil reservoir to the elevator cylinder between the plunger packing area and the plunger drip (wiper) ring, to capture the oil leaking by the plunger pressure packing. Provide a vacuum relief valve. Connect the scavenge oil pump suction to the scavenge oil reservoir and the strainer, and the discharge to the elevator oil reservoir. Provide a scavenge oil reservoir level switch to control the scavenge oil pump. Scavenger pump shall operate independently of elevator hydraulic fluid pressure. Provide a manual-reset pit flood switch to prevent pump operation if pit is flooded. Anchor pump and oil reservoir to the pit floor.

2.04 OPERATING SYSTEMS

- A. Elevator Control System:
 - 1. Provide a solid state microprocessor system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands manufactured by Motion Control Engineering.

Control system shall be non-proprietary in all respects. Technical support shall be available to without cost, regardless of who is providing ongoing maintenance support. System shall incorporate on-board diagnostics as part of the standard control design. Use of portable or removal diagnostic equipment is unacceptable.

No specifications, drawings, sketches, models, samples, tools, computer programs, technical information or data, written, oral or otherwise, furnished by Contractor to SI as part of this proposed project or in contemplation hereof shall be considered by Seller to be confidential or

proprietary.

Nothing in this specification is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability and safety over those prescribed in this specification. Technical documentation shall be submitted to OEDC/OFMR and Elevator staff to determine equivalency. The system, method, or device shall be approved for the intended purpose by the OEDC/OFMR Engineering and Elevator staff prior to being utilized.

- a. Elevator shall operate as simplex selective collective.
 - (1) Momentary pressure of car or hall button, other than landing at which car is parked, shall automatically start car and dispatch the car to the corresponding floor for which that call was registered. If a call is registered at the floor when the car is idle, the doors shall automatically open.
 - (2) When the direction of travel has been established, the car shall answer all calls corresponding to the direction of travel and shall not reverse direction until all car and hall calls, in that direction, have been answered.
 - (3) Calls registered for the opposite direction of car travel shall remain registered and shall be answered after car has completed its calls in the direction of travel.
 - (4) If no car buttons are pressed, and car starts up in response to several down calls. The car shall answer highest down call first and then reverse to collect other down calls.
 - (5) The car shall remain at the arrival floor for an adjustable interval to permit passenger transfer. Doors shall close after a predetermined interval after opening unless closing is interrupted by car door reversal device or door open button in car.

NOTE: USE WITH TWO ENTRANCES AT THE SAME FLOOR.

- (6) Where two entrances are provided at any one landing door operation shall be selective.
- b. Duplex Selective Collective:
 - (1) With two cars in service, one car shall normally park at the main floor ("home car") with doors closed. The other car ("free car") shall park at landing last served with doors closed.
 - (2) The free car shall answer hall calls above or below the landing at which the car is standing, except main floor hall calls.
 - (3) When the free car is clearing calls, the home car shall respond to:

- (a) A call registered on the home car buttons.
 - (b) An up hall call from the landing below the free car while the free car is traveling up.
 - (c) An up or down call registered from the landing above the free car while it is traveling down.
 - (d) Inability of the free car to clear all hall calls within approximately 40 seconds.
- (4) Registration of car call button shall cause the car to start. The car shall respond to its own car calls and corridor calls, in the direction of travel, and in order in which the landings are reached.
 - (5) Only one car shall stop in response to any one hall call. The first car to complete all calls shall return to the main floor.
 - (6) The car shall remain at the arrival floor for an adjustable interval to permit passenger transfer. Doors shall close after a predetermined interval, unless the car is parked at the main floor, after opening, unless closing is interrupted by car door reversal device or door open button in car.

NOTE: USE WITH TWO ENTRANCES AT THE SAME FLOOR

- (7) Where two entrances are provided at any one landing, door operation shall be selective.
- c. Group Supervisory System:
 - (1) Provide a closed loop, solid state microprocessor dispatch system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands:
 - (a) It shall provide for a continuously changing program of varying combinations when there are landing calls registered. These shall include components of incoming, outgoing, interfloor and special traffic in varying intensities.
 - (b) The main floor up call is to be given priority.
 - (c) The system shall have forecasting capabilities which will assign the desired degree of priority to any additional entrance floor.
 - (d) The system shall measure the call waiting times on all floors, and determine through forecasting whether the elevator on becoming vacant shall continue in the previous running direction or reverse and assist in concentrated interfloor traffic in specific areas of the building.
 - (e) The system shall constantly evaluate the service quality of all

forecasted waiting times. The landing calls will be allocated by the process of optimization with no final assignment established until the total quality of passenger service is assessed.

- (f) A light traffic mode is assumed when there are no registered landing calls within a preset time. During periods of traffic, elevators shall be parked in anticipation of new landing calls. At least one elevator is to be parked at the main floor. Other elevators can be parked at upper or lower floors, as previously stated. The elevators shall be parked with the doors closed. The need for parking shall be checked by the system at frequent intervals.
- (g) With the increasing traffic intensity, a priority method of call assignments shall be initiated. Priority of service for landing calls is determined by the call waiting time in relation to the prevailing traffic condition. The system shall prevent waiting times that are excessive as compared to the traffic intensity.
- (h) Peak type of demands shall be recognized by monitoring the total traffic flow including a predominance of car calls in one direction, a high intensity of landing calls in one direction, a sudden high percentage of load increase when answering landing calls, main floor landing hall call intensities and departure of elevators from a designated floor with a predetermined load several times in a preset time.
- (i) When an up peak type of demand is recognized, the main floor up call is immediately classified as priority call. The first vacant elevator is always dispatched to the main floor, the dispatch of another vacant elevator to the main floor is subject to optimization by the computer and decisions depending on the degree of up intensity and the amount of traffic flow against main floor. When passengers enter the elevator, the elevator can start as the first car call has been registered. The doors shall, however, stay open as long as further passengers are detected entering the elevator. Once the car call has been registered, the control system shall dispatch another vacant elevator to the main floor, unless a vacant elevator is already there.
- (j) With an up peak traffic type of operation, the main traffic flow (incoming traffic) shall receive preferential service. The system shall continuously re-evaluate the traffic pattern, and adjust the group operation. If it detects a sudden simultaneous intensive down demand, it shall cancel the automatic return to the main floor.
- (k) When a down peak condition is recognized, the down call shall be served through the optimization process to provide efficient traffic handling. In extremely intense down traffic situations, the priority of the up calls is decreased to a preset value according to the main traffic flow preference system. The system shall provide equal service to every floor, even during exceptionally heavy

down traffic.

- (l) The system operation shall continuously change by demand and shall not require forced system changes to provide optimum operation and call response.
- (m) Dispatch Protection: The system shall automatically provide dispatching in the event of failure of the primary system. A visible and audible alarm shall be provided to indicate loss of the dispatching computer.
- (n) Delayed Car Protection: The system shall automatically disassociate a car from the Group System in the event the car is delayed for a predetermined time. The car shall be automatically restored to the Group System when the cause of the delay has been eliminated.
- (o) Programmed Door Control: Separate adjustable times shall be provided for each car to establish minimum passenger transfer time for car stops, intermediate floor hall call stops and lobby floor stops. All timing shall be computerized to coincide with traffic demands.
- (p) Designated Parking: The system shall provide for cars to park as designated by the Group Controller or park at its last call.
- (q) Next Car: The car selected as next up at the lobby floor shall park with its door open. If an absence of calls exists, the door shall close automatically as commanded by the Group Controller.

d. Swing Service Operation:

- (1) Provide an inconspicuous jamb-mounted hall pushbutton for Elevator No. ____ at each floor.
- (2) Provide a two-position key switch within the elevator service cabinet or within the Lobby Control Panel which activates the operation.
 - (a) This switch shall have its "OFF" and "ON" positions identified. The key shall be removable in both positions.
- (3) The key switch in the "ON" position activates the swing service hall station and operation as follows:
 - (a) Elevator shall operate as simplex selective collective.
 - (i) Momentary pressure of car or hall button, other than landing at which car is parked, shall automatically start car and dispatch the car to the corresponding floor for which that call was registered. If a call is registered at the floor when the car is idle, the doors shall automatically open.
 - (ii) When the direction of travel has been established, the car

shall answer all calls corresponding to the direction of travel and shall not reverse direction until all car and hall calls, in that direction, have been answered.

- (iii) Calls registered for the opposite direction of car travel shall remain registered and shall be answered after car has completed its calls in the direction of travel.
- (iv) If no car buttons are pressed, and car starts up in response to several down calls, the car shall answer highest down call first and then reverse to collect other down calls.
- (v) The car shall remain at the arrival floor for an adjustable interval to permit passenger transfer. Doors shall close after a predetermined interval after opening unless closing is interrupted by car door reversal device or door open button in car.

NOTE: USE WITH TWO ENTRANCES AT THE SAME FLOOR.

- (vi) Where two entrances are provided at any one landing, door operation shall be selective.
- (b) The elevator shall only respond to the swing service hall station and not the group hall stations.
- (4) The key switch in the "OFF" position deactivates the swing service hall station and operation and returns the elevator to group operation.
- (5) Fire Service and Earthquake Operation override the swing service operation.

B. Tenant Security Operation:

- 1. Provide a card reader or proximity reader located adjacent to each hall pushbutton and the car pushbutton control panel or other location, as designated by COTR.
- 2. The insertion of a magnetic reader card or indication of a proximity reader card allows operation of the elevator system or pushbutton operation.
- 3. Fire Service and Earthquake Operation override the Security Service Operation.

C. Independent Service: Provide controls to remove elevator from normal operation and provide control of the elevator from car buttons only. Car shall travel at contract speed and shall not respond to corridor calls.

D. Car Top Operation: Provide per Code requirements.

E. Fire Service Emergency Recall Operation:

Phase I automatic recall of all elevator will only occur upon activation of smoke detectors in elevator lobbies, elevator machine rooms, and elevator hoistways. No other fire alarm initiating

devices will cause elevator recall. The elevator will be recalled to either the primary or alternate floor upon activation of a smoke detector in an elevator machine room, hoistway, or lobby. All elevators in other elevator banks will remain operable. Additional feature of Phase I Emergency Recall Operation will include a three-position switch that shall be:

1. Provided only at the designated level for single elevators or for each group of elevators.
2. Labeled "Fire Recall" and its positions marked "Reset", "Off", and "On" (in that order) with the "Off" position as the center position.
3. Located in the lobby within sight of the elevators in that group and shall be readily accessible.

Phase II Emergency In-Car Operation shall be provided by installing a three-position ("off", "hold", and "on") fire service switch in each car. The switch shall be labeled and provided in the operating panel of each car and shall function in accordance with ASME A17.1 requirements.

The elevator cab shall be provided with a Fire Alarm speaker. The speaker will only be capable of broadcasting a live voice message from the building's fire alarm control panel.

A member of the OSHM fire protection engineer and OFMR Elevator Inspector shall witness the final tests. Coordinate all testing with the required personnel. Each group of elevators shall be tested for phase I & II recall features. Both primary and alternate floor capture features will be tested for each group of elevators. All elevator lobby, machine room, and hoistway smoke detectors will be tested. Shunt trip test in each elevator machine room shall be tested by activation of the dedicated activation device. Any such repeated tests as required by the AHJ shall be done at no additional expense to the government.

F. Standby Power Panel and Operation:

1. Elevator Contractor shall provide all control wiring for automatic sequential lowering and emergency power operation of all elevators. At least one passenger and the service elevators will operate simultaneously at contract speed. Elevators shall automatically return to and park at main lobby with doors open. In the event an elevator is out of service, after a predetermined time, emergency power shall automatically switch to the next elevator in sequence. After all elevators have returned to the main lobby, the preselected elevators shall remain on emergency power. In the event a preselected elevator is out of service, the next available elevator shall automatically be selected to remain on emergency power operation.
2. Include all relays, auxiliary contacts and selector switches for emergency operation control and for motor starters in machine room.
3. Power wiring from emergency source and pre-signal wiring to emergency operating control provided by Electrical Contractor.
4. All relays shall automatically reset as emergency supply becomes available for each car.
5. Submit wiring diagrams for coordination.
6. Emergency operation shall be arranged such that the elevator system shall sense a loss of normal power at each automatic transfer switch on an individual basis. Upon power

loss at one transfer switch (partial power failure), no more than one elevator served by that transfer switch shall be capable of operating at one time. Upon loss of power at more than one elevator transfer switch, the elevators shall be interlocked such that no more than the selected elevators may operate simultaneously from the emergency power system. Sensing contacts at each transfer switch and related wiring to each elevator machine room shall be by the Electrical Contractor. The Elevator Contractor shall coordinate with the Electrical Contractor to determine the type of sensing contacts required (normally open or normally closed) and the contact rating. Refer to the electrical drawings for number of transfer switches and elevators served.

7. Install panel as directed.
8. Machine Room Monitor: Provide a color monitor in each machine room capable of displaying status, position and critical items for trouble shooting the equipment.
- G. Load Weighing: Provide automatic load weighing device set at approximately 80% of full load. The device when activated shall cause the elevator to bypass corridor calls and shall initiate dispatch of car at main terminal prior to elapse of normal dispatching interval. Provide adjustable setting from 50 - 80% of full load. Cross head deflection type is unacceptable.
- H. False Call Canceling: Provide device to cancel all car calls when car loading is not equal to the number of calls registered.
- I. Door Hold Operation: Provide controls and a button within operating panel which shall hold the doors open for an adjustable period of 30 to 90 seconds.
- J. The following shall resume normal door operation:
 1. Activation of door close button.
 2. Activation of any floor button within the elevator.
 3. Expiration of time period.

2.05 HOISTWAY EQUIPMENT

- A. Well Hole and Casings: Drill holes and provide steel driven well casing of sufficient diameter to allow PVC casing and cylinder to be set plumb on desired centerlines. The bottom of well casing shall be sealed with concrete plug and the PVC casing shall be capped.
- B. PVC Casing: Provide 1/2 inch thick PVC casing inside the well casing. Exterior surface of casing shall be cleaned prior to application of solvent welding material to ensure water tight connections.
 1. Fill space between PVC and cylinder casing with Union Guard type gel or liquid to prevent movement and to provide an additional layer of protection from galvanic corrosion. Provide positive sealing element at the top of the PVC casing to make joints watertight. Provide a port at the top of the cylinder assembly for monitoring of the fill level of the Union Guard type gel.
- C. Cylinder: Provide equipment as applicable for direct plunger type elevator. Cylinder shall be closed bottom seamless steel pipe with sufficient thickness to sustain 400 PSI test. The external surface shall be coated with heavy, double hot mopped bitumastic or asphaltum compound and allowed to

dry prior to installation or double wrapped with tapecoat. Provide cylinder head with adjustable packing gland which shall prevent excessive oil leakage. The cylinder head shall be provided with means to release air from cylinder and be easily repackable. A collection groove and coupling with run-off tube shall be connected to a scavenger system which shall automatically return oil to the oil reservoir. Provide a copper tubing scavenger line with in-line strainers between the pit and machine room. Telescopic cylinder-plunger units are not acceptable.

