Smithsonian Design Standards

October 2021

VOLUME 2 – SMITHSONIAN SPECIFICATIONS

SF PROJECT NUMBER: 1699622
EWINGCOLE PROJECT NUMBER: 20160528

EWING COLE

VOLUME 1:

Design Guidelines & Technical

Section Design Guidelines:

Technical Sections:

NOTE: * Contact Design Manager for Specification Section

VOLUME 3:

Appendices:

SECTION 01 32 50 BUILDING INFORMATION MODELING (BIM) REQUIREMENTS

PART 1 - GENERAL

Download Word document.

1.1 SUMMARY

A. Section includes requirements for Building Information Modeling including, but not limited to, the following:
   1. Development of BIM Execution Plan**.**
   2. Development of Construction Model(s)**.**
   3. Development of Fabrication/Shop Drawings at Contractor's option**.**
   4. Development of Coordination Model(s)**.**
   5. Development of Coordination Report**.**
   6. As-Built Model(s) and Drawings**.**

B. Related Requirements:
   1. Division 01 section Operation and Maintenance Data for Facility Asset Data Requirements.

C. Contractor's Responsibility:
   1. Develop deliverables required in this Section.
   2. Contractor is solely responsible for the quality and accuracy of all documentation and submittals of this Section.
   3. The intent of BIM deliverables is to avoid interference and conflicts, optimize construction sequencing, achieve greater efficiencies in cost estimating and project coordination, and ensure access for maintenance, replacement, or repairs.
      a. Coordination: Contractor is solely responsible for the coordination of facility systems and equipment.
      b. Construction sequencing: Contractor is solely responsible to sequence construction activities to facilitate the fabrication and installation of systems and equipment without interference, conflicts, or delays in construction, and providing adequate access to effectively maintain and replace systems and equipment.

D. Existing Documents:
   The following building information, obtained and developed by the Architect and/or Engineer during the design phase, may be available to the Contractor:
   1. Design Intent Model(s) (.rvt, .ifc, & .nws / .nwd)
   2. Contract Documents (.pdf)
   3. CAD Files (.dwg)
   4. Point Clouds (.rcs)
   5. Scans of the original building design drawings (.pdf)
   6. BIM PxP (.docx, .pdf)
   7. LOD Matrix(.xlsx, .pdf)

E. SI BIM Practice Requirements:

1. The following documents related to are available on the Smithsonian A/E Information Center website, under the SI Design Standards (SDS) section and are applicable to BIM requirements:

a. Smithsonian OPDC BIM Guidelines: Describes information, procedures, and responsibilities relevant to BIM work completed by architecture, engineering, and construction (AEC) consultants in order to assure accurate and consistent deliverables.

b. OPDC Revit Templates: BIM templates developed by Smithsonian OPDC are available for the Contractor to use when utilizing Autodesk Revit as the model authoring software to populate with accurate project-specific facility asset data.

1) Scope of required facility data is described in the template and should be modified to reflect actual Project requirements.

c. OPDC Revit Template Users Guide: This document, prepared by Smithsonian OPDC, describes how to incorporate and "OPDC Revit Templates" and develop the project BIM.

d. OPDC BIM Project Execution Plan (PxP): Template document that defines the expected BIM deliverables and guides the coordination of the project team, throughout the project lifecycle.

1.2 DEFINITIONS

A. As-Built Model: Building Information Model(s) developed by the Contractor that represents the installed condition of facility elements.

B. Building Information Model (BIM): A digital representation of physical and functional characteristics of a facility.

C. BIM Project Execution Plan (PxP): A document prepared by the contractor, utilizing a standard OPDC PxP template that defines the expected BIM deliverables and guides the coordination of the project team, throughout the project lifecycle.

D. Construction Model: Building Information Model(s) that demonstrates and communicates the facility data necessary to procure, fabricate, schedule or construct the Project.

E. Coordination: A process implemented to ensure the efficiency and harmony of the relationship of facility elements. Typically performed in a BIM environment by evaluating interferences, also called "clash detection".

F. Coordination Model: Building Information Model(s) that demonstrates and communicates the spatial relationship of facility elements.

G. Coordination Report: A report developed to communicate and demonstrate that the facility elements have been properly coordinated and identify areas where issues may still exist.

H. Design Intent Model: Building Information Model(s) that demonstrates and communicates the creative objectives of the designer.

I. Fabrication/Shop Drawing: Drawing generated by the contractor from a Construction Model based on the contract documents that communicates the information necessary to fabricate facility elements. Fabrication/Shop Drawings typically contain one system and are intended for use of trade personnel to fabricate, assemble, and install facility elements.

J. Facility Breakdown Structure: a system-oriented hierarchical decomposition of a facility into smaller components. Typically, the facility breakdown structure is based on disciplines, trades, described by Master Format.

K. Facility Asset Data: Non-graphical information attached to an object in a Building Information Model that defines various characteristics of an object.

L. Furnishings: Built-in or movable cabinets, casework, seating, or other appurtenances provided by the Contractor.

M. Interference: Spatial conflict between facility elements.

N. Level of Development: Describes the minimum dimensional, spatial, quantitative, qualitative, and other data includes in a model element as defined in the OPDC BIM Guidelines.

O. Level of Accuracy: Describes the minimum dimensional accuracy of element(s) as defined in the OPDC BIM Guidelines.

P. Conformed Model – Updates the Design Intent Model for those aspects maintained by the designer to record authorized design changes during construction.

1.3 SUBMITTALS

A. BIM Project Execution Plan (PxP): Prepare and submit a plan utilizing the "OPDC BIM Execution Plan" framework document available on the Smithsonian Architectural-Engineer Information Center website. Submit the PxP in Portable Document Format (PDF) within 60 days after contract award. BIM Project Execution Plan (PxP) shall be updated as required and submitted with Final As-Built Model(s).

B. Submit plans, sections, and other review documents monthly, in .pdf format. To include field changes that affect the accuracy of the Construction and As-Built Models.

C. Construction Model(s): Prepare and submit, on a quarterly basis**,** Construction Model(s) that contain spaces, objects and data required to purchase, fabricate, and install project elements. Graphically indicate construction progress in Construction Model(s). Construction Model(s) are to be submitted with all Coordination Model(s) link into one central model using Autodesk Navisworks with all disciplines.

D. Coordination Model(s): Prepare and submit Coordination Model(s) on a monthly basis. Coordination Model(s) are to be based on the facility breakdown structure of the Design Intent Model. Contractors are to perform all work utilizing 3D modeling software in order to facilitate seamless coordination with BIM workflows and file integration. All design elements should be produced three-dimensionally in programs that can output file formats supported by Autodesk Navisworks. Coordination Model(s) are to be submitted using Autodesk Navisworks with all disciplines.
   1. Coordination Model(s) are to be submitted prior to fabrication, and installation of any element within the area represented within the Coordination Model(s).
   2. Fabrication/Shop Drawings and Construction Model(s) are to be integrated into the Coordination Model(s) or otherwise referenced in the Coordination Model(s).

E. CAD Drawings. Export CAD documents from the BIM authoring application in a format conforming to SI requirements. Reference the “OPDC Revit Template Users Guide” and “OPDC CAD Guidelines”.

F. Coordination Report: Prepare and submit a written Coordination Report generated from the Coordination Model(s) prior to fabrication, and installation of any facility element within the area represented within the Coordination Model(s).
   1. Coordination Report is to be submitted in Portable Document Format (PDF).

G. Final As-Built Model(s): After installation of all Facility Elements, update and submit As-Built Model(s) to document the condition of the facility upon completion of construction. As-Built Models are to be submitted with all Model(s) and link into one central model using Autodesk Navisworks with all disciplines.

H. As-Built Fabrication/Shop Drawings: After installation of all Facility Elements, update and submit Fabrication/Shop Drawings to document the condition of the facility upon completion of construction.

I. By submitting the As-Built Model(s) and Coordination Report(s), the Contractor confirms that the following have been accomplished:
   1. Existing and As-Built conditions have been adequately identified, documented, and field verified.
   2. Facility elements are properly represented within the Model(s) to align with field verified conditions.
   3. Access to maintain, repair, or replace facility elements has been identified and validated.
   4. Clearances, such as those required by code and equipment specifications, have been identified and validated.
   5. Interferences have been identified and resolved.

J. Data Capture (Laser Scan): Survey, prepare and submit Point Cloud files at key stages during the construction process including but not limited to: post-demo, open trenches, rough-in / close-in, project completion, etc. as directed by COTR. This survey to be utilized to ensure all As-Built conditions for the project are documented properly. This will include establishing the necessary Survey Control Network throughout the site and scanning as many points as may be required to create a reliable point cloud of all interior and exterior surfaces of the building. The required object surface density of scanning shall be a minimum of 6mm (¼"). RGB color shall be mapped to both the exterior and interior scans. Point Cloud data should be broken into separate data sets as directed by COTR and be registered in the same coordinate frame (origin point) as the As-Built Model(s). Point cloud data to be submitted using Autodesk Recap.

PART 2 - EXECUTION

2.1 CONTRACT DOCUMENTS AND DESIGN INTENT MODEL(S)

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

B. The Contract Documents are the binding document(s) of record, the Design Intent Model(s) are provided for reference only.

2.2 DEVELOPMENT OF BUILDING INFORMATION MODELING PLAN (BIM PxP)

A. The BIM PxP shall be approved by SI prior to development of Construction / Coordination Model(s), and development of Facility Asset Data. Information contained in the BIM PxP shall conform to the "OPDC BIM Guidelines".

2.3 INSPECTION OF EXISTING CONDITIONS

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

2.4 FACILITY ASSET DATA

A. See spec 01 section OPERATION AND MAINTENACE DATA for asset data requirements

B. The Contractor is responsible for incorporating Design Intent Model and Facility Asset Data Spreadsheet revisions into the Construction and As-Built Model(s) in order to maintain an up-to-date basis for Building Information Modeling throughout construction.

C. Contractor is responsible for incorporating the following Asset Data from SI Facility Asset Data Spreadsheet into the Construction and As-Built Model(s):
1. Asset ID# (SI will provide)
2. Asset Name (SI will provide)
3. SpecID (CSI Master Format 2016)
4. Manufacturer
5. Description

2.5 DEVELOPMENT OF CONSTRUCTION MODEL(S)

A. The intent of the Construction Model(s) is to communicate the necessary information to construct the facility including size, location, and arrangement of both existing to remain and new elements and to incorporate the as-built conditions.

B. Develop Construction Model(s) based upon Contract Documents, Design Intent Model(s), and verified existing conditions.