- D. Plunger: Polished selected steel tubing of proper diameter turned true and smooth. Join multiple section plungers by means of internal couplings. Secure to car frame with suitable isolated platen plates. Provide stop ring to prevent plunger from leaving cylinder.
- E. Guide Rails: Planed steel, standard T-sections. Extend rails from pit floor to underside of concrete slab or grating at top of hoistway.
- F. Buffer: Spring type with pipe struts and braces as required. Mount on continuous channels secured to guide rails.
- G. Automatic Terminal Stopping Device: Per Code.
- H. Wiring:
 - 1. Conductors: Provide copper insulated wiring with flame retarding and moisture resisting outer cover. Install in galvanized metal wireways and raceways. Conductors from shaft riser to door interlocks shall be SF-2 type or equal, maximum operating temperature 392 degrees F. All terminations shall be insulated to maintain integrity of wiring. Flexible conduit may be used for short connections. Provide at a minimum at least two RG59 coaxial cables and six twisted shielded pair. Provide 10% spare conductors throughout.
 - 2. Trail Cables: UL labeled fire and moisture resistant outer braid and steel supporting strand. Provide four parts of shielded communication wires, coaxial cable and necessary car lighting circuits. Prevent cables from rubbing or chafing against hoistway or car items.
 - 3. Remote Wiring: Provide wiring between machine room, hoistway and remote locations of guard, security, and fire control panels.
 - 4. Work Light and Plug Receptacles: Provide on top and bottom of car with lamp guards.
- I. Provide fluorescent type convenience lighting mounted throughout the hoistway including the top and bottom of the elevator hoistway.

2.06 DOOR AND ENTRANCE EQUIPMENT

- A. General: Provide entrance assembly sub-frame at main lobby and standard entrances at all other landings with UL 1 1/2 hour rating.
- B. Frames: Fabricate frames from 12 gauge cold rolled furniture steel with bolted type construction at intermediate floors. A fireproof and sound-deadening material shall be applied to the unexposed side of each frame. Finish shall be no. 4 stainless steel above the lobby and baked enamel below the main lobby as selected by Architect. Provide entrances that are 8' – 0" high.
- C. Provide handicapped designations at a height of 60" above the floor.

1. The plaques shall have light colored numerals on a black background. The numeral color is to be eggshell finish (11 to 19 degree gloss).
 2. Designations shall be flush with inconspicuous mechanical mounting.
- D. Provide elevator identification numbers on entrance at lobby.
- E. Sills: Provide nickel silver sills with a non-slip surface at all landings. The use of aluminum sills is not acceptable.
- F. Struts: Minimum 3 inch continuous hot rolled or formed steel angle with secure fastening to sill and floor beam above.
- G. Header: Minimum 3/16 inch thick formed steel designed to support hangers. Header shall be bolted to supporting struts.
- H. Hanger Cover Plates: Removable, full length No. 14 gauge steel. Covers shall be made in sections for convenient access to hangers.
- I. Fascia: No. 14 gauge steel plates extending from top of header to sill of door above, or beam above if there is no door opening. Provide continuous fascia if front hoistway walls are not built out where openings do not exist.
- J. Toe Guard: No. 14 gauge sheet steel.
- K. Dust Cover: No. 14 gauge sheet steel.
- L. Door Bumpers: Provide on vertical struts at top and bottom.
- M. Doors: Door panels shall be hollow metal flush door construction, 14 gauge furniture steel. Fill with fireproof, sound deadening material. Provide reinforcement by formed vertical sections running full height of door. Doors shall be provided with two removable, non-metallic gibs, located at the leading and trailing edge of the door panel. [Center opening doors shall be provided with full length rubber astragal at leading edge of each door.] Finish shall match entrance frames. There shall be no visible exposed or protruding fasteners. Door roller and mounting assemblies shall be detachable and/or removable from the door panels. Doors shall also be provided with a secondary retention means as required by ASME A17.1m, rule 2.11.11.8.
- N. Sight guards: Provide for each landing door panel, constructed of No. 14 gauge furniture steel. Finish to match doors. Landing designations shall be permanently applied to the inside of each door panel.
- O. Transom: Provide special transom assembly as shown on the architectural drawings for the main lobby and flush type transoms at all other landings. Material, construction and finish to match hoistway doors.
- P. Hanger: Provide two-point suspension sheave type with provisions for vertical and lateral adjustments. Sheaves shall be minimum 2 1/4 inch in diameter with sealed ball or roller bearings.
- Q. Tracks: Cold drawn steel shaped and finished to permit free movement of sheaves. Bottom of

track shall be in contact with upthrust roller.

- R. Closer: Spring or spirator type.

2.7 CAR EQUIPMENT

- A. Car Frame: Welded or bolted steel channel construction.
- B. Platform: Isolated type, steel frame with steel or wood subfloor, fireproof on underside.
- C. Guide Shoes: Roller type with three or more sound-deadening rollers with adjustable springs or other method to maintain rail contact.
- D. Sill: Provide new, nickel silver type car sills with a non-slip surface.
- E. Toe Guard: Per Code.
- F. Hangers and tracks: Same as hoistway entrance doors hangers and tracks.
- G. Floor covering: Prepare for 3" flooring thickness and 10# per square foot. If final cab flooring is less than 3" then void shall be filled to allow for future changes without modifying the car sill height.
- H. Door Protection: The leading edge of the electronic detector device shall illuminate GREEN when opening, RED when closing and flash 5 seconds prior to closing.
 - 1. Electronic Entrance Detector Screen: Provide an electronic door edge device which projects an infrared curtain of light guarding the door opening. Arrange to reopen doors if one beam of the curtain is penetrated. Unit shall have Transmitters and Receivers spaced at a minimum distance to provide the maximum amount of protection within the height of the doorway. Systems which have the availability to turn Off or On individual zones within the curtain will not be allowed.
 - 2. Differential door timing feature: Provide adjustable timers to vary the time that the doors remain open in response to a car or hall call. The doors shall remain open for one second in response to a car call and five to eight seconds for a hall call. This time shall be reduced to 1/2 second if the proximity detector is interrupted. The doors shall remain open as long as passengers are crossing the threshold.
 - 3. Nudging: When doors are prevented from closing for 20 seconds due to failure of the entrance detector or obstruction, the doors shall close at reduced speed and a buzzer shall sound.
- J. Door Operator: Provide a high speed, heavy duty, closed loop type master electric power door operator to automatically open and close the car and hoistway doors. The doors shall be capable of smooth and quiet operation without slam or shock.
 - 1. Opening speed shall not be less than 3.0 f.p.s. with reversal in no more than 2 1/2 inches.
 - 2. Hoistway doors shall be automatically closed by an auxiliary closing device if car leaves the landing zone.
 - 3. In case of power interruption, it shall be possible to manually operate car and hoistway

doors from inside the cab.

4. Provide door safety retainers and restricted opening of car doors in accordance with Code requirements.
- K. Car Door Contacts: Electrical contacts shall prevent the operation of the elevator by normal operating devices unless car doors are closed or within tolerances allowed by Code.
- L. Car Enclosure: Car enclosure shall be manufactured by a SI approved company. Cab finishes shall be designed with heavy duty and durable finishes. Provide the following features:
 1. General: The enclosure shall be adequately reinforced and ventilated to meet all the Code requirements. Provide sound-deadening mastic to exterior. Provide manufacturer's standard steel shell.
 2. Shell: Sides and back shall be 14 gauge sheet steel with baked enamel interior finish. Baked enamel color as selected by the Architect. Arrange shell to accept interior panels as noted in Architectural Drawings.
 3. Canopy: Provide 9'-4" clear height under canopy. Reinforced 12 gauge furniture steel. Underside painted baked enamel reflective white. Arrange for hinged top emergency exit including lock as required by Code.
 4. Front return panels and entrance columns: 14 gauge sheet steel Return panel shall be swing type to allow access to car station wiring and fixtures. Provide cabinets for special operating features and telephone required by these specifications. Finish shall be as noted in Architectural Drawings.
 5. Transom: 14 gauge sheet steel finish to match front return panels and entrance columns. Finish shall be as noted in Architectural Drawings.
 6. Car door panels: Same construction as hoistway door panel. Finish shall be as noted in Architectural Drawings.
 7. Pads and Hooks: Provide pad hooks and pads. Pad hooks shall be conspicuous type (buttons) at front return panels and at sides and rear walls. Mount pad hooks at sides and rear above suspended ceiling line. Pads shall cover all walls and front return panels.
 8. Ventilation: Two-speed exhaust fan.

2.08 SIGNALS AND FIXTURES

- A. Provide "Vandal Resistant" custom signal fixtures. The intent is not to furnish the new state-of-the-art plastic bezel mounting design. Provide vandal resistant type pushbutton modules manufactured by Innovation Industries push button style PB-23. Provide LED type illumination in all pushbuttons.
- B. Car Operating Panels:
 1. Provide two car operating panels. The use of swing return panels shall not be permitted. Panels shall have vandal resistant type LED illuminating pushbuttons numbered to conform to floors served. Buttons shall light to show registration and extinguish when car

stops in response to a call. The panels shall include an emergency stop switch, alarm bell button, DOOR OPEN and DOOR CLOSE and DOOR HOLD button. All operating controls shall be located no higher than 54" for side approach and 48" for front approach above the car floor, (35" for stop switch and alarm button). Provide fire service operating cabinet and all required control features within the main car panel in accordance with Code requirements. Braille/Arabic designations shall be flush with inconspicuous mechanical mounting.

Provide an Independent service key switch within the face of the car pushbutton station.

2. All fire service key switches shall utilize a FEOK1 key switch and all other keying for equipment shall utilize a "J Series" key switch. Cabinet shall contain the following key type controls:
 - a. A light switch.
 - b. Two speed fan switch.
 - c. Inspection switch, conforming to ASME Code.
 - d. Emergency Stop switch.
 - e. Emergency Light Test Switch
 3. Engrave the car operating panels with the following:
 - a. No Smoking.
 - b. Elevator Number over operating buttons.
 - c. Elevator Capacity.
 - d. Fire Service Instructions
- C. Car Position Indicator: Provide digital readout type with 2" high (minimum) indications over each operating panel.
- D. Hall Buttons: Provide one riser of hall pushbuttons. Station shall include flush mounted faceplate. Centerline of riser to be at 3'-6" above the finished floor. Finish shall be stainless steel No. 4 satin finish. Fire signs shall be integral within the faceplate. Provide vandal resistant type pushbuttons and incorporate fire service devices and signage in lobby stations.
- E. Combination Hall Position Indicators and Direction Lanterns: Provide UP and DOWN lanterns with digital readout type position indicator with 2" high (minimum) indications at intermediate landings, single lantern at terminal landings. Gongs for each lantern shall sound once for the up direction of travel and twice for the down direction of travel. The lantern shall illuminate for corresponding direction of car travel and the gong shall sound when the elevator is at a predetermined distance from the scheduled floor stop. The design and location of the hall lanterns shall be as selected. Faceplate material to be identical to hall button faceplate.

- F. Hoistway Access Switch: Mount with faceplate adjacent to entrance frame side jamb at all top and bottom terminal landings. Activation of the hoistway access switch shall initiate a call to feature that allowing the elevator mechanic to call the car directly from either landing. Faceplate to match hall button finish.
- G. Emergency Car Lighting and Alarm System: Provide in each car station an Emergency Light Unit consisting of two (2) LED type units. Unit shall provide emergency light in car upon failure or interruption of normal car lighting. Emergency lighting unit shall provide a minimum illumination of 0.2 foot-candle at 4 feet above car floor approximately 1 foot in front of car operating panel for not less than 4 hours. Battery shall be 6 volt minimum, sealed rechargeable lead acid or equal. Battery charger shall be capable of restoring battery to full charge within 16 hours after resumption of normal power. Provide an external means for testing battery, lamps, and alarm bell.
- H. Building Lobby Control Panel: Provide digital readout type traffic direction, key switches and special operation devices for each elevator. Panel shall contain position and direction indicators, corridor call indicator for each direction and shall be located at the main lobby entrance desk.
- I. Elevator Fire Control Panel: Provide a common control panel for all elevators, locate as directed. Panel to contain a digital readout type position and direction indicator per elevator; Fireman's return switch per group or individual elevator as required; a jewel to indicate if doors are open at the fire egress floor per elevator; in car fire service jewel per elevator; space for fireman's phone jack; a cabinet containing the in car fire service keys with instructions for fire service operation and emergency power selector switches and status indicators. Use of CRT monitors is unacceptable.
- J. Machine Room Monitors: Provide a monitor in each machine room capable of displaying status, position and critical items for trouble shooting the equipment.
- K. Voice Annunciator: Provide a new voice annunciator manufactured by CE Electronics, Inc. Provide a unit with the following voice messages in a female voice.
 - 1. Name of floor and direction of travel. *"Second Floor, Going Up"*.
 - 2. This elevator is now in fire return. When the doors open, please exit the building in a safe and orderly manner.
 - 3. Please stand clear of the closing doors.
 - 4. This elevator is on independent service.
 - 5. This car is in overload status. Please remove part of the load to resume service.
 - 6. This elevator is now on emergency power and the car is returning to the main level.
 - 7. This car is now on inspection service.
 - 8. The seismic sensor has been activated. Please exit the elevator when the doors open.
 - 9. This elevator is needed because of an emergency. Please exit the elevator when the doors open.

2.09 COMMUNICATION SYSTEM:

- A. Telephone System: Provide telephone integral with car operating panel. Provide automatic dial telephone station located in the car station. Activation of auto dialer shall be by a button suitably identified for the visually impaired. Speaker shall be mounted without faceplate or visible fasteners and located behind the control station. Communication shall be capable of being heard from any location within the car enclosure. The telephone should be programmed to automatically dial the Building's OPS Security Office.
 - 1. Provide a telephone symbol minimum 2 inch high, and raised 1/32 inch with Braille indications adjacent to a separate activation button mounted on the control panel.
 - 2. Provide engraved emergency instructions above the activation button. Instructions shall read: "TO USE EMERGENCY TELEPHONE, PRESS BUTTON BELOW. DIALING WILL OCCUR AUTOMATICALLY. Identical instructions in Braille shall be provide below the engraved instructions.
 - 3. Provide a visual indication, approximately 3/4 inch in diameter, or a jewel that illuminates once a call has been received by the master station. Instructions under the visual indicator or within the lighted jewel shall read: "CALL HAS BEEN RECEIVED".
- B. Provide wiring from car to telephone terminal box in elevator machine room.
- C. Provide installation of Fire alarm speaker provided by others within the elevator cab. Provide wiring from car to Fire alarm junction box in machine room.
- D. Provide a system that allows for two way communication between the elevator car and machine room in accordance with ASME A17.1, rule 2.27.1.1.4.

III. PART 3 - EXECUTION**3.01 EXAMINATION**

- A. The elevator contractor shall examine the supporting structure and the conditions under which the work shall be installed and notify the COTR of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected and are acceptable.
- B. Verify dimensions of supporting structure at the site by accurate field measurements. The work shall be accurately fabricated and fitted to the structure. Elevator contractor shall confirm by review of the working drawings and field observation that the clearances and the alignments are proper for the installation of this work.
- C. Coordinate work with the work of other trades, and provide items to be placed during the installation at the proper time to avoid delays in the overall work. Use bench marks where necessary.

3.02 FIELD QUALITY CONTROL

- A. Tests:

1. Perform as required by Code and as required by authorities having jurisdiction.
 2. Provide labor, materials, equipment and connections.
 3. Repair or replace defective work as required.
 4. Pay for restoring or replacing damaged work due to tests.
- B. Final Inspection: When all work is completed, and tested, notify the COTR in writing that the elevator is ready for final inspection and acceptance test. A testing and inspection date shall then be arranged. The proper operation of every part of the elevator system and compliance with contract requirements of the Code, shall be demonstrated to the COTR. Furnish all test instruments, weights, and materials, required at the time of final inspection.
1. Final System Tests for Smoke Detection/Fire Elevator Recall: After work is completed, conduct a final test of entire system. Submit results on approved test report forms.
 2. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected the COTR shall be notified and the elevator shall be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

If deficiencies are found, or if the consultant/COTR deems it to be necessary the contractor shall perform the following tests at no additional charge immediately following the final inspection.
 3. Test Period: The elevator shall be subjected to a test for a period of one hour continuous run, with full specified load in the car. During the test run, the car shall be stopped at all floors in both directions of travel for a standing period of 10 seconds per floor.
 4. Speed Load Tests: The actual speed of the elevator car shall be determined in both directions of travel with full contract load and with no load in the elevator car. Speed shall be determined by a tachometer. The actual measured speed of elevator car with full load shall be within 5% of rated speed. The maximum difference in actual measured speeds obtained under the various conditions outlined between the "UP" and the "DOWN" directions shall be checked.
 5. Floor-to-floor times with no load in the car, balanced load in the car and full load in the car shall be checked.
 6. Car Leveling Tests: Elevator car leveling devices shall be tested for accuracy of landing at all floors with no load in the car, balanced load in; the car and full load in the car, in both directions of travel. Accuracy of floor landing (plus or minus 1/4 inch) shall be determined both before and after the full-load run test.
 7. Insulation Resistance Tests: The complete wiring systems of the elevator shall be free from short circuits and grounds, and the insulation resistance shall be determined by use of a "Megger." Conductors shall have a insulation resistance of not less than one megohm

between each conductor and ground and between each conductor and all other conductors.

8. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected. The COTR shall be notified and the elevator shall be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

3.04 ADJUSTING, PAINTING AND CLEANING

- A. All equipment shall be adjusted prior to final testing and acceptance.
- B. Paint exposed work soiled or damaged during installation. Repair to match adjoining work prior to final acceptance. At a minimum all hoistway and machine room components shall be painted in the field with at least one coat of machine grade enamel. The intent is to provide a complete final product that is neat, clean and painted.
- C. Contractor shall clean and paint the machine room walls and floor with an epoxy based paint as selected by the Contracting Officer.
- D. Contractor shall patch any and all damage to the hoistway walls after demolition. Hoistway shall be painted white to improve effectiveness of lighting when working in the hoistway.

3.05 INSTRUCTIONS

Upon completion of all work, the Elevator Contractor shall provide a training session. Instructions shall be given by competent supervisory personnel and shall apply to actual field conditions. The instructions shall cover, but shall not be limited to the following:

- A. Operation of elevators under emergency conditions.
- B. Operation and maintenance of smoke detector and elevator fire recall system.
- C. Operation of elevator communication, electronic entrance detector, hoistway access devices, etc.

END OF SECTION

SECTION 14245 – HYDRAULIC FREIGHT ELEVATOR

I. PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope: Provide materials, labor, and services necessary for the complete installation of one heavy duty hydraulic freight elevator, designed for Class C-1 loading and designed to Smithsonian standards as shown and specified. To ensure that elevators comply with specifications and installation procedures in the standards, the A/E shall retain the services of an elevator consulting firm to provide design, specification and construction/inspection services.
- B. Related work by other trades:
 - 1. Hoistway, pit and machine room modifications and construction.
 - 2. Lighting and ventilation of pit, hoistway and machine room of a minimum level of 100 lx (10 fc) in the hoistway and 200 lx (19 fc) in the machine room.
 - 3. Access ladder and guards.
 - 4. Supports for guide rail brackets, buffers and entrance installation.
 - 5. Installation of pipe sleeves.
 - 6. Installation of guide rail mounting.
 - 7. Electric feeders to fused lockable disconnect switches to elevator starter or control panels, electric circuits to disconnect switches and to elevator relay panels. Circuit breakers are unacceptable for use as disconnect switches.
 - 8. Conduit to remote locations for elevator intercommunication and alarm systems.
 - 9. Indicated or required chases and openings.
 - 10. Finish painting except as noted.
 - 11. Guarding and protecting hoistway during construction.
 - 12. Storage space for tools and materials.
 - 13. Electric power for testing and adjusting equipment.
 - 14. Telephone wiring to control panels.
 - 15. Signal from fire alarm system.
 - 16. Installation of elevator pit sump pump, sump pump crock and all necessary piping and

wiring. The use of drains shall not be acceptable.

1.02 REFERENCES

A. Applicable Codes (Latest Edition)

1. American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.1).
2. International Building Code (IBC)
3. American National Standard Specification for Making Buildings and Facilities Accessible to and Usable By Physically Handicapped People (ANSI A117.1).
4. GSA "Facilities Standards for the Public Buildings Service – PBS P-100. Latest edition as accepted by GSA.
5. National Elevator Industry, Incorporated (NEII) Building Transportation Standards and Guidelines.
6. National Electric Code (NFPA 70).
7. United States Department of Labor – Occupational Safety & Health Administration (OSHA).
8. Local codes.

1.03 DEFINITIONS

- A. "Provide": to furnish and install, complete for safe operation, unless specifically indicated otherwise.
- B. "Install": to erect, mount and connect complete with related accessories.
- C. "Supply": to purchase, procure, acquire and deliver complete with related accessories.
- D. "Work": labor and materials required for proper and complete installation.
- E. "Wiring": raceway, fittings, wire, boxes, and related items.
- F. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions or above hung ceilings, in trenches, in crawl spaces or in enclosures.
- G. "Exposed": not installed underground or "concealed" as defined above.
- H. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or as specified.
- I. "Similar," "or" "equal": to base bid manufacturer, equal in materials, weight, size, design and efficiency of specified product, conforming to "Acceptable manufacturers."

- J. "Reviewed,""satisfactory,""accepted,""or"directed": as reviewed, satisfactory, accepted or directed, by or to COTR.

1.04 OPERATION PERFORMANCE

- A. The control system shall provide smooth acceleration and deceleration with 1/4" leveling accuracy at all landings from no load to full rated load in the elevator.
- B. The door open time shall be 3.0 seconds measured from start of door open to fully open.
- C. The speed of the elevator shall not vary +/- 10% under loading conditions.
- D. Prior to final acceptance and prior to the termination of the maintenance period, the elevators shall be adjusted as required to meet these performance requirements.

1.05 SUBMITTALS

- A. Shop Drawings and Samples:
1. Shop Drawings: Provide complete shop drawings, to scale. Include layouts of pits, machine rooms, overhead requirements, power and heat data for all equipment, static and impact loads, reaction points and required clearances. Provide manufacturers standard catalog literature and brochures of all components scheduled for use as part of this project. Provide cab and fixture drawings.
 2. Samples: Materials and finishes exposed to public view, 6" by 6" panels or 12" lengths as applicable.
 3. Partial or incomplete submittal packages will be rejected and returned without comment.
 4. Provide a standard submittal register that identifies all items scheduled for submittal and required by this section. Arrange register by specification section and item number for project tracking and coordination. Contractor should provide a submittal package with tabs or notes that clearly identify the information submitted, where it is located and whether that information has been modified and/or updated since the previous submissions in order to expedite the review process and to encourage a collaborative effort.
 5. LEED Submittals
 - a. Product data for EQ 4.1: For adhesives and sealants applied within the building waterproofing envelope, documentation indicating VOC content in g/L.2. Product data for Credit EQ 4.
 - b. For paints and coatings applied within the building waterproofing membrane, documentation indicating VOC content in g/L.
 - c. Product data for Credit EQ 4.4: For composite wood and laminating adhesives, documentation indicating no urea formaldehyde.
- B. Equipment Brochure and Service Manuals:

1. Before acceptance of work, furnish three sets of manufacturer's equipment brochures and service manuals. Assemble manuals in chronological order according to the specification alpha-numerical system. Provide manufacturer's standard binders consisting of:
 - a. Equipment and components, descriptive literature.
 - b. Performance data, model number.
 - c. Installation instructions.
 - d. Operating instructions and technical field adjustment manuals.
 - e. Maintenance and repair instructions.
 - f. Spare parts lists.
 - g. Lubrication instructions.
 - h. Detailed, record and as-built layout drawings.
 - i. Detailed, simplified, one line, wiring diagrams. Provide one complete set per manual.
 - j. Field test reports.
 - k. Submit valve tag chart indicating size, type, location, system and number of all valves.
- C. Machine Room Prints. Provide three complete sets of "as-built" field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway as well as the machine room. One set of these diagrams shall be laminated and mounted in the elevator machine room as directed.
- D. Keys: Five (5) sets of keys and key tags to operate all key switches and locks shall be furnished upon completion of work. All keys shall be designed to work with the SI's in house key system.

1.06 QUALITY ASSURANCE

- A. Quality and gauges of materials:
 1. New, best of their respective kinds, free from defects.
 2. Materials, equipment of similar application; same manufacturer, unless otherwise noted.
 3. Gauges as noted.
 4. Steel
 - a) Commercial-quality carbon steel that is stretcher-leveled and cold rolled shall be used for exposed work. Such steel must comply with ASTM 366.

- b) Commercial-quality carbon steel that is hot-rolled shall be used for concealed work. Such steel must comply with ASTM 568 and ASTM 569.
- 5. Stainless steel: Type 302 or Type 304 that complies with ASTM 167 shall be chosen as follows:
 - a) No. 4 finish: Satin finish.
 - b) No. 8 finish: Mirror finish.
 - c) Textured: Patterned type with .050-inch mean pattern depth with satin finish.
- 6. Bronze materials shall be constructed of stretcher-leveled sheets with 60 percent copper and 40 percent zinc that are similar to Muntz Metal, Alloy Group #2. After cleaning, spray with one coat of clear lacquer.
- 7. Aluminum extrusions shall comply with ASTM B221 requirements. Sheet and plate shall comply with ASTM B209 requirements.
- 8. Plastic laminate shall comply with ASTM E 84 Class A fire-rated grade (GP- 50), and as follows:
 - a) The COTR shall select the appropriate color for exposed surfaces.
 - b) Use the manufacturer's standard for plastic laminate on non-exposed surfaces.
- 9. Fire retardant particleboard panels shall have a minimum of 3/4-inch thick backup for natural veneer or plastic laminated panels.
- 10. Paint
 - a) Clean exposed surface of oil, grease and scale.
 - b) Apply one coat of rust-resistant mineral paint and one coat of finish enamel.
 - c) Paint pit floor and machine floor room with a water based epoxy Rust-Oleum Concrete Saver Water-Based Epoxy (6000 System) or approved equal.
- 11. Laminated safety glass shall comply with ANSI Z.97.1 and CPSC 16 CFR, part 1201.
- 12. Non-Shrink Grout: Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 4000 PSI at 28 days.
- 13. Fire Resistance: Treat wood components with fire-retardant treatment conforming to requirements of authorities having jurisdiction and to achieve flame spread rating of 25, ASTM E84.

- a. Protect electric wiring with flame retardant and moisture resistant outer covering, run in conduit, tubing or electrical wire ways.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship in original crated sections of a size to permit passage through available space.
- B. Obtain approval and schedule delivery of material to meet SI's requirements.
- C. Storage of equipment and materials shall be coordinated with COTR.

1.08 WARRANTY

- A. The elevators and associated equipment shall be free of defective material, imperfect work and faulty operation not due to ordinary wear and tear or improper use or care, for a period of one year from final acceptance and substantial completion of the project. Defective work shall be repaired or replaced at no additional cost to the COTR.

1.09 MAINTENANCE SERVICE

Maintenance service shall be performed in accordance with the requirements listed below for the duration of warranty period and then the units shall be placed under the existing master maintenance agreement currently in place:

- A. It is the intent of the Smithsonian Institution to provide the best possible coverage to maximize equipment up-time during the hours that the Museums are open to the public and staff, and to correct, repair and minimize interruptions to normal Smithsonian Institution business. The Contractor shall arrange their work hours and schedules to meet the performance requirements of this contract. Museums are generally open to the public seven days a week from 10:00 AM to 6:00 PM, excluding Christmas Day. Museum hours will vary seasonally with extended summer hours that occasionally keep the Museums open later during the evening. Museum and Administration staff office hours are generally from 6:00 AM to 6:00 PM Monday through Friday, except holidays. Holidays for Smithsonian Institution employees include New Years Day, Martin Luther King Day, Presidents Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, and Christmas Day.
- B. Routine, Emergency and Entrapment Callbacks.
 1. The Contractor shall provide seven (7) days a week, twenty-four (24) hour callback service consisting of a prompt response to requests from designated Smithsonian Institution representatives including the COTR or their designated representative and on-site OPS Security personnel at any hour, any day, including weekends and holidays. Callback services are defined as any request for repairs, inspections, adjustments, and entrapment calls for equipment. The Callback Responder shall acknowledge the request by returning the call within ten (10) minutes of receipt, and provide an estimated time of arrival.
 2. The Contractor shall ensure that the responding technician is qualified, trained, certified and has the ability to repair and correct the inventory equipment for which the callback was placed.

3. All Entrapment Callbacks shall be treated as an emergency and shall be responded to immediately to extricate passengers. All callbacks for equipment within the Museums during museum and staff hours shall be considered an Emergency Callback and shall be responded to immediately including all Special Events. Emergency Callbacks shall also include safety related concerns and be responded to immediately to correct hazardous situations and prevent further damage to the equipment inventory and/or facilities.
4. Routine Callbacks shall include responding to non-safety, or after hour repairs or outages.
5. The Contractor shall respond to all callbacks to ensure the condition that caused the callback is corrected as quickly as possible and the unit is returned back to service prior to the departure of the responding technician. No equipment shall be left out of service unless due to the repair being beyond the ability of the responding technician for reasons such as; an after hour call where there is a lack of additional and available personnel to assist in the completion of the repair or the lack of parts or material available to complete the repair.
6. In the event of these circumstances, the responding technician shall Lock Out/Tag Out (LO/TO) the out of service equipment until the repairs can be made. The responding technician shall report all findings, corrections or deficiencies to the on-site OPS Security personnel in accordance with the contract reporting requirements as soon as possible and prior to departure. The responding technician shall also immediately report all such findings, deficiencies and/or corrective actions to the Project Manager. The Project Manager shall report to the COTR the status of the findings, deficiencies and corrections. If the equipment is left out of service, the Project Manager shall report the findings, a schedule for repair and duration of the outage to the COTR immediately (if during normal business hours) or by the close of the following business day and no longer than twenty-four (24) hours of the callback, in order to allow the COTR to inform the Museum/Building occupants. The Project Manager shall also report to the COTR any change of status of such accordingly.
7. It is the intent of the Smithsonian Institution to insure that the responding callback technician arrives within the times that are listed below:
 - Entrapment Callback: Within thirty (30) minutes of receipt of call during working hours and one (1) hour during non working hours.
 - Emergency Callback (non-entrapment): Within one (1) hour during the regular working hours as determined by this Contract, and within two (2) hours after the regular working hours as determined by this Contract.
 - Routine, After Hours Callback: Sufficient time to place the unit back in service by the start of business the next day.

The response times required above shall be from the time the contractor receives initial notification to the time the responding technician arrives on-site.

8. When a callback is placed after regular work hours as defined by this contract, a time ticket/log shall be signed by the on-site OPS Security personnel or a designated Smithsonian Institution Representative. The time ticket/log shall be provided by the Contractor and shall include but not be limited to the time the callback was placed, the time of the technician's arrival, the time of the technician's departure, a description of the

complaint/deficiency, a description of correction or service provided, date, equipment number and building/facility. A copy of the time ticket/log must be provided to the on-site OPS Security personnel or a designated Smithsonian Institution Representative. A copy shall be provided to the COTR upon request.

C. Maintenance Requirements:

1. On a monthly basis, regularly and systematically examine, adjust, lubricate, clean and, when conditions warrant, repair or replace the following items and all other mechanical or electrical equipment including but not limited to:
 - a. Hydraulic power unit and accessories: pump, motor, valves, operating valves, pulleys, drive belts, flexible hose and fitting assemblies, oil tank, muffler, strainer, sound isolating coupling, plunger, packing gland, scavenger system, piping and other components.
 - b. Controller, selector, and dispatching equipment: All components including all relays, solid state components, resistors, condensers, transformers, contacts, leads, computer devices, selector switches, mechanical or electrical driving equipment, coils, magnet frames, contact switch assemblies, springs, solenoids, resistance grids, hoistway vanes, magnets and inductors.
 - c. Hoistway door interlocks or locks and contacts, hoistway door hangers, tracks, bottom door gibs, cams, rollers and auxiliary door closing devices for power operated doors. Chains, tracks, cams, interlocks, sheaves for vertical bi-parting doors.
 - d. Hoistway limit switches, slowdown switches, leveling switches and associated cams, vanes and electronic components.
 - e. Guide shoes including rollers or replaceable guides.
 - f. Automatic power operated door operators, door protective devices, car door hangers, tracks and car door contacts.
 - g. Traveling cables.
 - h. Elevator control wiring in hoistway and machine room.
 - i. Buffers.
 - j. Fixture contacts, pushbuttons, key switches, locks, lamps and sockets or button stations (car and hall), hall lanterns, position indicators (car and hall), direction indicators.
 - k. The guide rails shall be kept free of rust and dry.
 - l. Examine all safety devices, and conduct an annual no load test, and every fifth year perform a full load, full speed test of the buffers. The car balance shall be checked. All tests shall be performed in accordance with the provisions of the

American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.2), current edition.