C. Construction Model(s) shall accurately reflect the geometry and details of existing and new elements within the facility.

1. Use manufacturer or custom model elements to accurately reflect the components detailed in documents submitted for approval.

2. Update the model elements to accurately reflect any revisions to geometry or details arising from the submittal review process.

D. Construction Model(s) are to have a consistent origin that can be referenced to a real world datum or benchmark, located as required in the "OPDC Revit Template Users' Guide".

E. Quality Control. The Construction Model(s) will undergo automated model checks utilizing rulesets, as described in the "OPDC BIM Guidelines" document and visual review by SI.

F. The Construction Model(s) are to reflect all necessary access and clearances.

G. The Construction Model(s) will include, but not be limited to, the following elements with all necessary intelligence included to produce plans, sections, elevations, riser diagrams, and schedules as applicable:
   1. Substructure: All foundations, subgrade enclosures, slabs-on-grade, and water and gas utility connections. Substructure elements shall be depicted with all necessary recesses, curbs, pads, slopes, closure pours, expansion/construction joints, and major penetrations depicted.
   2. Shell: All superstructure, exterior vertical enclosures, and exterior horizontal enclosures, including a depiction of expansion/construction joints.
      a. Superstructure: All columns, primary and secondary framing members, and bracing for the roof and floor systems (including decks).
      b. Exterior Vertical Enclosures: Exterior vertical enclosures shall be depicted to the exact height, length, width, and ratings (thermal, acoustic, fire) to properly reflect element types. Exterior windows, doors and grilles including hardware sets, louvers and vents, and wall appurtenances shall be depicted to represent their actual size, type and location.
   3. Interiors: All interior partitions, windows, doors and grilles, louvers, and vents, raised floors, and ceilings, depicted to represent their exact location, height, length, width, and ratings (thermal, acoustic, fire) to properly reflect element types.
   4. Services: All elevators, escalators, plumbing, HVAC, fire protection, electrical, communications, electronic safety and security, and integrated automation elements, including all major openings and penetrations, cable trays, cable bundles and pipe grouping. All clearances and insulation shall be accounted for in the model for use in interference management and maintenance access requirements. Nonpermanent items are not required to be modeled or contain

facility data.

a. Plumbing: All plumbing elements including plumbing piping and fixture layouts, floor and area drains, and related equipment.
b. Heating, Ventilation, And Air Conditioning (HVAC): All heating, ventilation, and air conditioning (HVAC) elements including piping, valves, ductwork fixture lay- outs and related equipment.
c. Fire Protection: All fire protection elements including piping, valves, and related equipment.
d. Electrical: All electrical elements including conduit, fixture layouts and related equipment (including power for systems furniture).
e. Communications: All communications and low voltage systems elements including conduit and related equipment.
f. Security: All Electronic Safety and Security elements including conduit and related equipment.
g. Integrated Automation: All integrated automation elements including conduit and related equipment.
h. Model all elements larger than 38mm (1-1/2 inch) in diameter for any trade. When equal or smaller element are grouped or run in a uniform path. That group of elements shall be modeled when larger than 152mm (6 inches).

5. Equipment and Furnishings: All fixed equipment and furnishings, depicted to represent their exact location, height, length, width, configuration, materials, finishes, and mechanical and electrical requirements.
6. Special Construction and Demolition: All special construction and demolition including special construction, facility remediation and demolition.
7. Sitework: All sitework elements, including site improvements, liquid and gas utilities, electrical site improvements, and site communications.

H. Construction Model(s) must be revised and certified by the Contractor prior to installation of facility elements contained within the models.

2.6 DEVELOPMENT OF COORDINATION MODEL(S)

A. Develop Coordination Model(s) that combine facility elements contained within the Construction Models with other facility elements depicted in the Design Intent Model to review the efficiency and harmony of the relationship of the facility elements.

B. Verify that all facility elements are properly represented within the Construction and Coordination Model(s) prior to coordination.

C. Conduct the following interferences checks to ensure that there are no conflicts in the installation of facility elements.

1. Substructure/Shell vs Interiors
2. Substructure/Shell vs Equipment and Furnishings provided by Contractor
3. Interiors vs Equipment and Furnishings provided by Contractor.
4. Substructure vs. Shell
5. Services vs other components:
    a. Services vs Substructure/Shell
    b. Services vs Interiors
    c. Services vs Equipment and Furnishing
    d. Services vs Site work
6. Services
    a. Plumbing vs HVAC
    b. Plumbing vs Fire Protection
    c. Plumbing vs Electrical
    d. Plumbing vs Communications
    e. Plumbing vs Electronic Safety and Security
    f. HVAC vs Fire Protection
    g. HVAC vs Electrical
    h. HVAC vs Communications
    i. HVAC vs Electronic Safety and Security
    j. Fire Protection vs Electrical
    k. Fire Protection vs Communications
    l. Fire Protection vs Electronic Safety and Security
    m. Electrical vs Communications
    n. Electrical vs Electronic Safety and Security
    o. Communications vs Electronic Safety and Security
7. ADA Accessibility

D. Coordination Model(s) shall be free of interferences prior to installation of any associated facility element.

E. Update the Coordination Model(s) to reflect changes throughout construction prior to installation of any associated facility element.

2.7 COORDINATION REPORT(S)

A. Develop Coordination Reports identifying outstanding issues after the development of the Coordination Model(s), including but not limited to:
1. Clashes:
    a. Itemize number of clashes.
    b. Clash Category
    c. Describe clashes.
    d. Describe the resolution of clashes and other conflicts.
2. Design changes.
3. Differing site conditions.
4. Hazardous or safety related issues.
5. Assets installed and assets pending installation.

B. The report shall be organized by CSI Master Format 2016 specification section or by trade.

C. The issues identified within the Coordination Report are to be addressed by the **Contractor** in consultation with the SI and the Architect / Engineer prior to installation of facility elements.

D. The Contractor is solely responsible for the cost of remedying any clashes that could have been discovered during the clash detection process.

2.8 INSTALLATION

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

B. Adjust Coordination Model(s) throughout construction to reflect all changes made to the approved Contract Drawings and Specs, Design Intent Model, and Fabrication/Shop Drawings.

C. Maintain an up-to-date Fabrication/Shop Drawing set and Coordination Model(s) for all parties to access.

2.9 AS-BUILT MODEL AND DRAWINGS

A. Upon completion of the installation of facility elements, update and deliver As-Built Model(s) and Fabrication/Shop Drawings to document the condition of the facility upon completion of construction.

1. The updated Construction and Coordination Model(s) are considered the As-Built Model for this facility. These models shall clearly indicate portions of the facility that are constructed and portions where construction is pending.
2. As-Built Model(s) shall be field verified for accuracy and updated as required. The Level of Development (LOD) shall be LOD 500
3. The Level of Accuracy (LOA) of the model(s) shall be minimal 12mm (1/2") for existing and align with construction tolerances for all new construction (minimal 24mm (1")).
4. Model(s), CAD and SI-GIS exports are to be delivered in native file formats as well as file formats and naming conventions consistent with SI standards. Reference the "OPDC Revit Templates Users Guide" and "Smithsonian OPDC BIM Guidelines" guidance documents.
5. All models shall be linked and submitted using Autodesk Navisworks.

END OF SECTION 01 3250

SECTION 01 56 39 – SITE PROTECTION

26.1. Tree Protection: The following procedures shall be followed for any project taking place on Smithsonian Institution grounds when any tree may be impacted.

26.1.1 Prior to any work taking place or vehicles and equipment being brought on site, the Contractor shall meet with the Smithsonian Gardens (SG) Arborist, Landscape Architect, and other appropriate staff to discuss and plan for tree protection measures.

26.1.2 The project site shall be defined, and all trees that may be impacted identified.

A. Where proposed utility work and connections cross roadways into adjacent SG property, the project site will include tree protection within the adjacent property if deemed necessary by the Smithsonian Gardens Arborist and/or other qualified SG staff.

26.1.3 For every tree that may be impacted, the Critical Root Zone (CRZ) shall be identified.

The CRZ shall be determined by the following method:

A. Measure the diameter of the tree at breast height (4.5 feet above grade), and for every inch of diameter, measure a distance of 1.5 feet from the trunk. The area inside this circle is the CRZ.

26.1.4 The following activities shall **NOT** take place in the CRZ, unless specified in a written tree protection plan pre-approved by SG:

A. Stockpiling of materials, soil, mulch, or debris.
B. Parking or driving of equipment or vehicles.
C. Compaction of soil from any activity, including the placement of vehicles, materials, equipment, or outriggers.
D. Trenching, tunneling, grade changing, or removing soil.
E. Cutting, tearing, or grubbing of tree roots.
F. Wounding trees in any way.
G. Changing the site drainage.
H. Dumping or spraying gasoline, oil, dirty water, or any chemical or material

that can damage a tree.

I. Using trees as backstops, winch supports, or anchors.

J. Attaching anything to trees, including, but not limited to, signage, nails, screws, spikes, ropes, and wires.

26.1.5 Once the CRZ's have been identified, fencing shall be erected on the edge of the CRZ to prevent any activities from taking place in those zones. Fencing should consist of minimum 48" height (72" preferred) chain link or welded wire fence with steel posts set into the ground. Refer to Smithsonian Gardens standard Tree Protection Fence Detail. Alterations to or deviations from this detail shall be pre-approved by SG through the COTR. Orange construction fencing should NOT be used without advance approval from SG Arborist.

Warning signs shall be placed on each CRZ fence, be a minimum size of 8.5 x 11 inches, and state the following: "TREE PROTECTION ZONE. This fence shall not be removed." Removal of fences, even temporarily, to allow deliveries or equipment access is not allowed without the prior approval of the Smithsonian Gardens Arborist or other qualified SG staff.

26.1.6 In the event that it is impossible to complete a project without some activity in a CRZ, a written tree protection plan pre-approved by SG shall be implemented. Tree protection plan requirements may include impact avoidance, root protection groundcover, air excavation and root pruning, supplemental watering, chemical applications, branch pruning and/or tiebacks, and/or any number of other industry standard tree protection methods generally reviewed in the *Managing Trees During Construction Best Management Practices* manual (Fite and Smiley 2016) and other literature reviewing tree care industry standard tree protection practices.

A. Boring of utilities under protected root zones shall be required in circumstances where it is not possible to trench around a CRZ. Refer to Smithsonian Gardens standard Tree Protection Utility Boring Detail.