- m. Furnish lubricants compounded specifically for elevator usage.
- 2. The Elevator Contractor shall not be required to install new attachments on the elevator whether or not recommended or directed by insurance companies or by governmental authorities, nor make any replacements with parts of a different design. The Contractor shall not be required to make renewals or repairs necessitated by reason of negligence or misuse of the equipment or by reason of any other cause beyond the Contractor's control except ordinary wear and tear unless the Contractor receives just compensation.
- 3. The Contractor shall check the group dispatching systems and make necessary tests to insure that all circuits and time settings are properly adjusted, and that the system performs as designed and installed.
- C. Maintenance Responsibility:
 - 1. The Contractor shall keep the elevator maintained to operate at the original contract speed, keeping the original performance times, including acceleration and retardation as designed and installed by the manufacturer. The door operation shall be adjusted as required to maintain the original door opening and door closing times, within legal limits.
 - 2. The COTR reserves the right to make inspections and tests as and when deemed advisable. If it is found that the elevator and associated equipment are deficient either electrically or mechanically, the Contractor will be notified of these deficiencies in writing, and it shall be his responsibility to make corrections within 30 days after his receipt of such notice. In the event that the deficiencies have not been corrected within 30 days, the COTR may terminate the contract and employ a Contractor to make the corrections at the original bidder's expense.
 - 3. Approximately three months prior to the end of the contract term, the COTR will make a through maintenance inspection of all elevators covered under the contract. At the conclusion of this inspection, the COTR shall give the Contractor written notice of any deficiencies found. The Contractor shall be responsible for correction of these deficiencies within 30 days after receipt of such notice.
- D. The COTR reserves the right to accept or reject any or all alternates.
- E. Diagnostic Tools and Spare Parts: At the completion of the work as specified, the Contractor shall provide items listed. The items shall become the SI's property.
 - 1. One complete set of all diagnostic tools and equipment required for the complete maintenance of all aspects of the control and dispatch system. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the serviceman and the controls. All such systems shall be free from secret codes and decaying circuits that must be periodically reprogrammed by the manufacturer.
 - 2. A list of vendors for all parts used in the installation.

3. Technical field adjustment manuals with all faults, service codes and nomenclature.
- F. Machine Room Log. The Contractor shall provide, create, manage, update and maintain a Machine Room Log for the inventory equipment to include but not be limited to records, data, maintenance, callbacks, repairs, oil usage, etc. according to the most recent ASME A17 series code and any other standard, directive, law or code applicable. The log shall include the date the service/inspection was performed, the technician that performed the work and any follow up requirements that were reported. The log shall remain in the Machine Rooms as required by applicable code. All required records and logs shall be the property of the Smithsonian Institution and shall be made available for examination on site at anytime by the COTR. Records and logs shall be maintained in a legible, complete, orderly, timely, and accurate manner at all times. The original records and logs shall be submitted to the COTR within 15 calendar days of expiration of the contract. Copies of the records and logs shall be provided to the COTR at anytime upon request.

1.10 ELECTRIC SERVICE

- A. Power: [TBD] volts, 3 phase, 60 hertz. Elevator Contractor to verify voltage.
- B. Lighting: 120 volts, 1 phase, 60 hertz.

II. PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Product of individuals, firms or corporations regularly engaged in manufacturing elevators comparable with the needs of this project and in satisfactory operation for a period of not less than five years.
- B. Qualified Bidders:
 1. Otis Elevator Company
 2. ThyssenKrupp Elevator Company
 3. KONE Elevator Company
 4. Schindler Elevator Company
 5. Independent installers of approved equal equipment.
- C. Approved Components:
 1. Elevator controller: Motion Control Engineering
 2. Elevator door operator (passenger): GAL MOVFR
 3. Elevator door operator (freight): Peele
 4. Fixtures: Innovation Industries, vandal resistant, Button style PB-23.

5. Elevator emergency telephone: EMS.
6. Infrared safety curtain: Janus Panachrome.

2.02 OUTLINE OF EQUIPMENT

- | | | |
|-----|----------------------------------|---|
| A. | Elevator number: | []. |
| 1. | Elevator use: | Freight, Class C-1 Loading |
| 2. | Contract load, in pounds: | []. |
| 3. | Contract speed, in fpm: | 150 fpm (Maximum) |
| 4. | Travel distance: | Maximum 35' 0" |
| 5. | Serves: | _____ |
| 6. | Number of stops: | Maximum (4) |
| 7. | Number of openings: | ___ – front, ___ - rear |
| 8. | Machine location: | TBD |
| 9. | Machine type: | Oil hydraulic, direct plunger with PVC. |
| 10. | Operation: | Simplex Selective Collective |
| 11. | Platform size: | ___' - ___" wide by ___' – ___" deep |
| 12. | Car and hoistway door size: | ___' - ___" wide by ___' - ___" high |
| 13. | Car and hoistway door type: | Bi-Parting Freight |
| 14. | Car and hoistway door operation: | Power, heavy duty freight |
| 15. | Hoistway entrance: | As specified. |
| 16. | Cab enclosure: | As specified. |
| 17. | Door-reversal device: | Electronic detector and safe edge |
| 18. | Car operating panel. | As specified |
| 19. | Auxiliary car operating panel. | _____. |
| 20. | Car position indicator (in car). | As specified. |
| 21. | Hall call stations. | Single riser. |

- | | | |
|-----|--------------------------------------|--|
| 22. | Combination hall position indicator: | As specified. |
| 23. | Fire Control Panel: | As specified. |
| 24. | Self-Leveling. | As specified. |
| 25. | Communication system: | Telephone. |
| 26. | Signage: | All signage and engraving to be Helvetica Medium font. |

2.03 MACHINE ROOM EQUIPMENT

- A. Provide equipment to fit space conditions shown.
- B. Tank: Provide welded reinforced steel structure designed to support the tank. Tank shall have surge control to prevent oil leaving tank when elevator descends, protective vent opening and overflow connection. Provide oil heating and cooling device as may be required in tank or comparable means to ensure constant oil temperature and operation of elevator. Capacity of tank shall be sufficient to lift elevator to top landing plus minimum of 10 gallons. Provide a sight glass mounted in the side of the tank and appropriate marks for oil level.
- C. Pump: Provide positive displacement pump designed to give smooth and quiet operation. Mount pump and motor on common bedplate with sound and vibration absorbing devices. Submersible pumps are unacceptable.
- D. Motor: Provide alternate current induction type motor with solid state soft starting designed for hydraulic elevator starting and running requirements. The use of "Across the line" or "Wye-Delta" starters is unacceptable.
- E. Control Valves: Valves including main, leveling, safety check, up and down direction, lowering valve including down leveling and manual leveling shall be provided. Control valves shall be magnetic type and designed to open and close gradually to give smooth control. Manual shut off valve shall be in line adjacent to pump unit. Provide a permanent quick connect fitting on the valves for attachment of test pressure gauges.
- F. Piping: Provide approved steel or wrought iron piping tested for 500 PSI but not to operate beyond a working pressure of over 400 PSI. A blow-out proof oil line muffler and sound isolating coupling shall be provided in oil line near pump unit.
 - 1. A minimum of two gate valves, one in the pit and one in the machine room with oil pressure gauge.
 - 2. Sleeves, when passing through walls, shall have a minimum 1 inch clearance between piping and sleeve. All penetrations shall be fire stopped per the Firestopping specification section 07620. Sleeves shall be provided by the elevator contractor and installed by others.
 - 3. Provide oil tight enclosure from remote machine room to hoistway, pitched to machine

room.

- G. Controller: Provide enclosed controller panels with ventilated cabinets and hinged or removable doors. Cabinets shall be designed for wall or machine mounting.
 - 1. Pump motor shall be provided with solid state, soft start type reduced voltage starting in order to limit starting current of elevator motor.
 - 2. Provide automatic two-way leveling and releveling to maintain the leveling of the car within + or -1/4 inch of floor.
 - 3. Provide permanently marked symbols or letters identical to those on wiring diagrams adjacent to each component.
 - 4. If the pump motor should run continuously for 20 seconds longer than the period of time necessary to move the elevator (in normal operation) from the bottom floor to the top floor, a time protective device shall return the elevator to the lowest level and park. All control buttons, except car alarm, shall be inoperative.
- H. Selectors: Relay, solid state or moving crosshead type electrically or mechanically coupled to car.
- I. Pump Discharge Strainer: Provide strainer in pump discharge to prevent foreign materials from entering control system and cylinder-plunger unit (jack).
- J. Scavenger Pump Unit: Provide a scavenge oil reservoir, an electrically operated oil transfer pump, scavenge oil lines, a strainer, and pump controls. Connect the scavenge oil reservoir to the elevator cylinder between the plunger packing area and the plunger drip (wiper) ring, to capture the oil leaking by the plunger pressure packing. Provide a vacuum relief valve. Connect the scavenge oil pump suction to the scavenge oil reservoir and the strainer, and the discharge to the elevator oil reservoir. Provide a scavenge oil reservoir level switch to control the scavenge oil pump. Scavenger pump shall operate independently of elevator hydraulic fluid pressure. Provide a manual-reset pit flood switch to prevent pump operation if pit is flooded. Anchor pump and oil reservoir to the pit floor.

2.04 OPERATING SYSTEMS

- A. Elevator Control System:
 - 1. Provide a solid state microprocessor system which shall provide for continuously changing operations in various traffic situations, and efficiently handle the varying passenger traffic demands manufactured by Motion Control Engineering.

Control system shall be non-proprietary in all respects. Technical support shall be available to without cost, regardless of who is providing ongoing maintenance support. System shall incorporate on-board diagnostics as part of the standard control design. Use of portable or removal diagnostic equipment is unacceptable.

No specifications, drawings, sketches, models, samples, tools, computer programs, technical information or data, written, oral or otherwise, furnished by Contractor to SI as part of this proposed project or in contemplation hereof shall be considered by Seller to be confidential or

proprietary.

Nothing in this specification is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability and safety over those prescribed in this specification. Technical documentation shall be submitted to OEDC/OFMR and Elevator staff to determine equivalency. The system, method, or device shall be approved for the intended purpose by the OEDC/OFMR Engineering and Elevator staff prior to being utilized.

- a. Elevator shall operate as simplex selective collective.
 - (1) Momentary pressure of car or hall button, other than landing at which car is parked, shall automatically start car and dispatch the car to the corresponding floor for which that call was registered. If a call is registered at the floor when the car is idle, the doors shall automatically open.
 - (2) When the direction of travel has been established, the car shall answer all calls corresponding to the direction of travel and shall not reverse direction until all car and hall calls, in that direction, have been answered.
 - (3) Calls registered for the opposite direction of car travel shall remain registered and shall be answered after car has completed its calls in the direction of travel.
 - (4) If no car buttons are pressed, and car starts up in response to several down calls. The car shall answer highest down call first and then reverse to collect other down calls.
 - (5) The car shall remain at the arrival floor for an adjustable interval to permit passenger transfer. Doors shall close after a predetermined interval after opening unless closing is interrupted by car door reversal device or door open button in car.

NOTE: USE WITH TWO ENTRANCES AT THE SAME FLOOR.

- (6) Where two entrances are provided at any one landing door operation shall be selective.

B. Tenant Security Operation:

- 1. Provide a card reader or proximity reader located adjacent to each hall pushbutton and the car pushbutton control panel or other location, as designated by COTR.
- 2. The insertion of a magnetic reader card or indication of a proximity reader card allows operation of the elevator system or pushbutton operation.
- 3. Fire Service and Earthquake Operation override the Security Service Operation.

C. Independent Service: Provide controls to remove elevator from normal operation and provide

control of the elevator from car buttons only. Car shall travel at contract speed and shall not respond to corridor calls.

D. Car Top Operation: Provide per Code requirements.

E. Fire Service Emergency Recall Operation:

Phase I automatic recall of all elevator will only occur upon activation of smoke detectors in elevator lobbies, elevator machine rooms, and elevator hoistways. No other fire alarm initiating devices will cause elevator recall. The elevator will be recalled to either the primary or alternate floor upon activation of a smoke detector in an elevator machine room, hoistway, or lobby. All elevators in other elevator banks will remain operable. Additional feature of Phase I Emergency Recall Operation will include a three-position switch that shall be:

1. Provided only at the designated level for single elevators or for each group of elevators.
2. Labeled "Fire Recall" and its positions marked "Reset", "Off", and "On" (in that order) with the "Off" position as the center position.
3. Located in the lobby within sight of the elevators in that group and shall be readily accessible.

Phase II Emergency In-Car Operation shall be provided by installing a three-position ("off", "hold", and "on") fire service switch in each car. The switch shall be labeled and provided in the operating panel of each car and shall function in accordance with ASME A17.1 requirements.

The elevator cab shall be provided with a Fire Alarm speaker. The speaker will only be capable of broadcasting a live voice message from the building's fire alarm control panel.

A member of the OSHM fire protection engineer and OFMR Elevator Inspector shall witness the final tests. Coordinate all testing with the required personnel. Each group of elevators shall be tested for phase I & II recall features. Both primary and alternate floor capture features will be tested for each group of elevators. All elevator lobby, machine room, and hoistway smoke detectors will be tested. Shunt trip test in each elevator machine room shall be tested by activation of the dedicated activation device. Any such repeated tests as required by the AHJ shall be done at no additional expense to the government.

F. Standby Power Panel and Operation:

1. Elevator Contractor shall provide all control wiring for automatic sequential lowering and emergency power operation of all elevators. At least one passenger and the service elevators will operate simultaneously at contract speed. Elevators shall automatically return to and park at main lobby with doors open. In the event an elevator is out of service, after a predetermined time, emergency power shall automatically switch to the next elevator in sequence. After all elevators have returned to the main lobby, the preselected elevators shall remain on emergency power. In the event a preselected elevator is out of service, the next available elevator shall automatically be selected to remain on emergency power operation.
2. Include all relays, auxiliary contacts and selector switches for emergency operation control and for motor starters in machine room.

3. Power wiring from emergency source and pre-signal wiring to emergency operating control provided by Electrical Contractor.
4. All relays shall automatically reset as emergency supply becomes available for each car.
5. Submit wiring diagrams for coordination.
6. Emergency operation shall be arranged such that the elevator system shall sense a loss of normal power at each automatic transfer switch on an individual basis. Upon power loss at one transfer switch (partial power failure), no more than one elevator served by that transfer switch shall be capable of operating at one time. Upon loss of power at more than one elevator transfer switch, the elevators shall be interlocked such that no more than the selected elevators may operate simultaneously from the emergency power system. Sensing contacts at each transfer switch and related wiring to each elevator machine room shall be by the Electrical Contractor. The Elevator Contractor shall coordinate with the Electrical Contractor to determine the type of sensing contacts required (normally open or normally closed) and the contact rating. Refer to the electrical drawings for number of transfer switches and elevators served.
7. Install panel as directed.
8. Machine Room Monitor: Provide a color monitor in each machine room capable of displaying status, position and critical items for trouble shooting the equipment.
- G. Load Weighing: Provide automatic load weighing device set at approximately 80% of full load. The device when activated shall cause the elevator to bypass corridor calls and shall initiate dispatch of car at main terminal prior to elapse of normal dispatching interval. Provide adjustable setting from 50 - 80% of full load. Cross head deflection type is unacceptable.
- H. False Call Canceling: Provide device to cancel all car calls when car loading is not equal to the number of calls registered.
- I. Door Hold Operation: Provide controls and a button within operating panel which shall hold the doors open for an adjustable period of 30 to 90 seconds.
- J. The following shall resume normal door operation:
 1. Activation of door close button.
 2. Activation of any floor button within the elevator.
 3. Expiration of time period.