26.1.7 During the project, project activities shall not physically impact the tree or delineated CRZ, unless described in tree protection plan pre-approved by SG. The impacted trees shall also be closely monitored for signs of shock or stress. Any decline in tree condition that is noted by the Contractor shall be immediately reported to the SG Arborist or other staff. The Contractor shall be prepared to provide temporary water to irrigate.

26.1.8 Upon completion of the project, all trees within the project area will be inspected by the SG Arborist and/or other qualified SG staff for any signs of tree damage, soil

compaction, and/or other negative impacts to the site. If any issues are found, the

Contractor shall be responsible for remediation activities including, but not limited to, root zone invigoration/air spading, liquid fertilization/bio-stimulant injections, root pruning, branch pruning, bark tracing, and/or supplemental watering.

26.1.9 If a tree is found by the SG staff to be irreversibly damaged, the Contractor may be required to install a replacement tree of matching size, quality, and variety, using a contractor designated by SG. If an acceptable tree is not available, the Contractor may be required to pay damages to SG for the value of the damaged tree in accordance with the guidelines set forth in the *Guide for Plant Appraisal, 10th Edition*, using the Trunk Formula Method.

26.2 Flora Protection: The Contractor is expressly prohibited from collecting plant materials on Smithsonian property.

26.3 Soil, Turf and Planting Bed Protection: Vehicular traffic or parking on turf areas or on planting beds is not permitted without prior approval of the Smithsonian Gardens through the COTR. If turf areas or planting beds must be crossed by vehicles, beds bridging is required. The Contractor shall meet with the Smithsonian Gardens (SG) Arborist, Landscape Architect, and other appropriate staff to discuss required protection measures. The scope of work and types of vehicles or machinery being used will determine the selection of the following ground protection techniques. Install any underlayment or drainage for these protection measures as directed by the associated standard details.

A. ¾’ Temporary Plywood Matting – used in zones of low vehicle traffic, including lighter weight vehicles (lulls, skid steer loaders, or equivalent) where the duration of use does not exceed three days. Refer to Smithsonian Gardens standard Temporary Soil Protection – Plywood Matting Detail.

B. Rigid Plastic Decking (Geoterra Mats) – used in main circulation zones with high vehicle traffic, including wheeled vehicles or machinery of H20-rated loading or greater; and where sensitive and newly installed soil is located. Refer to Smithsonian Gardens standard Soil Protection – Geoterra Mats Detail.

C. Timber Mats – used in zones of high vehicle traffic, where heavy (H20-rated loading) vehicles and machinery are entering or exiting the project site; and where sensitive and newly installed soil is located. Refer to Smithsonian Gardens standard Soil Protection – Timber Mats Detail.

26.3.1 The Contractor shall be responsible to ensure that no soil disturbance, compaction, or other damages will occur from construction traffic or other construction

activities. Any such disturbance, compaction, and/or damage shall be repaired by the Contractor at no additional expense to Smithsonian Gardens.

26.3.2 Repair and re-establish grades where turf and bed surfaces have become eroded, rutted, or compacted. Scarify, or, if directed by the COTR or other appropriate SG staff, remove and replace soil (with approved soil material) to the depth as directed.

26.3.3 Any soil area that becomes compacted to a density greater than 85% Standard Proctor (or 300 lbs per sq ft) and/or the determined maximum by the COTR or SG staff shall be dug up and reinstalled. Surface tilling shall not be considered adequate to reduce over-compaction at levels 6" or greater below finish grade.

26.4 If a generator is placed on the turf, Smithsonian Gardens must have approved its placement. Generator shall be place on anti-compactor boards. The generator must be placed in a drip containment basin.

26.5 Where aerial work is being performed above shrub/planting beds, the Contractor shall protect them with an approved protective framework installed at least 300 mm above the tops of the plant materials. The Contractor shall submit the proposed method of protection to the COTR and Smithsonian Gardens for approval. Trees and shrubs shall only be tied back with the approval of the COTR and Smithsonian Gardens.

A. Trees in proximity to construction equipment with moving arms at heights above standard protection fencing shall have their trunks protected. Refer to Smithsonian Gardens standard Trunk Protection Detail.

B. Once work is complete, all fallen debris within a 10' radius of scaffolding shall be removed from the surface of the soil and any plants beneath. The Contractor shall utilize magnetic sweepers and metal detectors to remove any fallen metal debris and construction materials.

26.6 Irrigation Protection: Smithsonian Gardens should be notified immediately, should any damage occur to existing irrigation systems during construction. Any damage to the existing irrigation systems during construction shall be repaired by the Contractor within two calendar days from when the damage occurred. All repairs to the irrigation system shall be made by a certified irrigation contractor to work on Rain Bird Maxicom computer controlled irrigation systems. Certification is required.

26.6.2 Damaged piping shall be replaced using approved materials per section Division Two, "Site Work, Irrigation Systems".

26.6.3 The Contractor shall bear all costs for repairs to the damaged irrigation system. Where the low voltage control wiring is damaged due to construction then said wiring shall be replaced from the zone valve to controller. No splicing will be

permitted.

26.6.4 Mainlines damaged during the construction process shall be replaced with an identification wire from valve to controller.

26.6.5 All damaged irrigation piping shall be cleared of debris prior to making the permit connections.

26.7 Replacement Plants: The Contractor shall bear all costs for replacement of damaged plant materials. Replacement plant materials shall meet the criteria established by the Smithsonian Gardens. Any plant material destroyed and/or damaged by the Contractor during construction shall be replaced with like genus and species of the same size, at no additional cost to the Smithsonian.

26.8 Replacement Turf: Turf areas damaged during construction shall be repaired by the Contractor according to Smithsonian Gardens Lawns and Grasses Specifications (329200). Replacement turf shall be sod, not seed. Contractor shall request a copy of Lawns and Grasses Specifications prior to commencing repair. Specifications include roto-tilling a minimum depth of 6 inches, backfilled with sandy-loam topsoil. Prior to installing sod, contractor shall obtain Smithsonian Gardens acceptance of finish grading. Sod shall be certified sod, non-netted and a minimum of one year old. Sod shall be 90:10, consisting of a minimum of three varieties tall fescues and one Kentucky Bluegrass. Smithsonian Gardens through the COTR must approve the source of the sod. Following installation, sod shall be rolled by hand with a water roller to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. The Contractor shall bear all costs for these repairs. Suggested sources are:

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

2. Collins Wharf Sod
25361 Collins Wharf Rd
Eden, MD 21822
Phone 410-334-6676
Fax 410-749-3815

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

26.9 Replacement Soil: Planting soil damaged by compaction or removed during construction shall be repaired or replaced. All removed soil shall be stored on site, protected properly, and used for replacement. Any replacement soil brought from off-site shall match the existing soil texture. Smithsonian Gardens, through the COTR, must approve the source of any replacement soil before procuring and transporting the soil to the site.

26.10 Compacted Soil: Planting soil damaged by compaction during construction shall be repaired or replaced. Before the Contractor concludes their Work (at time of Substantial Completion or Final Review), they must notify Smithsonian Gardens, through the COTR, to check for compaction. If compaction has occurred, the Smithsonian COTR will direct the Contractor to the proper remediation process and details based on the depth of compaction found to be present.

26.11 Artifacts and Furniture Collection Pieces: Smithsonian Gardens requires (5) working day notice should any of the artifacts or furniture collection need to be removed to facilitate construction. Any artifacts or furniture collection piece damaged during the construction process must be replaced prior to final payment.

26.12 Trash and Debris Removal: The Contractor shall be responsible for the daily removal of trash and construction debris from turf and flower/shrub beds within the limits of construction.

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

26.14 Haupt Garden: Due to structural weight limits, vehicular traffic is permitted inside the Smithsonian's Enid A. Haupt Garden only with prior approval by the COTR and Smithsonian Gardens.

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

Details

Tree Preservation

identifying impacts and tolerances

1 PERCENTAGE OF CRZ IMPACTED

The number of quadrants, or “sides,” of the critical root zone that are impacted will significantly affect tree preservation. The consequences become more severe with each additional quadrant impacted.

The root plate is the “base of the wine glass” around each tree that is responsible for structural support. It is very important to avoid severing these roots because damage to them can result in catastrophic windthrow failure.

% CRZ Impacted	% SRP Impacted	Survivability
0 - 30%		Good - Great
31 - 40%		Moderate
41 - 50%	0 - 25%	50 / 50 Chance
> 50%	> 25%	Remove Tree

2 EXISTING TREE HEALTH

Tree condition is categorized from excellent to dying. This is a conclusion based upon visual inspection of growth rates, consistency of growth, percentage of live crown, live crown ratio, history of failure, structural defects and anticipated life span. For tree preservation purposes, only trees with a condition rating of fair, or better, should be considered as preservation candidates.

Excellent
Good
Fair
Poor
Dying or dead

3 SEASON OF IMPACT

The least impactful season for severing roots is the dormant season. This is because of the low energy demand for the tree during this time. Alternatively, the most stressful time are the spring months when energy demands are at their highest.

Season	Energy Needs	Recovery Time
Winter	Low	1 year
Fall	Medium-Low	2 years
Summer	Medium-High	3 years
Spring	High	4 years

4 TOLERANCE TO IMPACT

The assessed trees typically fall into one of three tolerance categories – high, moderate and low. This is typical of trees in the Mid-Atlantic region.

High Tolerance	Moderate Tolerance	Low Tolerance
White Oak	Hickory	Tulip poplar
Willow oak	Sugar maple	Black walnut
Red Maple	Southern magnolia	Dogwood
Catalpa	Eastern white pine	Sourwood
Elm	Eastern red cedar	Cherries
Sycamore		Linden
Hackberry		Yellowwood

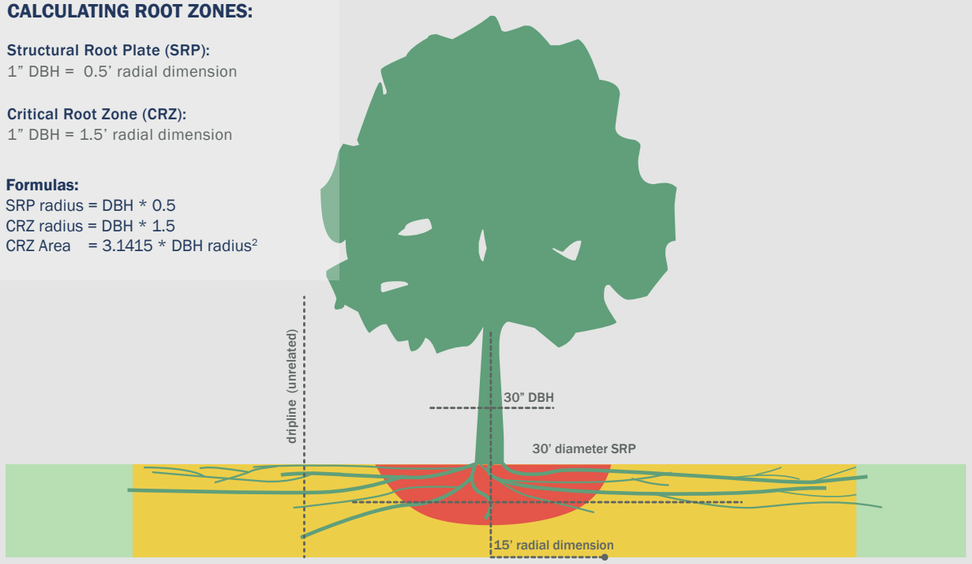
CRZ IN OPEN SOIL VOLUMES

CALCULATING ROOT ZONES:

Structural Root Plate (SRP):
1” DBH = 0.5’ radial dimension

Critical Root Zone (CRZ):
1” DBH = 1.5’ radial dimension

Formulas:
SRP radius = DBH * 0.5
CRZ radius = DBH * 1.5
CRZ Area = 3.1415 * DBH radius^2



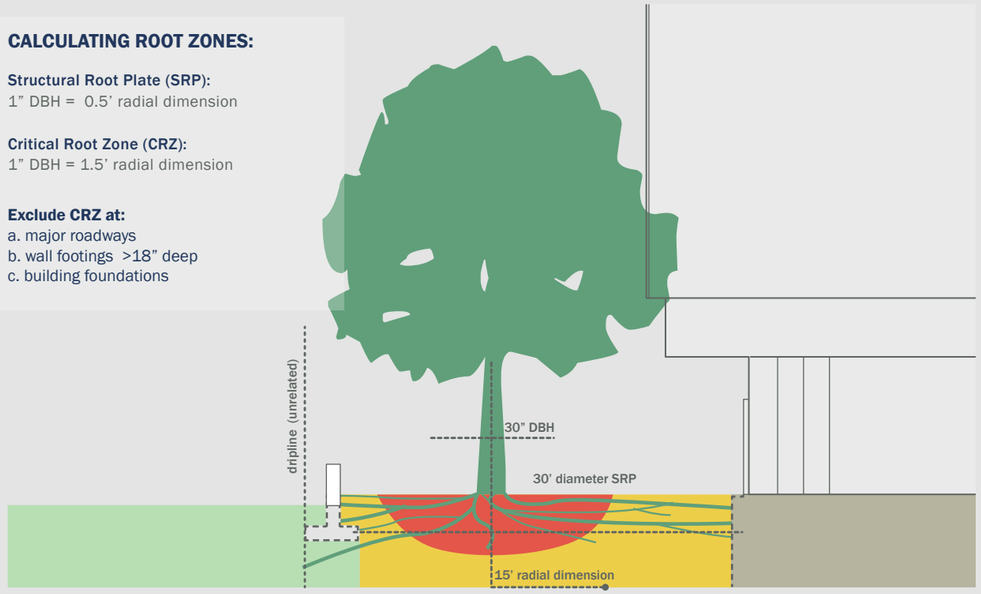
CRZ IN CONSTRAINED SOIL VOLUMES

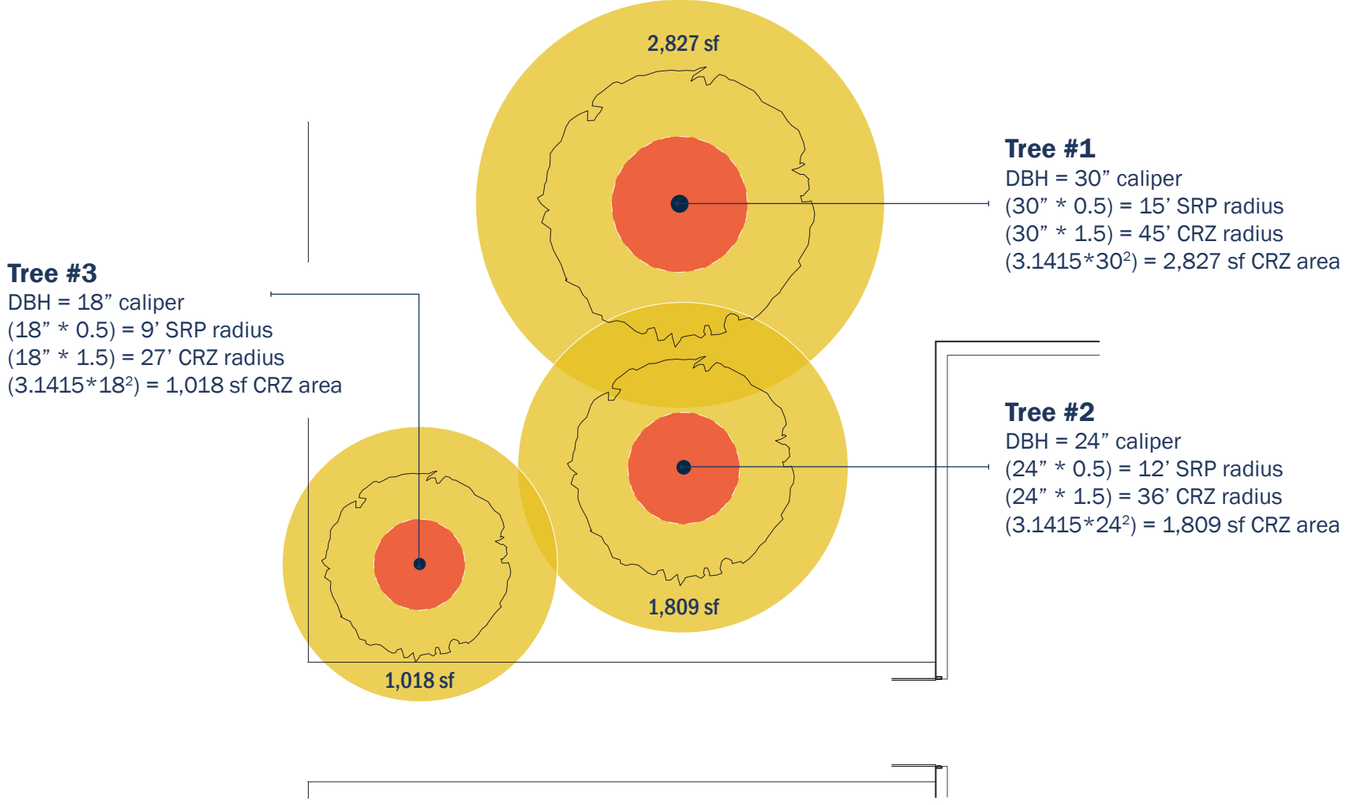
CALCULATING ROOT ZONES:

Structural Root Plate (SRP):
1” DBH = 0.5’ radial dimension

Critical Root Zone (CRZ):
1” DBH = 1.5’ radial dimension

Exclude CRZ at:
a. major roadways
b. wall footings >18” deep
c. building foundations