2.05 HOISTWAY EQUIPMENT

- A. Well Hole and Casings: Drill holes and provide steel driven well casing of sufficient diameter to allow PVC casing and cylinder to be set plumb on desired centerlines. The bottom of well casing shall be sealed with concrete plug and the PVC casing shall be capped.
- B. PVC Casing: Provide 1/2 inch thick PVC casing inside the well casing. Exterior surface of casing shall be cleaned prior to application of solvent welding material to ensure water tight connections.

1. Fill space between PVC and cylinder casing with Union Guard type gel or liquid to prevent movement and to provide an additional layer of protection from galvanic corrosion. Provide positive sealing element at the top of the PVC casing to make joints watertight. Provide a port at the top of the cylinder assembly for monitoring of the fill level of the Union Guard type gel.
- C. Cylinder: Provide equipment as applicable for direct plunger type elevator. Cylinder shall be closed bottom seamless steel pipe with sufficient thickness to sustain 400 PSI test. The external surface shall be coated with heavy, double hot mopped bitumastic or asphaltum compound and allowed to dry prior to installation or double wrapped with tapecoat. Provide cylinder head with adjustable packing gland which shall prevent excessive oil leakage. The cylinder head shall be provided with means to release air from cylinder and be easily repackable. A collection groove and coupling with run-off tube shall be connected to a scavenger system which shall automatically return oil to the oil reservoir. Provide a copper tubing scavenger line with in-line strainers between the pit and machine room. Telescopic cylinder-plunger units are not acceptable.
- D. Plunger: Polished selected steel tubing of proper diameter turned true and smooth. Join multiple section plungers by means of internal couplings. Secure to car frame with suitable isolated platen plates. Provide stop ring to prevent plunger from leaving cylinder.
- E. Guide Rails: Planed steel, standard T-sections. Extend rails from pit floor to underside of concrete slab or grating at top of hoistway.
- F. Buffer: Spring type with pipe struts and braces as required. Mount on continuous channels secured to guide rails.
- G. Automatic Terminal Stopping Device: Per Code.
- H. Wiring:
 1. Conductors: Provide copper insulated wiring with flame retarding and moisture resisting outer cover. Install in galvanized metal wireways and raceways. Conductors from shaft riser to door interlocks shall be SF-2 type or equal, maximum operating temperature 392 degrees F. All terminations shall be insulated to maintain integrity of wiring. Flexible conduit may be used for short connections. Provide at a minimum at least two RG59 coaxial cables and six twisted shielded pair. Provide 10% spare conductors throughout.
 2. Trail Cables: UL labeled fire and moisture resistant outer braid and steel supporting strand. Provide four parts of shielded communication wires, coaxial cable and necessary car lighting circuits. Prevent cables from rubbing or chafing against hoistway or car items.
 3. Remote Wiring: Provide wiring between machine room, hoistway and remote locations of guard, security, and fire control panels.
 4. Work Light and Plug Receptacles: Provide on top and bottom of car with lamp guards.
- I. Provide fluorescent type convenience lighting mounted throughout the hoistway including the top and bottom of the elevator hoistway.

2.06 DOOR AND ENTRANCE EQUIPMENT

- A. General: Provide entrance assembly with UL 1 1/2 hour rating.
- B. Frames: Provide new steel channel entrance frames. Finish shall be epoxy type. Color as selected by Contracting Officer.
- C. Provide handicapped designations at a height of 60" above the floor.
 - 1. The plaques shall have light colored numerals on a black background. The numeral color is to be eggshell finish(11 to 19 degree gloss).
 - 2. Designations shall be flush with inconspicuous mechanical mounting.
- D. Provide entrance threshold or walk on plate as may be required at each entrance to the elevator. Sill plates shall be level and adjusted to match elevator car platform.
- E. Toe Guard: No. 14 gauge sheet steel.
- F. Doors: Provide new vertically sliding freight elevator doors at each landing entrance. Doors shall have required fire labeling and shall be flush finish on the room side. Door panels shall be one piece, welded 12 gauge construction and have shoe angles with solid precision grooves and vision panels at each landing. Provide door panels with epoxy finish as selected by the Contracting Officer. There shall be no visible exposed or protruding fasteners. Door roller and mounting assemblies shall be detachable and/or removable from the door panels. The lower edge of each door panel shall have a safety astragal. Landing designations shall be permanently applied to the inside of each door panel. Construction of the door panels shall be in accordance with ASME A17.1 requirements.
- G. Rails and Hardware: All rails and guides shall be steel. Door panels shall be connected to each other or to counterweights with suitable roller chain running over grooved ball bearing sheaves. Chains and rods shall be connected to panels with steel or malleable iron connectors. All chains and hardware shall be removable and adjustable.
- H. Tracks: Cold drawn steel shaped and finished to permit free movement of door guides.
- I. Interlocks and Retiring Cam: Each hoistway landing door shall be equipped with an interlock. Each interlock shall have all required labels. Provide a motor operated retiring cam mounted on the car sides facing the interlocks. The retiring cam and interlock shall work in conjunction with the elevator control, to prevent normal operation of the elevator unless all doors are closed and locked.
- J. Door Operation and Motors: Each door shall be electrically operated with two closed loop type power door operators mounted on each side of the door assembly. Each motor shall be two speed. Door travel shall be determined by limit switch control and each motor shall provide smooth and consistent operation with immediate reversal. All operating mechanisms shall be located entirely within the elevator hoistway. Manual operation shall be available in the event of power failure.
- K. Car Gates: Gates shall be solid panel, counter weighted, vertical slide-up single section type. Provide gate panels with epoxy finish as selected by the Contracting Officer. Each gate shall have shoe angles, guide shoes, guide rails, suitable roller chains with adjustable connectors, power operated gate sheaves, two speed gate motor and required electrical contact.

L. Door Protection:

1. Electronic Entrance Protection: Provide entrances to car with full height protective device which projects infrared light beams across the entire opening and beyond the leading edge of the door and gate panels. Doors shall automatically return to open position if any light beam is blocked or obstructed. Doors shall not be required to contact an obstruction to initiate the reopening process. Provide onboard automatic diagnostic circuits. Electronic device shall illuminate GREEN when opening, RED when closing and flash 5 seconds prior to closing.
2. Safety Edges: Provide car gates with full width protective device which projects beyond the leading edge of the gate. Gate shall automatically return to open position if it touches a person or object while closing.

M. Door Operation: Provide door operating controls panels mounted in cabinets in the machine room for control of the doors and gates. Doors and gates shall be arranged to open automatically as the elevator arrives at a floor and to close by continuous pressure push button operation. Door and gate shall reopen automatically if not closed to the full limit switch activation. Provide automatic closing operation and all required signaling lights and alarms for future use. Doors shall be capable of smooth and quiet operation without slam or shock.

Provide signage that encourages the riding public to close the doors when they are through using the elevator.

- N. All hoistway doors shall be equipped with a new electro mechanical interlock, designed to prevent the starting of the car until the doors are closed and locked. The interlock shall be of a type to meet all requirements of the Code. Engaging components of the mechanical-locking device shall be free of noises. At each landing, provide heavy duty emergency unlocking device and box.
- O. Car Gate Contacts: Electrical contacts shall prevent the operation of the elevator by normal operating devices unless car doors are closed or within tolerances allowed by Code.

2.07 CAR EQUIPMENT

- A. Car Frame: Welded or bolted steel channel construction. Formed construction is unacceptable.
- B. Platform: Steel frame with welded channel cross members and steel or wood subfloor, fireproof on underside. Platform shall be designed for Class C-1 loading.
- C. Guide shoes: Slide type with removable inserts with method to maintain rail contact.
- D. Toe Guard: Per Code.
- E. Hangers and tracks: Same as hoistway entrance doors hangers and tracks.
- F. Provide welded steel or aluminum diamond plate flooring.
- G. Car Enclosure: Car enclosure shall be manufactured by a SI approved company. Provide the following features:

1. General: The enclosure shall be adequately reinforced and ventilated to meet all the Code requirements. Provide sound-deadening mastic to exterior.
2. Shell: Provide new standard metal cab manufactured from 12 gauge sheet steel and painted with epoxy based paint. Properly brace and support cab walls. Width and length of the cab shall be designed to match the existing platform. Design fronts to match hoistway entrances. Design cab for maximum allowable height under crosshead. Color as selected by the Contracting Officer. Provide sound-deadening mastic to exterior.
2. Ceiling: Provide new 12 gauge sheet steel. Arrange for hinged top emergency exit per Code requirements. Paint canopy reflective white color.
3. Protective Rails: Provide two rows of 2" by 12" oak bumper rails on the side and rear walls to protect the elevator walls.
4. Lighting: Provide recessed lighting mounted in the ceiling. Lighting fixtures shall be constructed of (12 gauge) steel housing and door. Light shall have a full length piano hinge and be retained by recesses center pinned tamper-proof screws. Standard shielding shall be a minimum of 3/8" clear polycarbonate with a 1/8" acrylic prismatic lens overlay or approved equal. All wiring shall be concealed in the walls or ceiling.
5. Pads and Hooks: Provide pad hooks and pads. Pad hooks shall be conspicuous type. Pads shall cover all walls and front return panels.
6. Ventilation: Provide new two-speed exhaust fan.

2.08 SIGNALS AND FIXTURES

- A. Provide "Vandal Resistant" custom signal fixtures. The intent is not to furnish the new state-of-the-art plastic bezel mounting design. Provide vandal resistant type pushbutton modules manufactured by Innovation Industries push button style PB-23. Provide LED type illumination in all pushbuttons.
- B. Car Operating Panels:
 1. Provide two car operating panels. The use of swing return panels shall not be permitted. Panels shall have vandal resistant type LED illuminating pushbuttons numbered to conform to floors served. Buttons shall light to show registration and extinguish when car stops in response to a call. The panels shall include an emergency stop switch, alarm bell button, DOOR OPEN and DOOR CLOSE and DOOR HOLD button. All operating controls shall be located no higher than 54" for side approach and 48" for front approach above the car floor, (35" for stop switch and alarm button). Provide fire service operating cabinet and all required control features within the main car panel in accordance with Code requirements. Braille/Arabic designations shall be flush with inconspicuous mechanical mounting.

Provide an Independent service key switch within the face of the car pushbutton station.
 2. All fire service key switches shall utilize a FEOK1 key switch and all other keying for

equipment shall utilize a "J Series" key switch. Cabinet shall contain the following key type controls:

- a. A light switch.
 - b. Two speed fan switch.
 - c. Inspection switch, conforming to ASME Code.
 - d. Emergency Stop switch.
 - e. Emergency Light Test Switch
3. Engrave the car operating panels with the following:
- a. No Smoking.
 - b. Elevator Number over operating buttons.
 - c. Elevator Capacity.
 - d. Fire Service Instructions
- C. Car Position Indicator: Provide digital readout type with 2" high (minimum) indications over each operating panel.
- D. Hall Buttons: Provide one riser of hall pushbuttons. Station shall include flush mounted faceplate. Centerline of riser to be at 3'-6" above the finished floor. Finish shall be stainless steel No. 4 satin finish. Fire signs shall be integral within the faceplate. Provide vandal resistant type pushbuttons and incorporate fire service devices and signage in lobby stations.
- E. Combination Hall Position Indicators and Direction Lanterns: Provide UP and DOWN lanterns with digital readout type position indicator with 2" high (minimum) indications at intermediate landings, single lantern at terminal landings. Gongs for each lantern shall sound once for the up direction of travel and twice for the down direction of travel. The lantern shall illuminate for corresponding direction of car travel and the gong shall sound when the elevator is at a predetermined distance from the scheduled floor stop. The design and location of the hall lanterns shall be as selected. Faceplate material to be identical to hall button faceplate.
- F. Hoistway Access Switch: Mount with faceplate adjacent to entrance frame side jamb at all top and bottom terminal landings. Activation of the hoistway access switch shall initiate a call to feature that allowing the elevator mechanic to call the car directly from either landing. Faceplate to match hall button finish.
- G. Emergency Car Lighting and Alarm System: Provide in each car station an Emergency Light Unit. Unit shall provide emergency light in car upon failure or interruption of normal car lighting. Emergency lighting unit shall provide a minimum illumination of 0.2 foot-candle at 4 feet above car floor approximately 1 foot in front of car operating panel for not less than 4 hours. Battery shall be 6 volt minimum, sealed rechargeable lead acid or equal. Battery charger shall be capable of restoring battery to full charge within 16 hours after resumption of normal power. Provide an

external means for testing battery, lamps, and alarm bell.

- H. Building Lobby Control Panel: Provide digital readout type traffic direction, key switches and special operation devices for each elevator. Panel shall contain position and direction indicators, corridor call indicator for each direction and shall be located at the main lobby entrance desk.
- I. Elevator Fire Control Panel: Provide a common control panel for all elevators, locate as directed. Panel to contain a digital readout type position and direction indicator per elevator; Fireman's return switch per group or individual elevator as required; a jewel to indicate if doors are open at the fire egress floor per elevator; in car fire service jewel per elevator; space for fireman's phone jack; a cabinet containing the in car fire service keys with instructions for fire service operation and emergency power selector switches and status indicators. Use of CRT monitors is unacceptable.
- J. Machine Room Monitors: Provide a monitor in each machine room capable of displaying status, position and critical items for trouble shooting the equipment.
- K. Voice Annunciator: Provide a new voice annunciator manufactured by CE Electronics, Inc. Provide a unit with the following voice messages in a female voice.
 - 1. Name of floor and direction of travel. *"Second Floor, Going Up"*.
 - 2. This elevator is now in fire return. When the doors open, please exit the building in a safe and orderly manner.
 - 3. Please stand clear of the closing doors.
 - 4. This elevator is on independent service.
 - 5. This car is in overload status. Please remove part of the load to resume service.
 - 6. This elevator is now on emergency power and the car is returning to the main level.
 - 7. This car is now on inspection service.
 - 8. The seismic sensor has been activated. Please exit the elevator when the doors open.
 - 9. This elevator is needed because of an emergency. Please exit the elevator when the doors open.

2.09 COMMUNICATION SYSTEM:

- A. Telephone System: Provide telephone integral with car operating panel. Provide automatic dial telephone station located in the car station. Activation of auto dialer shall be by a button suitably identified for the visually impaired. Speaker shall be mounted without faceplate or visible fasteners and located behind the control station. Communication shall be capable of being heard from any location within the car enclosure. The telephone should be programmed to automatically dial the Building's OPS Security Office.
 - 1. Provide a telephone symbol minimum 2 inch high, and raised 1/32 inch with Braille

indications adjacent to a separate activation button mounted on the control panel.

2. Provide engraved emergency instructions above the activation button. Instructions shall read: "TO USE EMERGENCY TELEPHONE, PRESS BUTTON BELOW. DIALING WILL OCCUR AUTOMATICALLY. Identical instructions in Braille shall be provide below the engraved instructions.
 3. Provide a visual indication, approximately 3/4 inch in diameter, or a jewel that illuminates once a call has been received by the master station. Instructions under the visual indicator or within the lighted jewel shall read: "CALL HAS BEEN RECEIVED".
- B. Provide wiring from car to telephone terminal box in elevator machine room.
- C. Provide installation of Fire alarm speaker provided by others within the elevator cab. Provide wiring from car to Fire alarm junction box in machine room.
- D. Provide a system that allows for two way communication between the elevator car and machine room in accordance with ASME A17.1, rule 2.27.1.1.4.