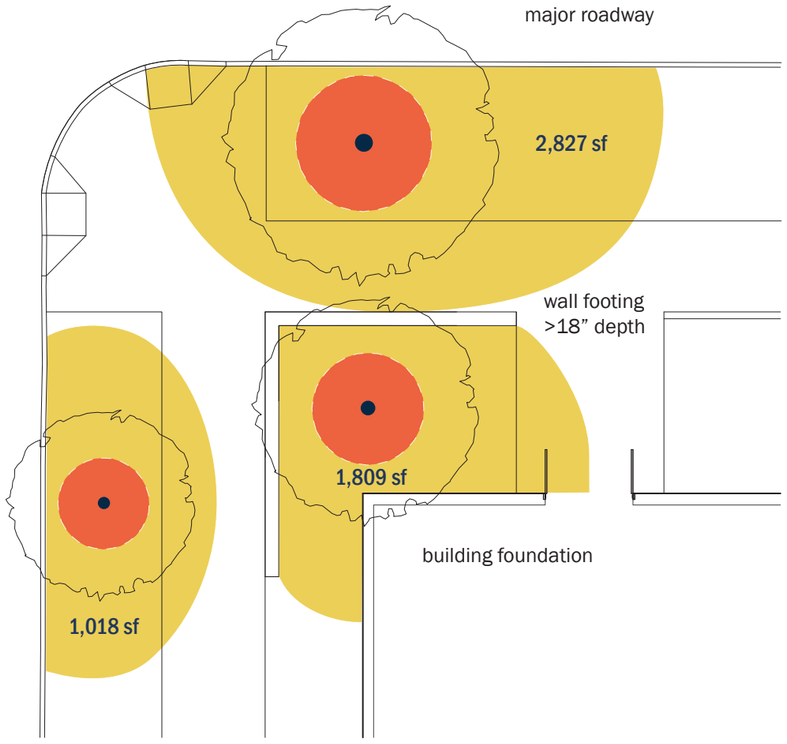


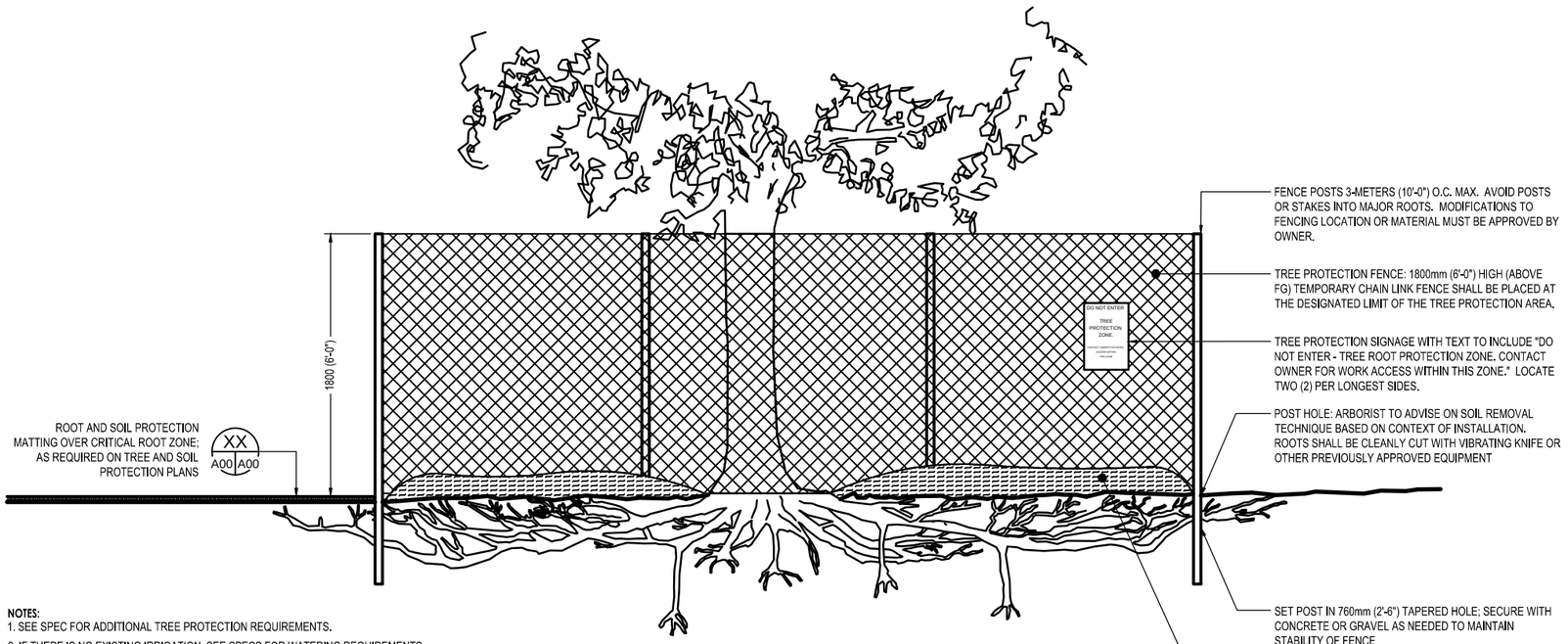


Tree #1
DBH = 30” caliper
(30” * 0.5) = 15’ SRP radius
(30” * 1.5) = 45’ CRZ radius
(3.1415*30^2) = 2,827 sf CRZ area

Tree #2
DBH = 24” caliper
(24” * 0.5) = 12’ SRP radius
(24” * 1.5) = 36’ CRZ radius
(3.1415*24^2) = 1,809 sf CRZ area

Tree #3
DBH = 18” caliper
(18” * 0.5) = 9’ SRP radius
(18” * 1.5) = 27’ CRZ radius
(3.1415*18^2) = 1,018 sf CRZ area





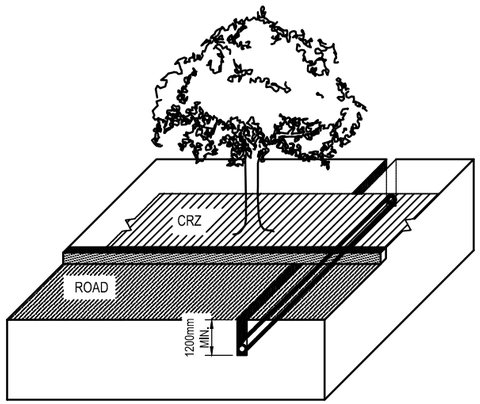
NOTES:

1. SEE SPEC FOR ADDITIONAL TREE PROTECTION REQUIREMENTS.
2. IF THERE IS NO EXISTING IRRIGATION, SEE SPECS FOR WATERING REQUIREMENTS.
3. NO PRUNING SHALL BE PERFORMED EXCEPT BY APPROVED ARBORIST.
4. NO EQUIPMENT SHALL OPERATE INSIDE THE PROTECTIVE FENCING INCLUDING DURING FENCE INSTALLATION AND REMOVAL.
5. SEE SITE PREPARATION PLAN FOR ANY MODIFICATIONS WITH THE TREE PROTECTION AREA.
6. NO STOCKPILING OF MATERIALS, VEHICULAR TRAFFIC, OR STORAGE OF EQUIPMENT OR MACHINERY IS ALLOWED WITHIN FENCING LIMITS.
7. FENCING SHALL NOT BE MOVED UNLESS APPROVED BY OWNER.
8. WORK WITHIN FENCING SHALL BE DONE MANUALLY AND UNDER THE SUPERVISION OF THE ARBORIST/OWNER AND WITH OWNERS PRIOR APPROVAL.
9. NO PART OF ANY TREE PROTECTION SHALL BE MOVED, ALTERED, OR CHANGED IN ANY WAY FOR THE ENTIRE LENGTH OF THE CONSTRUCTION PROJECT
10. IF ANY PART OF THE TREE PROTECTION MUST BE ACCESSED, CONTRACTOR MUST CALL XXXXX XXXX AT XXX-XXX-XXXX TO REQUEST PERMISSION TO ACCESS TREE PROTECTION AREAS.

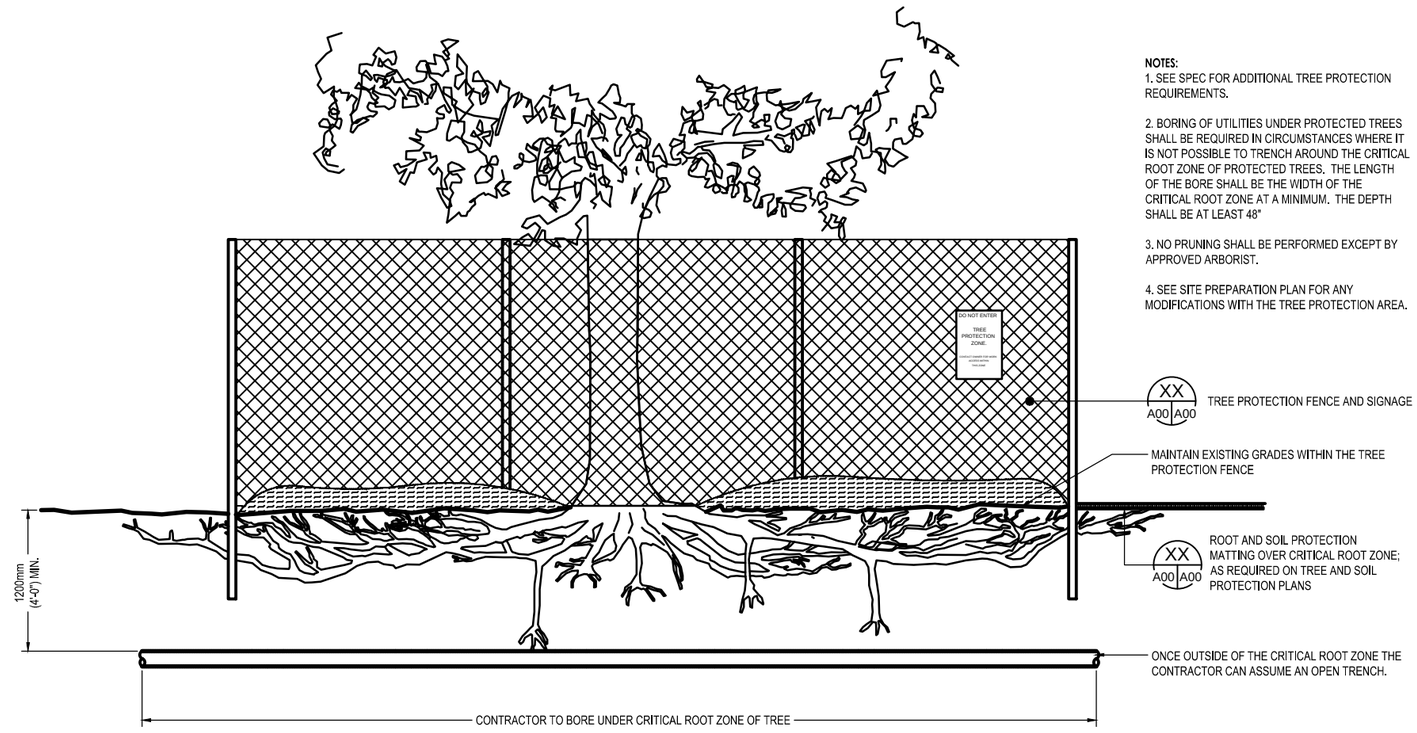
XX
A00 A00 TREE PROTECTION FENCE
SCALE: 1:20

SF PROJECT #:
DATE:
DRAWN BY:
SCALE:
BUILDING NAME:
PROJECT TITLE:

Smithsonian Institution
Smithsonian Facilities
600 Maryland Avenue SW
Suite 5001 Washington, DC 20560



AXON: NTS



NOTES:
1. SEE SPEC FOR ADDITIONAL TREE PROTECTION REQUIREMENTS.

2. BORING OF UTILITIES UNDER PROTECTED TREES SHALL BE REQUIRED IN CIRCUMSTANCES WHERE IT IS NOT POSSIBLE TO TRENCH AROUND THE CRITICAL ROOT ZONE OF PROTECTED TREES. THE LENGTH OF THE BORE SHALL BE THE WIDTH OF THE CRITICAL ROOT ZONE AT A MINIMUM. THE DEPTH SHALL BE AT LEAST 48"

3. NO PRUNING SHALL BE PERFORMED EXCEPT BY APPROVED ARBORIST.

4. SEE SITE PREPARATION PLAN FOR ANY MODIFICATIONS WITH THE TREE PROTECTION AREA.

XX / A00 | A00 — TREE PROTECTION FENCE AND SIGNAGE

MAINTAIN EXISTING GRADES WITHIN THE TREE PROTECTION FENCE

XX / A00 | A00 — ROOT AND SOIL PROTECTION MATTING OVER CRITICAL ROOT ZONE; AS REQUIRED ON TREE AND SOIL PROTECTION PLANS

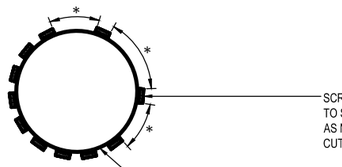
ONCE OUTSIDE OF THE CRITICAL ROOT ZONE THE CONTRACTOR CAN ASSUME AN OPEN TRENCH.

XX / A00 | A00 TREE PROTECTION - UTILITY BORING
SCALE: 1:20

SF PROJECT #:
DATE:
DRAWN BY:
SCALE:

BUILDING NAME:
PROJECT TITLE:

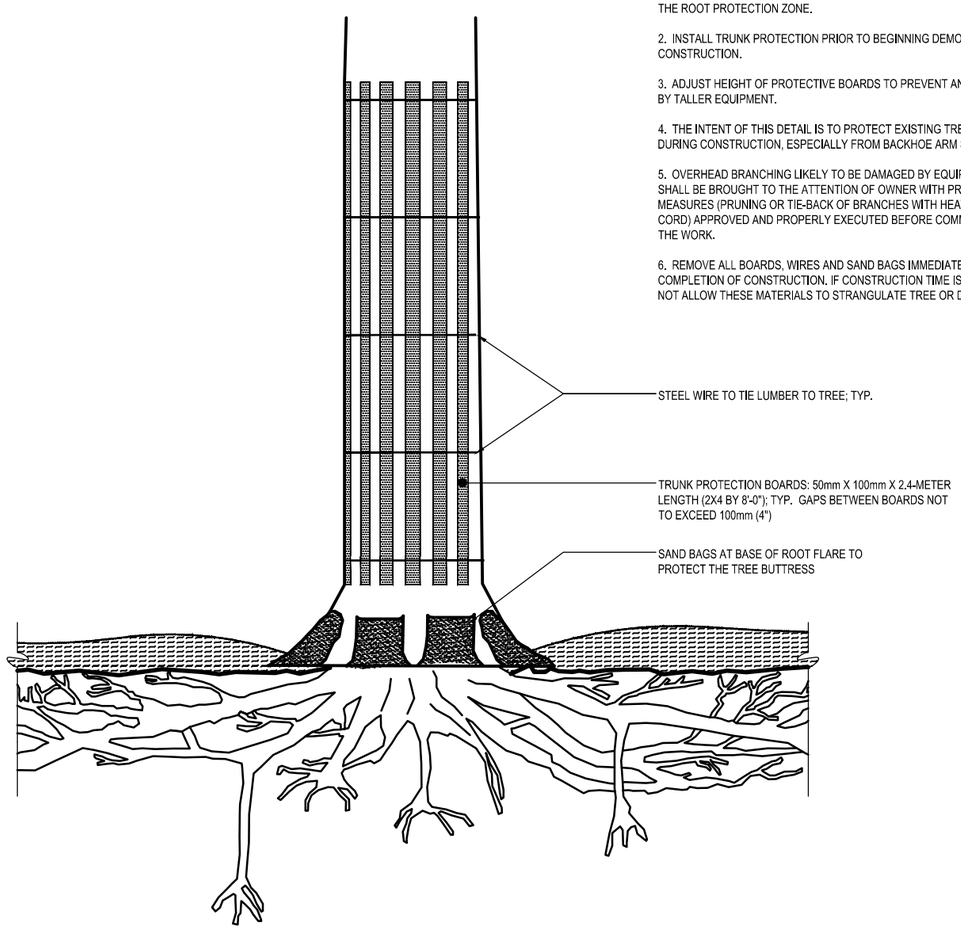
Smithsonian Institution
Smithsonian Facilities
600 Maryland Avenue SW
Suite 5001 Washington, DC 20560



SCRAP 50mm X 100mm (2X4) LUMBER MAY BE USED TO SUPPORT WIRE ON BACKSIDE OF TREE; SPACING AS NEEDED TO SUPPORT THE WIRE SO AS NOT TO CUT INTO THE TREE BARK

BURLAP PROTECTION LAYER BENEATH BOARDS; THREE TO FOUR LAYERS

ELEVATION VIEW



STEEL WIRE TO TIE LUMBER TO TREE; TYP.

TRUNK PROTECTION BOARDS: 50mm X 100mm X 2.4-METER LENGTH (2X4 BY 8'-0"); TYP. GAPS BETWEEN BOARDS NOT TO EXCEED 100mm (4")

SAND BAGS AT BASE OF ROOT FLARE TO PROTECT THE TREE BUTTRESS

NOTES:

1. CONSTRUCTION DEBRIS, EQUIPMENT AND FILL SHOULD NOT BE STORED IN THE ROOT PROTECTION ZONE.

2. INSTALL TRUNK PROTECTION PRIOR TO BEGINNING DEMOLITION OR CONSTRUCTION.

3. ADJUST HEIGHT OF PROTECTIVE BOARDS TO PREVENT ANTICIPATED DAMAGE BY TALLER EQUIPMENT.

4. THE INTENT OF THIS DETAIL IS TO PROTECT EXISTING TREES FROM DAMAGE DURING CONSTRUCTION, ESPECIALLY FROM BACKHOE ARM SWING.

5. OVERHEAD BRANCHING LIKELY TO BE DAMAGED BY EQUIPMENT OPERATION SHALL BE BROUGHT TO THE ATTENTION OF OWNER WITH PREVENTATIVE MEASURES (PRUNING OR TIE-BACK OF BRANCHES WITH HEAVY DUTY JUTE CORD) APPROVED AND PROPERLY EXECUTED BEFORE COMMENCEMENT OF THE WORK.

6. REMOVE ALL BOARDS, WIRES AND SAND BAGS IMMEDIATELY AFTER COMPLETION OF CONSTRUCTION. IF CONSTRUCTION TIME IS EXTENDED, DO NOT ALLOW THESE MATERIALS TO STRANGULATE TREE OR DAMAGE BARK.

XX
A00 A00 TREE PROTECTION - TRUNK PROTECTION

SCALE: 1:15

SF PROJECT #:

DATE:

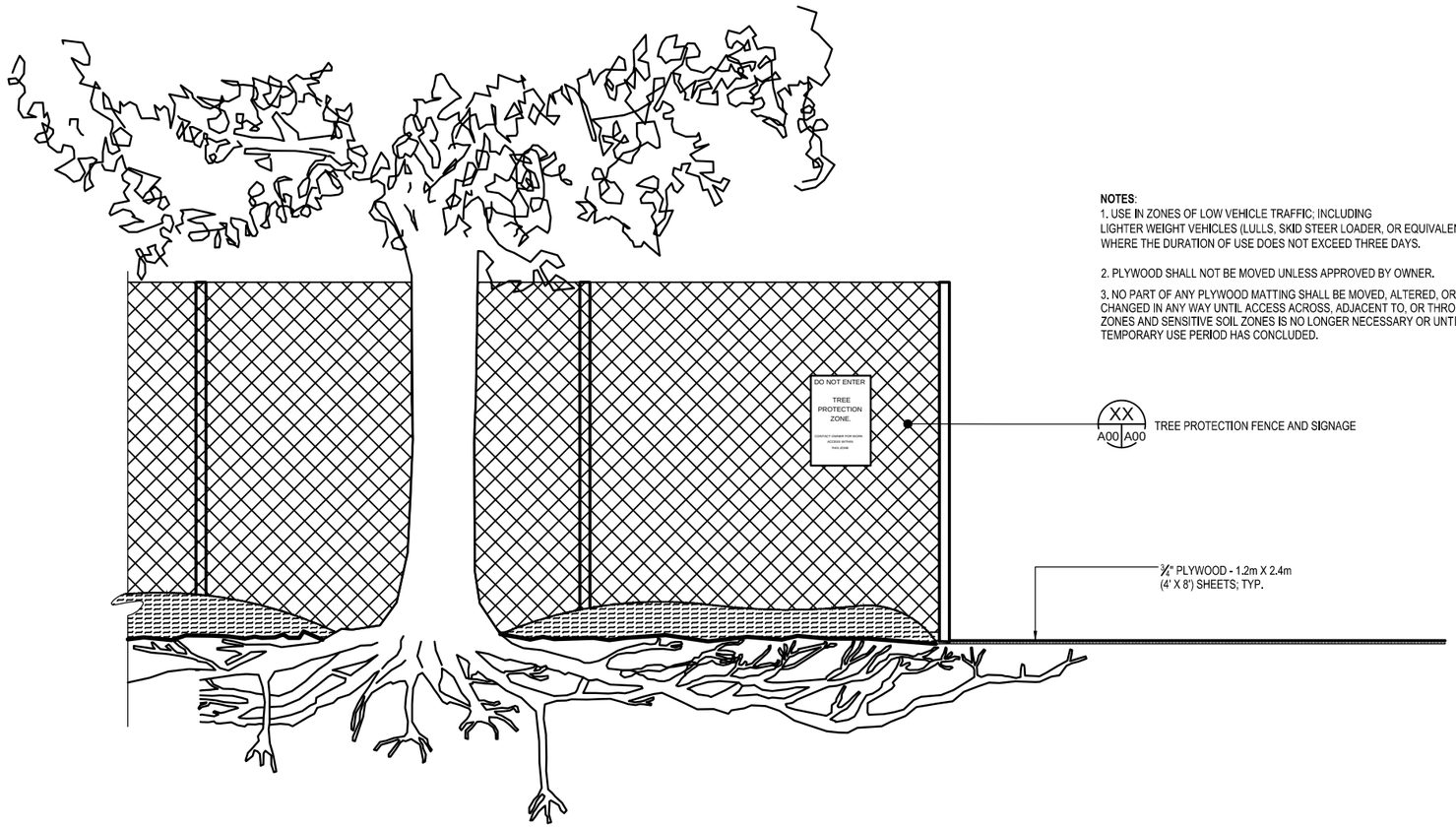
DRAWN BY:

SCALE:

BUILDING NAME:

PROJECT TITLE:

Smithsonian Institution
Smithsonian Facilities
600 Maryland Avenue SW
Suite 5001 Washington, DC 20560



NOTES:
1. USE IN ZONES OF LOW VEHICLE TRAFFIC, INCLUDING LIGHTER WEIGHT VEHICLES (LULLS, SKID STEER LOADER, OR EQUIVALENT) WHERE THE DURATION OF USE DOES NOT EXCEED THREE DAYS.

2. PLYWOOD SHALL NOT BE MOVED UNLESS APPROVED BY OWNER.

3. NO PART OF ANY PLYWOOD MATTING SHALL BE MOVED, ALTERED, OR CHANGED IN ANY WAY UNTIL ACCESS ACROSS, ADJACENT TO, OR THROUGH CRZ ZONES AND SENSITIVE SOIL ZONES IS NO LONGER NECESSARY OR UNTIL THE TEMPORARY USE PERIOD HAS CONCLUDED.