III. PART 3 - EXECUTION

3.01 EXAMINATION

- A. The elevator contractor shall examine the supporting structure and the conditions under which the work shall be installed and notify the COTR of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected and are acceptable.
- B. Verify dimensions of supporting structure at the site by accurate field measurements. The work shall be accurately fabricated and fitted to the structure. Elevator contractor shall confirm by review of the working drawings and field observation that the clearances and the alignments are proper for the installation of this work.
- C. Coordinate work with the work of other trades, and provide items to be placed during the installation at the proper time to avoid delays in the overall work. Use bench marks where necessary.

3.02 FIELD QUALITY CONTROL

- A. Tests:
1. Perform as required by Code and as required by authorities having jurisdiction.
 2. Provide labor, materials, equipment and connections.
 3. Repair or replace defective work as required.
 4. Pay for restoring or replacing damaged work due to tests.
- B. Final Inspection: When all work is completed, and tested, notify the COTR in writing that the elevator is ready for final inspection and acceptance test. A testing and inspection date shall then

be arranged. The proper operation of every part of the elevator system and compliance with contract requirements of the Code, shall be demonstrated to the COTR. Furnish all test instruments, weights, and materials, required at the time of final inspection.

1. Final System Tests for Smoke Detection/Fire Elevator Recall: After work is completed, conduct a final test of entire system. Submit results on approved test report forms.
2. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected the COTR shall be notified and the elevator shall be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

If deficiencies are found, or if the consultant/COTR deems it to be necessary the contractor shall perform the following tests at no additional charge immediately following the final inspection.

3. Test Period: The elevator shall be subjected to a test for a period of one hour continuous run, with full specified load in the car. During the test run, the car shall be stopped at all floors in both directions of travel for a standing period of 10 seconds per floor.
4. Speed Load Tests: The actual speed of the elevator car shall be determined in both directions of travel with full contract load and with no load in the elevator car. Speed shall be determined by a tachometer. The actual measured speed of elevator car with full load shall be within 5% of rated speed. The maximum difference in actual measured speeds obtained under the various conditions outlined between the "UP" and the "DOWN" directions shall be checked.
5. Floor-to-floor times with no load in the car, balanced load in the car and full load in the car shall be checked.
6. Car Leveling Tests: Elevator car leveling devices shall be tested for accuracy of landing at all floors with no load in the car, balanced load in; the car and full load in the car, in both directions of travel. Accuracy of floor landing (plus or minus 1/4 inch) shall be determined both before and after the full-load run test.
7. Insulation Resistance Tests: The complete wiring systems of the elevator shall be free from short circuits and grounds, and the insulation resistance shall be determined by use of a "Megger." Conductors shall have a insulation resistance of not less than one megohm between each conductor and ground and between each conductor and all other conductors.
8. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the elevator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the elevators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected. The COTR shall be notified and the elevator shall be reinspected. Rejected elevators shall not be used until they have been reinspected and approved.

3.04 ADJUSTING, PAINTING AND CLEANING

- A. All equipment shall be adjusted prior to final testing and acceptance.
- B. Paint exposed work soiled or damaged during installation. Repair to match adjoining work prior to final acceptance. At a minimum all hoistway and machine room components shall be painted in the field with at least one coat of machine grade enamel. The intent is to provide a complete final product that is neat, clean and painted.
- C. Contractor shall clean and paint the machine room walls and floor with an epoxy based paint as selected by the Contracting Officer.
- D. Contractor shall patch any and all damage to the hoistway walls after demolition. Hoistway shall be painted white to improve effectiveness of lighting when working in the hoistway.

3.05 INSTRUCTIONS

Upon completion of all work, the Elevator Contractor shall provide a training session. Instructions shall be given by competent supervisory personnel and shall apply to actual field conditions. The instructions shall cover, but shall not be limited to the following:

- A. Operation of elevators under emergency conditions.
- B. Operation and maintenance of smoke detector and elevator fire recall system.
- C. Operation of elevator communication, electronic entrance detector, hoistway access devices, etc.

END OF SECTION

SECTION 14310 – ESCALATORS

I. PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope: Provide materials, labor, and services necessary for the complete installation of one escalator, designed to Smithsonian standards as shown and specified. To ensure that escalators comply with specifications and installation procedures in the standards, the A/E shall retain the services of an escalator consulting firm to provide design, specification and construction/inspection services.
- B. Related work:
 - 1. Installation of wellways, pits and machine areas.
 - 2. Lighting and ventilation of pits, wellways and machine areas.
 - 3. Building foundation support beams including required structure for intermediate supports.
 - 4. Bearing plates for concrete beams.
 - 5. Fire rating as required by Code.
 - 6. Special metal finish cladding of the escalator truss assemblies as detailed and in accordance with section 05700 Ornamental Metals. Provide fire-rated covering for the exterior of the escalator from the edge of the deck covers, including covering for exterior balustrades, sides and bottom of truss and soffit of material, finish and design specified.
 - 7. Flooring around the openings including grouting and filling after installation of the escalators.
 - 8. 42" high floor opening protection adjacent to and near the escalators.
 - 9. Electric feeders to fused lockable disconnect switches to elevator starter or control panels, electric circuits to disconnect switches and to elevator relay panels. Circuit breakers are unacceptable for use as disconnect switches.
 - 10. GFCI Outlet box at center of wellway and the top and bottom of the escalator truss.
 - 11. Hoist Beam: Provide hoist beams located above the escalator(s) at both the lower and upper head. The length of the beam shall be placed perpendicular to the escalator length to allow centering of the hoisting device over the final escalator position in the building. The hoist beams shall be of sufficient strength to support the hoisting of the escalator from floor level to final position.
 - 12. Guarding and protecting wellway during construction.

13. Storage space for tools and materials
14. Electric power for testing and adjusting equipment.
15. Provide exposed metal surfaces with finishes as specified in section 05700 Ornamental Metals.
16. Interior surfaces and moving components shall be painted as directed by the COTR.
17. Installation of escalator pit sump pump, sump pump cock and all necessary piping and wiring. The use of drains shall not be acceptable.

1.02 REFERENCES

A. Applicable Codes (Latest Edition)

1. American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.1).
2. International Building Code (IBC)
3. American National Standard Specification for Making Buildings and Facilities Accessibility to and Usable By Physically Handicapped People (ANSI A117.1).
4. GSA "Facilities Standards for the Public Buildings Service – PBS P-100. Latest edition as accepted by GSA.
5. National Elevator Industry, Incorporated (NEII) Building Transportation Standards and Guidelines.
6. National Electric Code (NFPA 70).
7. United States Department of Labor – Occupational Safety & Health Administration (OSHA).
8. Local codes.

1.03 DEFINITIONS

- A. "Provide": to furnish and install, complete for safe operation, unless specifically indicated otherwise.
- B. "Install": to erect, mount and connect complete with related accessories.
- C. "Supply": to purchase, procure, acquire and deliver complete with related accessories.
- D. "Work": labor and materials required for proper and complete installation.
- E. "Wiring": raceway, fittings, wire, boxes, and related items.

- F. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions or in hung ceilings, in trenches, in crawl spaces or in enclosures.
- G. "Exposed": not installed underground or "concealed" as defined above.
- H. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or as specified.
- I. "Similar" or "equal": of base bid manufacturer, equal in materials, weight, size, design and efficiency of specified product, conforming to "Acceptable manufacturers."
- J. "Reviewed," "satisfactory," "accepted," "or "directed": as reviewed, satisfactory, accepted or directed, by or to COTR.
- K. "Manual Reset" for the purpose of this specification will be defined as requiring the micro switch itself to be resettable and not via the escalator controller. Exception for optically monitored devices.

1.04 OPERATION PERFORMANCE

- A. The control system shall provide smooth operation free of jars or bumps. Free running or fully loaded escalators shall be designed to produce a noise level no greater than 65dBA when noise is measured at five feet above the entrance combs at both ends or at any point on the incline.
- B. The speed of the escalator shall not vary +/- 5% under loading conditions.
- C. Direction of travel shall be considered as either direction, and unit shall be up or down reversible.
- D. Prior to final acceptance and prior to the termination of the maintenance period, the escalator shall be adjusted as required to meet these performance requirements.

1.05 SUBMITTALS

- A. Shop Drawings and Samples:
 - 1. Shop Drawings: Provide [] complete sets of full size shop drawings, to scale. Include layouts of pits, machine areas, headroom requirements, power and heat data for all equipment, static and impact loads, reaction points and required clearances. Drawings shall show:
 - a. Truss stanchion.
 - b. Step nosing radius at upper and lower ends.
 - c. Support details (including upper, lower, intermediate, and slip joint), balustrade deck cover, interior panels, skirt panels, and their moldings.
 - d. Safety switches and operating devices.
 - e. Floor plates.
 - f. Radial, vertical, and horizontal dimensions required for manufacture, and positions of lower and upper working points.
 - g. Attachment of truss to structure.
 - h. Drainage and electrical interfaces.
 - i. Ceiling intersection guards.

- j. Passenger instruction signs.
 - k. Emergency stop button.
 - l. Operating panel in upper and lower balustrades (including stop button, start and direction selection switches, and fault finder receptacle).
- 2. Samples: Materials and finishes exposed to public view, 6" by 6" panels or 12" lengths as applicable.
 - 3. Partial or incomplete submittal packages will be rejected and returned without comment.
 - 4. Provide manufacturer's standard catalog literature for all components installed as part of this project.
 - 5. Provide a standard submittal register that identifies all items scheduled for submittal and required by this section. Arrange register by specification section and item number for project tracking and coordination. Contractor should provide a submittal package with tabs or notes that clearly identify the information submitted, where it is located and whether that information has been modified and/or updated since the previous submissions in order to expedite the review process and to encourage a collaborative effort.
 - 6. Provide one set of all submittals, shop drawings, wiring diagrams and service manuals in electronic format for long term document storage.
 - 7. LEED Submittals
 - a. Product data for EQ 4.1: For adhesives and sealants applied within the building waterproofing envelope, documentation indicating VOC content in g/L.2. Product data for Credit EQ 4.
 - b. For paints and coatings applied within the building waterproofing membrane, documentation indicating VOC content in g/L.
 - c. Product data for Credit EQ 4.4: For composite wood and laminating adhesives, documentation indicating no urea formaldehyde.
- B. Equipment Brochure and Service Manuals:
- 1. Before acceptance of work, furnish [] sets of manufacturer's equipment brochures and service manuals. Assemble manuals in chronological order according to the specification alpha-numerical system. Provide manufacturer's standard binders consisting of:
 - a. Equipment and components, descriptive literature.
 - b. Performance data, model number.
 - c. Installation instructions.
 - d. Operating instructions and technical field adjustment manuals with fault codes and nomenclature.
 - e. Maintenance and repair instructions.

- f. Spare parts lists.
 - g. Lubrication instructions.
 - h. Detailed, record and as-built layout drawings.
 - i. Detailed, simplified, one line, wiring diagrams. Provide one complete set per manual.
 - j. Field test reports.
 - k. Submit valve tag chart indicating size, type, location, system and number of all valves.
- C. Machine Area Prints. Provide three complete sets of "as-built" field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway as well as the machine room. One set of these diagrams shall be laminated and mounted inside each control panel.
- D. Keys: Five (5) sets of keys and key tags to operate all key switches and locks shall be furnished upon completion of work. All keys shall be designed to work with the SI's in house key system.

1.06 QUALITY ASSURANCE

- A. Quality and gauges of materials:
 - 1. New, best of their respective kinds, free from defects.
 - 2. Materials, equipment of similar application; same manufacturer, except as noted.
 - 3. Gauges as noted.
 - 4. Steel
 - a) Commercial-quality carbon steel that is stretcher-leveled and cold rolled shall be used for exposed work. Such steel must comply with ASTM 366.
 - b) Commercial-quality carbon steel that is hot-rolled shall be used for concealed work. Such steel must comply with ASTM 568 and ASTM 569.
 - 5. Stainless steel: Shapes and bars: ASTM A-276, type 304 or 316, A-554 for tubes as follows. Plate, sheet, and strip ASTM A-240. Type 304 for interior installations for 316 for exterior installations.
 - a) No. 4 finish: Satin finish.
 - b) No. 8 finish: Mirror finish.
 - c) Textured: Patterned type with .050-inch mean pattern depth with satin finish.

6. Bronze materials shall be constructed of stretcher-leveled sheets with 60 percent copper and 40 percent zinc that are similar to Muntz Metal, Alloy Group #2. After cleaning, spray with one coat of clear lacquer.
7. Aluminum extrusions shall comply with ASTM B221 requirements. Sheet and plate shall comply with ASTM B209 requirements.
8. Galvanizing
 - a) Sheet Steel: ASTM A446, or A526, as applicable. Coating designation G185.
 - b) Other galvanizing ASTM A123, AS1M A 153, ASTM A 385, or ASTM A 386, as applicable.
9. Galvanizing Touch Up: Zinc dust coating, MIL-P-21035 or MIL-P-26915.
10. Paint
 - a) Clean exposed surface of oil, grease and scale.
 - b) Apply one coat of rust-resistant mineral paint and one coat of finish enamel.
 - c) Paint pit floor with a water based epoxy Rust-Oleum Concrete Saver Water-Based Epoxy (6000 System) or approved equal.
11. Laminated safety glass shall comply with ANSI Z.97.1 and CPSC 16 CFR, part 1201.
12. Non-Shrink Grout: Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 4000 PSI at 28 days.
13. Fire Resistance: Wood components shall be fire-retardant pressure impregnated conforming to requirements of authorities having jurisdiction and to achieve flame spread rating of 25, ASTM E84.
 - a. Protect electric wiring with flame retardant and moisture resistant outer covering, run in conduit, tubing or electrical wire ways.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship in original crated sections of a size to permit passage through available space.
- B. Obtain approval and schedule delivery of material to meet COTR's requirements.
- C. Storage of equipment and materials shall be coordinated with COTR.

1.08 WARRANTY

- A. The escalators and associated equipment shall be free of defective material, imperfect work and faulty operation not due to ordinary wear and tear or improper use or care, for a period of one year from final acceptance and substantial completion of the project. Defective work shall be repaired or

replaced at no additional cost to the COTR.

1.09 MAINTENANCE SERVICE

Maintenance service shall be performed in accordance with the requirements listed below for the duration of warranty period and then the units shall be placed under the existing master maintenance agreement currently in place:

- A. Museums are generally open to the public seven days a week from 10:00 AM to 6:00 PM, excluding Christmas Day. Museum hours will vary seasonally with extended summer hours that occasionally keep the Museums open later during the evening. Museum and Administration staff office hours are generally from 6:00 AM to 6:00 PM Monday through Friday, except holidays. Holidays for Smithsonian Institution employees include New Years Day, Martin Luther King Day, Presidents Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, and Christmas Day. It is the intent of the Smithsonian Institution to provide the best possible coverage to maximize equipment up-time during the hours that the Museums are open to the public and staff, and to correct, repair and minimize interruptions to normal Smithsonian Institution business. The Contractor shall arrange their work hours and schedules to meet the performance requirements of this contract.
- B. Routine, Emergency and Entrapment Callbacks.
 - 1. The Contractor shall provide seven (7) days a week, twenty-four (24) hour callback service consisting of a prompt response to requests from designated Smithsonian Institution representatives including the COTR or their designated representative and on-site OPS Security personnel at any hour, any day, including weekends and holidays. Callback services are defined as any request for repairs, inspections, adjustments, and entrapment calls for equipment. The Callback Responder shall acknowledge the request by returning the call within ten (10) minutes of receipt, and provide an estimated time of arrival.
 - 2. The Contractor shall ensure that the responding technician is qualified, trained, certified and has the ability to repair and correct the inventory equipment for which the callback was placed.
 - 3. All Entrapment Callbacks shall be treated as an emergency and shall be responded to immediately to extricate passengers. All callbacks for equipment within the Museums during museum and staff hours shall be considered an Emergency Callback and shall be responded to immediately including all Special Events. Emergency Callbacks shall also include safety related concerns and be responded to immediately to correct hazardous situations and prevent further damage to the equipment inventory and/or facilities.
 - 4. Routine Callbacks shall include responding to non-safety, or after hour repairs or outages.
 - 5. The Contractor shall respond to all callbacks to ensure the condition that caused the callback is corrected as quickly as possible and the unit is returned back to service prior to the departure of the responding technician. No equipment shall be left out of service unless due to the repair being beyond the ability of the responding technician for reasons such as; an after hour call where there is a lack of additional and available personnel to

assist in the completion of the repair or the lack of parts or material available to complete the repair.

6. In the event of these circumstances, the responding technician shall Lock Out/Tag Out (LO/TO) the out of service equipment until the repairs can be made. The responding technician shall report all findings, corrections or deficiencies to the on-site OPS Security personnel in accordance with the contract reporting requirements as soon as possible and prior to departure. The responding technician shall also immediately report all such findings, deficiencies and/or corrective actions to the Project Manager. The Project Manager shall report to the COTR the status of the findings, deficiencies and corrections. If the equipment is left out of service, the Project Manager shall report the findings, a schedule for repair and duration of the outage to the COTR immediately (if during normal business hours) or by the close of the following business day and no longer than twenty-four (24) hours of the callback, in order to allow the COTR to inform the Museum/Building occupants. The Project Manager shall also report to the COTR any change of status of such accordingly.
7. It is the intent of the Smithsonian Institution to insure that the responding callback technician arrives within the times that are listed below:
 - Entrapment Callback: Within thirty (30) minutes of receipt of call during working hours and one (1) hour during non working hours.
 - Emergency Callback (non-entrapment): Within one (1) hour during the regular working hours as determined by this Contract, and within two (2) hours after the regular working hours as determined by this Contract.
 - Routine, After Hours Callback: Sufficient time to place the unit back in service by the start of business the next day.

The response times required above shall be from the time the contractor receives initial notification to the time the responding technician arrives on-site.

8. When a callback is placed after regular work hours as defined by this contract, a time ticket/log shall be signed by the on-site OPS Security personnel or a designated Smithsonian Institution Representative. The time ticket/log shall be provided by the Contractor and shall include but not be limited to the time the callback was placed, the time of the technician's arrival, the time of the technician's departure, a description of the complaint/deficiency, a description of correction or service provided, date, equipment number and building/facility. A copy of the time ticket/log must be provided to the on-site OPS Security personnel or a designated Smithsonian Institution Representative. A copy shall be provided to the COTR upon request.

C. Maintenance Requirements:

1. On a monthly basis, regularly and systematically examine, adjust, lubricate, clean and, when conditions warrant, repair or replace the following items and all other mechanical or electrical equipment including but not limited to:
 - a. Pits should be dry and free from rubbish and lubricants. Accumulation of lubricants in the lower pan may indicate excessive lubrication or use of an incorrect lubricant. See ASME A17.1/CSA B44, requirement 8.6.8.13.

- b. Truss, tracks, steps, chains, handrails and drives should be cleaned as required by building conditions. Accumulations of lubricants, lint and dirt should be removed periodically. See ASME A17.1/CSA B44, requirement 8.6.8.13.
 - c. Step/pallet chains, handrail drive chains, main drive chains and step/pallet bushings should be clean and adequately lubricated. Manufacturer's lubricants and schedules should be used unless deviations are made through an engineering evaluation.
 - d. External gears, handrail drives and idler sheaves should be examined for proper lubrication.
 - e. Missing comb teeth must be replaced. Comb teeth must properly mesh with the step/pallet treads.
 - f. Machine and emergency brakes should be lubricated and serviced.
 - g. Demarcation lighting should be operative.
 - h. Escalator control wiring in hoistway and machine room.
 - i. Damaged balustrades should be replaced. Molding and fastenings should be flush and smooth.
 - j. Pushbuttons, key switches, locks, lamps and sockets or button stations shall be inspected.
 - k. Unusual sound, or vibration such as squeaks or scrapes should be investigated and the source of the problem corrected.
 - l. Examine all safety devices, and conduct an annual no load test. All tests shall be performed in accordance with the provisions of the American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.2), current edition.
 - m. Furnish lubricants compounded specifically for escalator usage.
2. The Escalator Contractor shall not be required to install new attachments on the escalator whether or not recommended or directed by insurance companies or by governmental authorities, nor make any replacements with parts of a different design. The Contractor shall not be required to make renewals or repairs necessitated by reason of negligence or misuse of the equipment or by reason of any other cause beyond the Contractor's control except ordinary wear and tear unless the Contractor receives just compensation.
- C. Maintenance Responsibility:
- 1. The Contractor shall keep the escalator maintained to operate at the original contract speed, keeping the original performance times, including acceleration and retardation as designed and installed by the manufacturer.
 - 2. The COTR reserves the right to make inspections and tests as and when deemed

advisable. If it is found that the escalator and associated equipment are deficient either electrically or mechanically, the Contractor will be notified of these deficiencies in writing, and it shall be his responsibility to make corrections within 30 days after his receipt of such notice. In the event that the deficiencies have not been corrected within 30 days, the COTR may terminate the contract and employ a Contractor to make the corrections at the original bidder's expense.

3. Approximately three months prior to the end of the contract term, the COTR will make a through maintenance inspection of all escalators covered under the contract. At the conclusion of this inspection, the COTR shall give the Contractor written notice of any deficiencies found. The Contractor shall be responsible for correction of these deficiencies within 30 days after receipt of such notice.
- D. The COTR reserves the right to accept or reject any or all alternates.
- E. Diagnostic Tools and Spare Parts: At the completion of the work as specified, the Contractor shall provide items listed. The items shall become the SI's property.
 1. One complete set of all diagnostic tools and equipment required for the complete maintenance of all aspects of the control and dispatch system. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the serviceman and the controls. All such systems shall be free from secret codes and decaying circuits that must be periodically reprogrammed by the manufacturer.
 2. A list of vendors for all parts used in the installation.
 3. Technical field adjustment manuals with all faults, service codes and nomenclature.
- F. Machine Room Log. The Contractor shall provide, create, manage, update and maintain a Machine Room Log for the inventory equipment to include but not be limited to records, data, maintenance, callbacks, repairs, oil usage, etc. according to the most recent ASME A17 series code and any other standard, directive, law or code applicable. The log shall include the date the service/inspection was performed, the technician that performed the work and any follow up requirements that were reported. The log shall remain in the Machine Rooms as required by applicable code. All required records and logs shall be the property of the Smithsonian Institution and shall be made available for examination on site at anytime by the COTR. Records and logs shall be maintained in a legible, complete, orderly, timely, and accurate manner at all times. The original records and logs shall be submitted to the COTR within 15 calendar days of expiration of the contract. Copies of the records and logs shall be provided to the COTR at anytime upon request.

1.10 ELECTRIC SERVICE

- A. Power: [TBD] volts, 3 phase, 60 hertz. Escalator Contractor to verify voltage.
- B. Lighting: 120 volts, 1 phase, 60 hertz.

II. PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Product of individuals, firms or corporations regularly engaged in manufacturing escalators comparable with the needs of this project and in satisfactory operation for a period of not less than five years.
- B. Qualified Bidders:
 - 1. Otis Elevator Company
 - 2. ThyssenKrupp Elevator Company
 - 3. KONE Elevator Company
 - 4. Schindler Elevator Company
 - 5. Independent installers of approved equal equipment.

2.02 OUTLINE OF EQUIPMENT

- A. Escalator number: TBD.
- D. Size: 40 inches.
- E. Speed: 90 fpm
- F. Serves: [,]
- G. Rise: [].
- H. Machine: Reversible AC induction motor.
- I. Truss Design: Heavy Duty.
- J. Arrangement: Adjacent
- K. Angle of incline: 30 degrees
- L. Balustrade: Solid, high deck.
- M. Decking: Stainless Steel, No. 4 brushed
- N. Molding and Trim: Stainless Steel, No. 4 brushed
- O. Skirt Panels: Reinforced, brushed finish stainless steel with low friction Teflon coated, continuous under handrail return newel area.
- P. Handrail: Black
- Q. Step Riser: Cleated.

R. Safety Features:

- a. Key operated start switches.
- b. Emergency stop buttons or switches.
- c. Upper and lower landing skirt switches.
- d. Broken step-chain and drive chain devices.
- e. Main drive shaft brake.
- f. Fail-safe service brake.
- g. Step upthrust device.
- h. Step level device.
- i. Missing step device.
- j. Reversal stop device.
- k. Handrail speed monitoring device.
- l. Handrail guards.
- m. Handrail entry device.
- n. Overload protection.
- o. Step demarcation lights.
- p. Comb plates, safety yellow. Rigid ribbed aluminum non-corrosive material with wear resistant, anti-slip surfaces.
- q. Comb-step impact device.
- r. Overspeed governor.
- s. Anti-slide knobs.
- t. Skirt obstruction.
- u. Step lateral displacement device.
- v. Disconnected motor safety device (if required).
- w. Safety skirt brushes.

2.03 MACHINE AREA EQUIPMENT

- A. Provide equipment to fit space conditions shown.
- B. Machine: Drive machine shall be connected to the main drive shaft by toothed gearing, a coupling, or a chain. Provide vibration isolation, of an approved type, which shall effectively prevent transmission of machine vibration to the building structure. The machine shall run in an oil tight housing.
- C. Motor: Provide reversible motor(s) which drive only one escalator. Motor shall be alternating current induction type designed to develop a high starting torque with low starting current. The use of VFD regenerative drives escalators motors and other energy saving devices are preferred.
 - 1. Brake: Provide an electrically released and mechanically or magnetically applied brake per Code.
 - 2. Controller: Provide enclosed controller panels with ventilated cabinets and hinged or removable doors, located inside the upper landing of the truss. Unit shall be light-weight for easy removal.
 - a. Provide diagnostic capabilities as an integral part of the controller. Coding or decaying circuits which require periodic reprogramming are not allowed.
 - b. Provide permanently marked symbols or letters identical to those on wiring diagrams adjacent to each component.
 - c. Provide upper and lower diagnostic annunciator panels.
 - d. Provide soft start, reduced voltage motor starting.
- D. Diagnostic Tools and Spare Parts Manual: At the completion of the work as specified, the Contractor shall provide all necessary diagnostic and service tools required to perform maintenance and repair of the equipment. The items shall become the property of the COTR.

One complete set of all diagnostic tools and equipment required for the complete maintenance and adjustment of all aspects of the control and dispatch system and solid-state motor drive units shall be provided. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the serviceman and the controls. All such systems shall be free from secret codes and decaying circuits that must be periodically reprogrammed by the manufacturer. A list of vendors for all parts used as part of the installation shall be provided.

2.04 OPERATING AND SAFETY SYSTEMS

- A. Provide a spring return key operated type starting switch for manual starting, located at the lower and upper landings so that the steps are within sight. Provide audible signal to indicate unit has reached full speed to indicate the safe removal of the key switch.
- A. Provide emergency stop buttons or other type of manually operated switches, which shall activate an alarm audible at device and interrupt the power to the driving machine, located at the lower and upper landing on the right side facing the escalator.

1. Buttons or switches shall be designated red in color and be protected against accidental contact but have an unlocked cover readily removable for access.
 - a. The cover shall be marked "EMERGENCY STOP; MOVE (SLIDE/LIFT) COVER; PUSH BUTTON." Letters shall be minimum 12.7 mm high for "EMERGENCY STOP" AND 4.76 mm for other wording.
 - b. The buttons or switches are prohibited to start the drive machine.
- C. Provide a speed governor which causes interruption of power to the drive machine if the speed of the steps exceeds a set value not greater than 40 percent of the rated speed. Governor shall be of the manually reset type. Governor is not required where an alternating-current squirrel motor is used and the motor is directly connected to the driving machine.
- D. Provide a broken step-chain device which causes interruption of power to the drive machine if the following occurs:
 1. A step-chain breaks.
 2. Excessive sag occurs in either step chain when no automatic tension device is provided.
 3. Device shall be of the manually reset type.
- E. Provide a broken drive-chain device which causes application of the brake on the main drive shaft and stops the drive machine if the drive chain parts. Device shall be of the manually reset type.
- F. Provide a machine area stop switch, which causes interruption of power to the drive machine and brake, where access is provided.
- G. Provide skirt obstruction devices which causes interruption of the power if an object is accidentally engaged between the step and the skirt as the step approaches the comb plate. Install a minimum of 4 switches per side with top and bottom switches at 18" from comb plates and one per side every 16 feet.
- H. Provide a reversal stop device which causes interruption of the power at the drive machine motor and brake in case of accidental reversal of travel in the up direction. Device shall be of the manually reset type.
- I. Provide a step upthrust device which causes interruption of the power at the drive machine motor and brake should a step be dislodged against the upthrust track at the lower curve.
- J. Provide a step level device located at the top and bottom of the escalator. Device shall detect downward movement displacement of 1/8 inch or greater at the riser end at either side of the step. When activated, device shall cause escalator to stop prior to the step entering the comb plate. Device shall be of the manually reset type.
- K. Provide a disconnected motor safety device which causes application of the brake if the motor becomes disconnected from the gear reducer - provided that the drive motor is attached by means other than a continuous shaft, coupling or toothed gearing. Device shall be of the manually

reset type.

- L. Provide a handrail speed monitoring device that will cause activation of the alarm whenever the speed of either handrail deviates from the step speed by more than 15% or more, the device shall interrupt the power to the drive machine motor and brake if the speed of 15% or more is continuous for more than 2 seconds. Device shall be of the manually reset type.
- M. Provide a handrail entry device at each newel. Operation shall be in the entry direction only. Device shall be of the manually reset type. The device shall interrupt the power to the drive machine motor and brake if either of the following occurs:
 - 1. An object becomes caught between the handrail and the guard.
 - 2. An object approaches the area between the handrail and the guard.
- N. Provide a missing step device that detects a missing step and stops the operation prior to the gap from the missing step exiting from the comb plate. Device shall be of the manually reset type.
- O. Provide a comb-step impact device. Device shall be of the manually reset type. The device shall interrupt the power to the drive machine motor and brake if either of the following occurs:
 - 1. A horizontal force in the direction of travel is applied exceeding 500 N at either side or exceeding 1000 N at the center of the front edge of the combplate.
 - 2. A resultant vertical force in the upward direction is applied exceeding 667 N at the center of the front of the combplate.
- P. Provide a speed governor on motor if a variable frequency drive is provided. Devices shall be manually reset.
- Q. Provide green step demarcation lights located below the step at the lower and upper landing. Locate within 16 inches of each comb plate.
 - 1. Provide LED type fixtures at each landing. Arrange lamp fixtures parallel to the comb plate (leading edge) with the first lamp located directly below the teeth line, Space lamp accordingly between the side edges of the steps and the skirt panel.
- R. Provide visible safety and passenger warning signs per Code at lower and upper landings.
- S. Continuous Long-life LED comb plate strip lighting located in both balustrades at lower and upper landings.
- T. In addition, each escalator shall be provided with a device capable of retaining and producing, upon demand the following data:
 - 1. Date, time and cause of failure.
 - 2. Previous failure.
 - 3. Number of hours usage each day, downtime for servicing, downtime caused by failures.