XX / A00 | A00 — TREE PROTECTION FENCE AND SIGNAGE

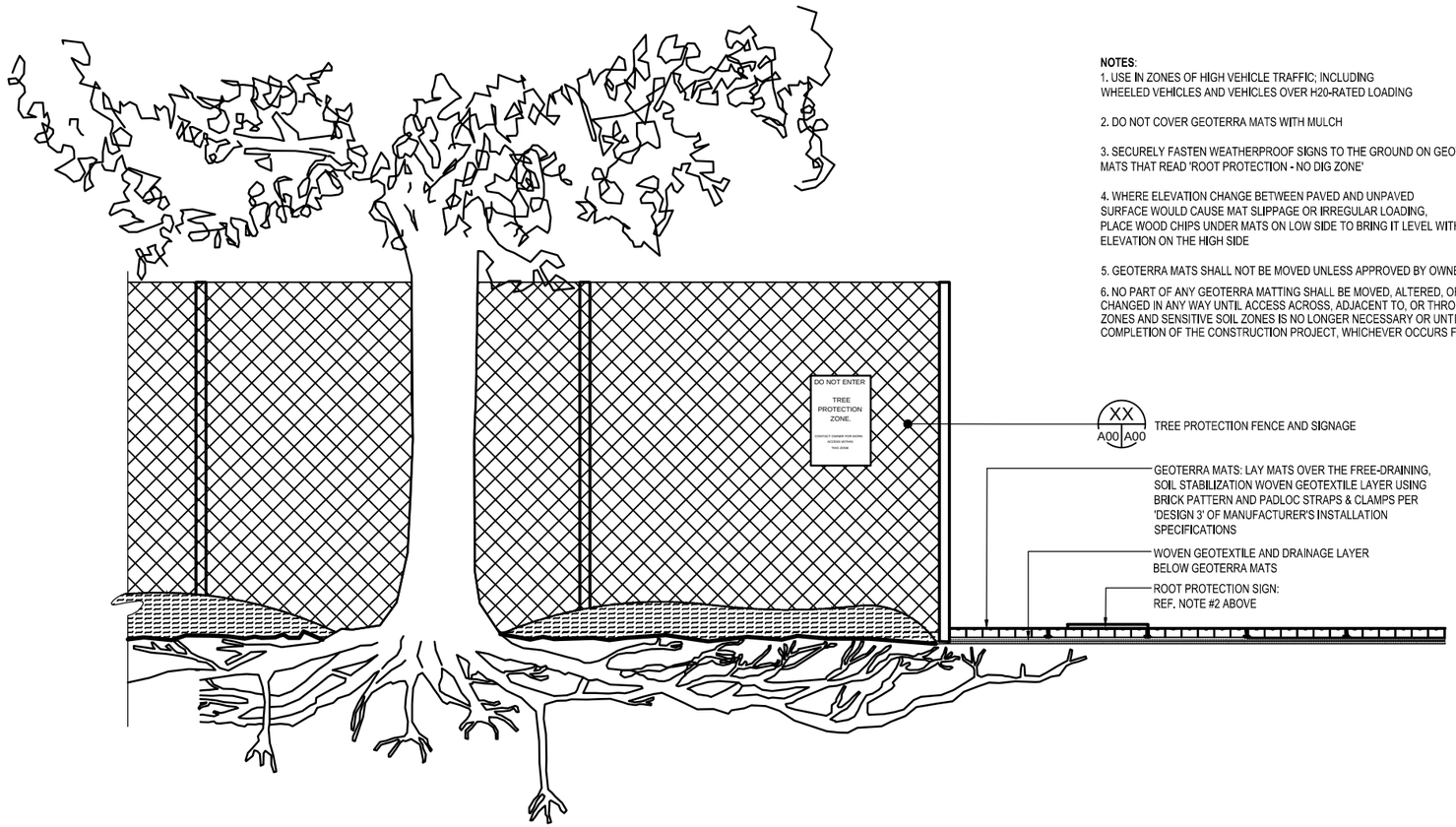
¾" PLYWOOD - 1.2m X 2.4m (4' X 8') SHEETS; TYP.

XX / A00 | A00 TEMPORARY SOIL PROTECTION - PLYWOOD MATTING
SCALE: 1:15

SF PROJECT #:
DATE:
DRAWN BY:
SCALE:

BUILDING NAME:
PROJECT TITLE:

Smithsonian Institution
Smithsonian Facilities
600 Maryland Avenue SW
Suite 5001 Washington, DC 20560



XX
A00 A00 TREE AND SOIL PROTECTION - GEOTERRA MATS
SCALE: 1:15

NOTES:
1. USE IN ZONES OF HIGH VEHICLE TRAFFIC; INCLUDING WHEELED VEHICLES AND VEHICLES OVER H20-RATED LOADING

2. DO NOT COVER GEOTERRA MATS WITH MULCH

3. SECURELY FASTEN WEATHERPROOF SIGNS TO THE GROUND ON GEOTERRA MATS THAT READ 'ROOT PROTECTION - NO DIG ZONE'

4. WHERE ELEVATION CHANGE BETWEEN PAVED AND UNPAVED SURFACE WOULD CAUSE MAT SLIPPAGE OR IRREGULAR LOADING, PLACE WOOD CHIPS UNDER MATS ON LOW SIDE TO BRING IT LEVEL WITH THE ELEVATION ON THE HIGH SIDE

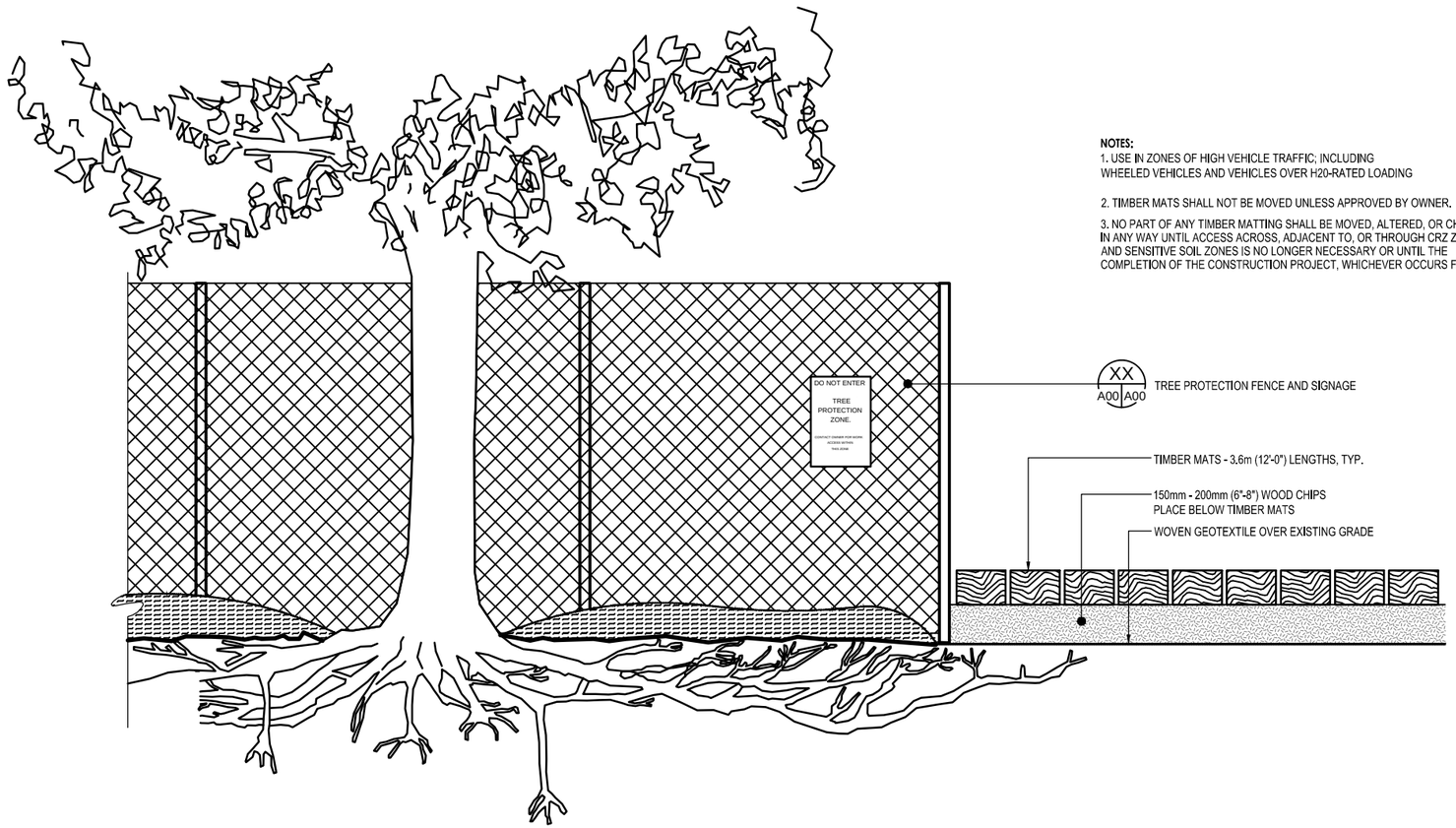
5. GEOTERRA MATS SHALL NOT BE MOVED UNLESS APPROVED BY OWNER.

6. NO PART OF ANY GEOTERRA MATTING SHALL BE MOVED, ALTERED, OR CHANGED IN ANY WAY UNTIL ACCESS ACROSS, ADJACENT TO, OR THROUGH CRZ ZONES AND SENSITIVE SOIL ZONES IS NO LONGER NECESSARY OR UNTIL THE COMPLETION OF THE CONSTRUCTION PROJECT, WHICHEVER OCCURS FIRST.

SF PROJECT #:
DATE:
DRAWN BY:
SCALE:

BUILDING NAME:
PROJECT TITLE:

Smithsonian Institution
Smithsonian Facilities
600 Maryland Avenue SW
Suite 5001 Washington, DC 20560



XX
A00 A00 TREE AND SOIL PROTECTION - TIMBER MATS
SCALE: 1:15

NOTES:
1. USE IN ZONES OF HIGH VEHICLE TRAFFIC; INCLUDING WHEELED VEHICLES AND VEHICLES OVER H20-RATED LOADING

2. TIMBER MATS SHALL NOT BE MOVED UNLESS APPROVED BY OWNER.

3. NO PART OF ANY TIMBER MATTING SHALL BE MOVED, ALTERED, OR CHANGED IN ANY WAY UNTIL ACCESS ACROSS, ADJACENT TO, OR THROUGH CRZ ZONES AND SENSITIVE SOIL ZONES IS NO LONGER NECESSARY OR UNTIL THE COMPLETION OF THE CONSTRUCTION PROJECT, WHICHEVER OCCURS FIRST.

SF PROJECT #:
DATE:
DRAWN BY:
SCALE:
BUILDING NAME:
PROJECT TITLE:

Smithsonian Institution
Smithsonian Facilities
600 Maryland Avenue SW
Suite 5001 Washington, DC 20560

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

Download Word document.