2.05 WIRING

- A. Conductors: Provide copper insulated wiring with flame retarding and moisture resisting outer cover. Install in galvanized metal wire ways and raceways. All terminations shall be insulated to maintain integrity of wiring. Flexible conduit may be used for short connections. Provide 10% spare conductors throughout. Torque each terminal connection to the manufacturers recommended torque value.
- B. Work Light and GFCI Plug Receptacles: Provide in machine and pit area with lamp guards.
- C. Install all wiring and conduit in accordance with National Electric Code requirements and industry standards and practices.
- D. Rout wire and cable as required to meet project conditions.
- E. Make installation in a neat, finished and safe manner, according to the latest published NECA Standard of Installation under competent supervision.
- F. Neatly train and secure wiring inside boxes, equipment, and panel boards.
- G. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- H. Riser cables shall have cable supports as required by Code.
- I. Identify all wire and cable as required. Identify each conductor with its circuit number and/or designation.
- J. Support conductors installed in vertical raceways at intervals not exceeding those distances indicated in the National Electric Code. Support conductors in pull boxes with strain reducing supports provided for the size and number of conductors in the raceway. Do not splice conductors in pull boxes used for vertical cable support.
- K. Control, communications or signal conductors shall be installed in separate raceway systems from branch circuit or feeder raceways.
- L. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom possible.
- M. Properly ground and bond all electrical conduits and raceways in accordance with National Electric Code requirements.

2.06 WELLWAY EQUIPMENT

- A. Truss: Structural steel truss adequately strengthened to carry full-capacity load including exterior and balustrade facing materials. Provide factor of safety per Code requirements. Truss shall be designed and installed with cladding panels. Include sample of cladding material with equipment submittals for approval by COTR. Design and insulate wellways and walk on plates to reduce machinery noise level to a maximum of 40 dBA.

- B. Connect to building structure with:
 - 1. Framing angles.
 - 2. Truss extension where required to connect to building structure.
- C. Drip Pan: Oil tight, steel construction, adequately reinforced per Code loading requirements which forms a working floor, continuous for the entire width and length of truss. Cross bracing or other obstacles shall not be permitted on the inner surfaces of the truss cover to allow for easy cleaning and debris removal. Drip pan shall be of sufficient size to collect any oil and grease drippings in order to contain and prevent the decontaminated material from entering the drain system. Provide drip pan with painted finish in color and finish as directed by COTR
 - 1. Provide corrosion resistant welded oil-tight drip pans for the entire length and width of the trusses. Drip pans shall be of sufficient strength to support a concentrated weight of 500 lbs. on any area of one square foot in the drip pan.
 - 2. Drip pans shall be fabricated of sheet steel hot dipped galvanized panels assembled to provide a smooth, leak-proof surface extending from the upper to and through the lower pit areas. Provide access to drip pans at lower landing of escalator for cleaning.
- D. Tracks: Stainless steel or hot dipped galvanized coated construction, reinforced and rigidly mounted to maintain alignment and ensure smooth operation of running gear. The step roller track for the step chains and step wheels shall be of hot-dip galvanized steel profiles with smooth and even running surfaces and with the joints cut diagonally to the running direction to assure smooth running. The profiles shall be welded together at the joints.
- E. Step Chains: High grade steel links with hardened pins connecting adjacent steps and arranged to distribute load evenly over engaged drive sprockets. Synthetic composition or rubber rollers with sealed ball bearings shall provide a continuous chain design which permits inspection and operation while running without steps in place. Adjustment which prevents sagging, adjacent steps from touching and maintains constant spacing of steps shall be automatic under various loading conditions. The use of non-lubricated step chains is prohibited.
 - 1. Step chains shall be transit-class design of the endless roller type. The chains shall be made of high grade steel links. Chain pins shall have a minimum diameter of 5/8", designed to accurately engage the drive sprockets and ensure smooth operation. .
 - 2. Ultimate strength of step chain and tension shall be at least 10 times the maximum anticipated applied load on the chain. A test certificate for the chain breaking load shall be provided.
 - 3. Chain shall be supported and guided on step chain rollers through the full length of travel. Step chain rollers shall be wear-proof, synthetic rubber or polyurethane tires, non-metallic hubs, and factory hermetically sealed roller bearings, not requiring additional lubrication with a minimum diameter of 3". Rollers shall be replaceable without dismantling step chains.
- F. Steps: Steel or aluminum construction adequately reinforced to maintain alignment under maximum eccentric loading conditions and sufficiently fastened to the drive chain or link axles. Treads and riser shall be cleated die cast aluminum with square edges and coated or lined with fireproof sound deadening material on the underside. The entire step assembly shall be treated with not less than one coat of zinc chromate primer and one coat of aluminum enamel for

corrosion-resistance. Face of riser shall constantly mesh with adjacent steps. Entire step shall be removable from unit without disturbance of balustrade or step chains.

1. Steps and step treads shall be integral formed die cast aluminum, reinforced and braced to provide the maximum rated load per step under eccentric loading conditions without distortion. The deflection shall not exceed 3/32" (2.38 mm) under a load of 1322 lbs. (600 kg.) at the center of the step. Steps shall be arranged to permit the removal of steps without disturbing balustrades.
 2. Surface of cleated risers shall be anodized finish in a color selected by COTR. Vertical cleats shall be arranged to pass with a minimum clearance between the cleats of the tread on the adjacent step so as to form an interlocking unit minimizing the possible seizure of articles between the riser of one step and the tread of the following step.
 3. Steps shall be finished in a powder-coated color selected by COTR with ground tread surfaces. There shall be a demarcation, one at one edge (full width) and both sides of each step tread not less than 1" wide, colored bright yellow. The zone shall be grooved or otherwise provided to match the step tread and shall mesh with cleated step riser.
 4. Step Wheels shall be wear-proof, synthetic rubber or polyurethane tires, non-metallic hubs, and factory hermetically sealed roller bearings, not requiring additional lubrication. Step wheels shall be easily accessible for inspection, cleaning and repair; not smaller than 3" diameter, and of a type which shall ensure wheel rotation and prevent flat spots; and shall be mounted so as to prevent tilting and/or rocking of steps.
 5. Removal of steps shall be performed without the need of dismantling of interior panels.
 6. The step to skirt gap shall comply with the requirements of ANSI A17.1.
- G. Handrails: Laminated canvas and rubber construction running on steel guides fastened to and matching curvature of balustrade. Provide guards per Code. Color to be black.
1. Provide traction drive handrails having a return of not less than 160 degrees around the newel.
 2. Handrails shall receive their motion from the main escalator drive so that handrail and steps operate at substantially the same speed in each direction of travel. Handrail lead shall not exceed 2%.
 3. The handrail drive shall be traction type. All handrail guide and drive wheels shall be provided sealed bearings rated at AFBMA L 10, 100,000 hrs. Bearings shall be protected against intrusion of dust or water.
 4. Provide a means of adjusting handrail tension and provision for releasing handrail tension for repair or removal of handrail.
 5. Handrails shall be constructed of laminated, steel reinforced, flexible material factory vulcanized into an integral, non-separating seamless smooth handrail. Handrail color shall be black.
 6. The handrail, handrail guides and handrail wheel shall be designed and constructed to prevent either inadvertent or intended derailment of the handrail by passengers.

7. Handrail guide tracks shall be smooth finished stainless steel.

H. Balustrade:

1. Glass Panels: Glass balustrades are unacceptable and shall not to be utilized.
 2. Balustrades shall be solid type.
 3. Outer decking and decking between escalators shall be continuous, brushed finish stainless steel, provided with anti-slide devices and designed to support live loads in accordance with ANSI Code.
 4. Skirt panels shall be reinforced, brushed finish stainless steel with low friction Teflon coating, continuous under handrail return newel area.
 5. All non-laminated balustrade, trim, deck covers, skirt panels and moldings shall be not less than 1/8" (3 mm) brushed finish stainless steel (AISI 316). Panels shall be sized in order that no more than (2) persons shall be required to remove a panel.
 6. All panels shall be designed to withstand a force of 175 lbs. per square inch without permanent deflection or distortion. Wood or combustible products shall not be permitted in the construction of panels.
 7. All fasteners shall be of concealed type. (Surface screws of any type shall be unacceptable.)
 8. Brackets, stiffeners, attachment angles, and other ferrous metal work shall be hot dipped, galvanized. All panels shall be supported at intervals of not greater than 5 feet.
 9. All panels shall be attached in a manner that permits easy removal for inspection, lubrication and adjustment of all safety devices.
- I. Decking: 16 gauge stainless steel no. 4 finish construction unless continuously reinforced. Provide finish as indicated which meets Code strength and design requirement. Back of decking shall be reinforced to resist denting and thoroughly coated with fireproof sound deadening material. All fastenings in handrail area concealed, except operating station cover. Provide anti-slide devices.
- J. Skirt Panels: 16 gauge stainless steel no. 4 construction, reinforced to resist denting and thoroughly coated with a fireproof sound deadening material. Provide positive adjustment maintaining a uniform clearance to step threads of not more than 4.76 mm. Extend beyond comb plates and wrap around base of newel.
- K. Provide safety skirt brush assemblies on both interior sides of the escalators. Mount brush assemblies with removable fasteners and properly aligned so as not to interfere with the removal of any skirt. Install skirt brushes to provide the maximum factor of safety available.

2.07 LANDINGS

- A. Comb plates: The color shall be yellow for safety demarcation. There shall be no sharp edges. Infill all grooves black.

1. Fabricate comb plate of rigid, wear resisting, non-corrosive material, with exposed anti-slip surfaces.
 2. Comb teeth sections shall be made of die-cast aluminum alloy, finished in powder coated, high visibility yellow. Individual sections shall be easily exchangeable and shall contain not less than three or more than six comb teeth sections. Comb plates shall be arranged for lateral and vertical adjustment so that the cleats of the step treads shall pass between comb teeth with minimum clearances.
 3. Teeth shall be designed to engage treads on escalator steps to minimize danger of injury to passengers and to prevent breakage and wear of teeth caused by interference with step treads. Teeth shall have no sharp edges.
 4. Floor plates shall be rigid, ribbed, cast aluminum, with anti-slip surfaces, capable of resisting a live load of 300 lbs/ sq. foot without deflection.
 5. Floor plates shall be hinged to provide ease of entry for maintenance. Tie down screw holes shall allow for the use of a pull-key device to ease opening.
- B. Landing Plates: Provide aluminum with non-slip surfaces. Plates shall extend from comb plate to end of truss at lower end and from comb plate to access panel at upper end. Plate shall extend full width of truss where it extends beyond newel. Fabricate in sections of a size and weight capable of being handled easily by one person.
- C. Access Panel: Provide an access panel requiring no more than 311 N effort to open shall be provided in the floor at the upper and lower landing for inspection and maintenance. Access panels provided in the side of the escalator enclosure shall be provided with a keyed lock. Key shall be removable only in the locked position.

2.08 SIGNALS AND FIXTURES

- A. Provide in lower and upper newels the following fixtures, as previously described, with a flush-mounted faceplate which matches the decking finish. Function and operating positions of switches and buttons shall be identified with engraved characters which are visible from the standing position. All key switches shall utilize a "Yale type" key switch similar to the current type utilized throughout the rest of the facility.
1. A spring return key operated start switch with alarm indicating that the key may be safely removed.
 2. Emergency stop button or switch.
 3. A key directional control switch.
 4. A key speed selecting switch if applicable.
 5. Upper and lower diagnostic annunciator panels.
 6. Provide "Hold Handrail" signs and all required signage at each landing per Code.

2.09 LIGHTING SYSTEM:

- A. Provide manufactures standard type, low level skirt and interior truss lighting systems. Provide separate on/off key switches for the lighting units mounted on the exterior of the units where easily accessible to building maintenance personnel. Final lighting design and placement of lighting units shall be reviewed by COTR.

III. PART 3 - EXECUTION

3.01 EXAMINATION

- A. The escalator contractor shall examine the supporting structure and the conditions under which the work shall be installed and notify the COTR of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected and are acceptable.
- B. Verify dimensions of supporting structure at the site by accurate field measurements. The work shall be accurately fabricated and fitted to the structure. Escalator contractor shall confirm by review of the working drawings and field observation that the clearances and the alignments are proper for the installation of this work.
- C. Arrange for temporary electrical power to be available for installation work and testing of escalator components.
- D. Coordinate work with the work of other trades, and provide items to be placed during the installation at the proper time to avoid delays in the overall work. Use contractor's bench marks where necessary.

3.02 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Perform as required by Code and as required by authorities having jurisdiction.
 - 2. Provide labor, materials, equipment and connections.
 - 3. Repair or replace defective work as required.
 - 4. Pay for restoring or replacing damaged work due to tests.
- B. Final Inspection: When all work is completed, and tested, notify the COTR in writing that the escalator is ready for final inspection and acceptance test. A testing and inspection date shall then be arranged. The proper operation of every part of the escalator system and compliance with contract requirements of the Code, shall be demonstrated to the COTR. Furnish all test instruments, weights, and materials, required at the time of final inspection.
 - 1. Final System Tests for Smoke Detection: After work is completed, conduct a final test of entire system. Submit results on approved test report forms.
 - 2. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the escalator does not conform to the requirements of the contract specifications or the

Safety Code, no approval or acceptance of the escalators shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected the COTR shall be notified and the escalator shall be reinspected. Rejected escalators shall not be used until they have been reinspected and approved.

If deficiencies are found, or if the consultant/COTR deems it to be necessary the contractor shall perform the following tests at no additional charge immediately following the final inspection.

3. Test Period: The escalator shall be subjected to a test for a period of one hour continuous run.
4. Speed Load Tests: The actual speed of the escalator shall be measured in both directions of travel with no load on the escalator. Speed shall be determined by a tachometer. The actual measured speed of escalator with no load shall be within 5% of rated speed. The maximum difference in actual measured speeds obtained under the various conditions outlined between the "UP" and the "DOWN" directions shall be checked.
5. Over-speed Protection Device: Test by operating escalator at rated speed and tripping over-speed device manually. Device shall have been separately tested and set in factory to operate at escalator speed as specified herein.
6. Handrail Tension Malfunction Device: Test manually.
7. Broken Drive Chain Protection: Test by operating escalator at rated speed and tripping broken chain device by hand.
8. Device providing protection against sudden and unusual strains on step chains: Test by operating device by hand.
9. Insulation Resistance Tests: The complete wiring systems of the escalator shall be free from short circuits and grounds, and the insulation resistance shall be determined by use of a "Megger." Conductors shall have a insulation resistance of not less than one megohm between each conductor and ground and between each conductor and all other conductors.
10. Reinspection: If any equipment is found to be damaged or defective, or if the performance of the escalator does not conform to the requirements of the contract specifications or the Safety Code, no approval or acceptance of the escalator shall be issued until all defects have been corrected. When the repairs and adjustments have been completed and the discrepancies corrected. The COTR shall be notified and the escalator shall be reinspected. Rejected escalator shall not be used until they have been reinspected and approved.

3.03 ADJUSTING, PAINTING AND CLEANING

- A. All equipment shall be adjusted prior to final testing and acceptance.
- B. Paint exposed work soiled or damaged during installation. Repair to match adjoining work prior to final acceptance. At a minimum all components shall be painted in the field with at least two coats of machine grade enamel. After final adjustment of equipment, all exposed iron work, metal

fittings, etc., shall be painted one coat of quick drying paint. The intent is to provide a complete final product that is neat, clean and painted.

- C. Contractor shall clean and paint the machinery equipment area, truss interior and upper and lower ends with an epoxy based paint as selected by the Contracting Officer.
- D. Clean balustrades, deck boards, skirt panels, operating and signal fixtures and trim.

3.05 INSTRUCTIONS

Upon completion of all work, the Escalator Contractor shall provide a training session. Instructions shall be given by competent supervisory personnel and shall apply to actual field conditions. The instructions shall cover, but shall not be limited to the following:

- A. Operation of escalators under emergency conditions.

END OF SECTION

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