1.1 RELATED DOCUMENTS

A. The Contract Documents in their entirety, including the Drawings, Specifications, Construction Contract Clauses, and any other documents issued as part of the Contract, apply to this Section. All submittal documentation shall be submitted in a PDF format plus program file and hard copies as required.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals and Facility Asset Data including, but not limited to, the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals
   6. Transfer of Building Equipment Asset Facility Data.
   7. Collection and Handover of Facility Data.
   8. Equipment and System Warranties

B. Related Requirements:
   1. Division 01 section BUILDING INFORMATION MODELING (BIM) REQUIREMENTS for building information modeling (BIM) requirements.
   2. Division 02 through 33 sections for specific operation and maintenance manual requirements for the work in those sections.

C. Contractor's Responsibility:
   1. Develop deliverables required in this Section.
   2. Contractor is solely responsible for the quality and accuracy of all documentation and submittals of this Section.

1.3 DEFINITIONS

A. Facility Breakdown Structure: a system-oriented hierarchical decomposition of a facility into smaller components. Typically, the facility breakdown structure is based on disciplines and trades described by CSI Master Format 2016.

B. Facility Asset Data: Pre-Defined set of attributes that defines various characteristics of

an object.

C. Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, and catalog information illustrating a material, product, or system to be installed on this project.

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

E. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

F. Subsystem: A portion of a system with characteristics similar to a system.

1.4 QUALITY ASSURANCE

A. Maintenance Manual Preparation: In preparation of Maintenance Manuals, use personnel thoroughly trained and experienced in operation and maintenance of the equipment or system involved.

1. Where written instructions are required, use personnel skilled in technical writing to the extent necessary for communication of essential data.
2. Where Drawings or diagrams are required, use draftsmen capable of preparing Drawings in a clear and understandable format, reference “OPDC CAD Guidelines” and/or “OPDC BIM Guidelines” for additional requirements.

B. Instructions / Training for SI Personnel: For instruction of the SI’s operations and maintenance personnel, use experienced instructors thoroughly trained and experienced in the operation and maintenance of the building equipment or system involved.

1. Prior to final inspection, instruct SI personnel in operation, adjustment, and maintenance of products, equipment and systems. Provide instruction at mutually agreed upon times.
    a. For equipment that requires seasonal operation, provide similar instruction during other seasons.
    b. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.
    c. Video Training may be required based on complexity, COTR to determine if

required.

1.5 SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of section submittals. Submit reviewed manual content formatted and organized as required by this section.
   1. COTR will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to COTR.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically bookmarked operation and maintenance directory.
   2. Three paper copies. Include a complete operation and maintenance directory.

C. Initial Manual Submittal: Submit draft copy of each manual within 45 working days of receipt of approved equipment submittal.
   1. COTR will comment on whether general scope and content of manual are acceptable and will return one copy within 15 working days of receipt.

D. Final Manual Submittal: Submit each manual in final form at least 45 working days before commencing demonstration and training and/or final inspection.
   1. After demonstration and training and/or final inspection COTR will return one copy with comments within 15 working days.
   2. Submit final approved manual(s) to the COTR within 15 working days of receipt of COTR comments.

E. Warranties
   1. Submittal: Submit written warranties on request of COTR for designated portions of the work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
   2. Partial Occupancy: Submit properly executed warranties within 15 working days of completion of designated portions of the work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

F. Facility Asset Data:
   1. Submittals:
      a. Submit SI Facility Asset Spreadsheet(s) with equipment submittal(s) for review / approval.
      b. Submit monthly updates of the SI Facility Asset Spreadsheet(s) that include data, assets and attributes of all components being installed and / or removed. Spreadsheet(s) should reflect work completed the previous month.

PART 2 - EXECUTION

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems and subsystems.
      a. List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
   3. List of equipment.
      a. List equipment for each system alphabetically organized by system. For pieces of equipment not part of system, list alphabetically in separate list.
   4. Table of contents.
      a. Include a table of contents for each manual.

B. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page: Include the following information.
      a. Name and address of Project.
      b. Name and address of Owner:

SMITHSONIAN INSTITUTION, WASHINGTON, DC

c. Date of submittal.
d. Subject matter included in manual
e. Name and contact information for Contractor and Sub-Contractor(s).
f. Name and contact information for Architect and Engineer(s)
g. Cross-reference to related systems in other operation and maintenance manuals.

2. Table of contents.
   a. List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   b. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
3. Manual contents.
   a. Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

B. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree.

C. Manuals, Hard Copy: Submit manuals in bound and labeled volumes.
1. Three full sets of Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 215-by-273mm (8-1/2-by-11-inch) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross- reference other binders if necessary to provide

essential information for proper operation or maintenance of equipment or system.

b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Where written material is required as part of the manual use the manufacturer's standard printed material, or if it is not available, specially prepared data, neatly typed, on 215-by-273mm (8-1/2-by-11-inch) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold, and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typed pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
      a. Fire.
      b. Flood.
      c. Gas leak.
      d. Water leak.
      e. Power failure.
      f. Water outage.
      g. System, subsystem, or equipment failure.
      h. Chemical release or spill.
   2. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

3. Emergency Procedures: Include the following, as applicable:
    a. Instructions on stopping.
    b. Shutdown instructions for each type of emergency.
    c. Operating instructions for conditions outside normal operating limits.
    d. Required sequences for electric or electronic systems.
    e. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents and SI Facility Asset Spreadsheet(s). Include the following:
    a. Asset ID # (SI Provided)
    b. Asset Name (SI Provided)
    c. Product name and model number. Use designations for products indicated on Contract Documents.
    d. Manufacturer's name.
    e. Equipment identification with serial number of each component.
    f. Equipment function.
    g. Operating characteristics.
    h. Limiting conditions.
    i. Performance curves.
    j. Engineering data and tests.
    k. Complete nomenclature and number of replacement parts.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures, Include the following as applicable:
    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Instructions on stopping.
    f. Normal shutdown instructions.
    g. Seasonal and weekend operating instructions.
    h. Required sequences for electric or electronic systems.
    i. Special operating instructions and procedures.
5. Operating logs.
6. Wiring diagrams.
7. Systems and Equipment Controls
    a. Describe the sequence of operation, and diagram controls as installed.

8. Piped systems diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.
    a. Include copy of all final inspection reports

B. Coordination Drawings: Provide each Contractor's Coordination Drawings.
   1. Provide as-installed color-coded piping diagrams, where required for identification.

C. Valve Tags:
   1. Provide charts of valve tag numbers, with the location and function of each valve.

D. Circuit Directories:
   1. For electric and electronic systems, provide complete circuit directories of panel boards, including the following: a. Electric service.
      a. Controls.
      b. Communication.

2.5 PRODUCT MAINTENANCE MANUALS

A. Provide one section for architectural products, including applied materials and finishes, and a second for products designed for moisture- protection and products exposed to the weather.
   1. Refer to individual Specification Sections for additional requirements on care and maintenance of materials and finishes.

B. ARCHITECTURAL PRODUCTS
   1. Content: Organize manual into a separate section for each product, material, and finish. Include the following as applicable:
      a. Product information
      b. Maintenance procedures
      c. Repair materials
      d. Source Information
         i List each product included in manual, identified by product name, and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
   2. Product Information: Include the following, as applicable:
      a. Product name and model number.
      b. Manufacturer's name.

c. Color, pattern, and texture.
d. Material and chemical composition.
e. Reordering information for specially manufactured products.

3. Care and Maintenance Procedures: Include manufacturer's written recommendations and the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Schedule for routine cleaning and maintenance.
   e. Repair instructions.
4. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

C. MOISTURE-PROTECTION AND WEATHER EXPOSED PRODUCTS
1. Content: Organize manual into a separate section for each product, material, and finish. Include the following as applicable:
   a. Product information
   b. Maintenance procedures
   c. Repair materials
   d. Source Information.
      i List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
2. Manufacturer's Data: Provide manufacturer's data giving detailed information, including the following, as applicable:
   a. Applicable standards.
   b. Chemical composition.
   c. Installation details.
   d. Inspection procedures.
   e. Maintenance information.
   f. Repair procedures.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each system, subsystem, and piece of equipment not part of a system, include the following as applicable:
1. Source information
   a. List each system, subsystem, and piece of equipment included in manual, identified by product name, and arranged to match manual's table of

contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

2. Manufacturers' Maintenance Documentation: Including the following information for each component part or piece of equipment:
    a. Standard maintenance instructions and bulletins.
    b. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
    c. Identification and nomenclature of parts and components.
    d. List of items recommended to be stocked as spare parts.
3. Maintenance procedures: Include the following information and items that detail essential maintenance procedures:
    a. Test and inspection instructions.
    b. Troubleshooting guide.
    c. Precautions against improper maintenance.
    d. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    e. Aligning, adjusting, and checking instructions.
    f. Demonstration and training video recording, if available.
4. Maintenance and Service schedules
    a. Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
        i Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semi-annual, and annual frequencies.
        ii Maintenance and Service Record: Include manufacturers' forms for recording maintenance
5. Spare Parts List and Source Information
    a. Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
6. Maintenance service contracts
    a. Include copies of maintenance agreements with name and telephone number of service agent.

2.7 WARRANTIES

A. Submission of original warranties for all products, equipment, and systems.
   1. The Contractor shall assemble original warranty certificates or notarized copies of warranty certificates executed by the Contractor, Subcontractors, suppliers, and manufacturers in a tab-indexed, three-ring loose-leaf binder with a durable plastic cover. Provide electronic copy, in PDF format. The table of contents shall identify:
      a. Asset ID # (SI Provided)
      b. Asset Name (SI Provided)
      c. Date of Substantial Completion
      d. Expiration date of the warranty
      e. Supplier
      f. Vendor
      g. Installing Contractor
   2. Each warranty certificate or bond shall identify the date(s) for:
      a. Substantial Completion status in accordance with project closeout requirements.
      b. Beginning and ending of the warranty period.
      c. The Contractor shall provide any coincidental product warranty, which is available on a product incorporated in the Work, but for which the warranty is not specifically required by the contract documents.
      d. List(s) of circumstances and conditions that would affect validity of warranties or bonds.
      e. Include procedures to follow and required notifications for warranty claims.
      f. Provide any extended warranties offered by manufactures and/or installers (including labor) for all equipment for Owner to review.
   3. Warranty of Construction: The Contractor shall warrant that the work performed under this contract conforms to the contract requirements and is free of any defect in equipment, materials, design furnished or workmanship performed by the Contractor or any subcontractor or supplier at any tier. Unless otherwise stated in the technical sections of the Specifications, the warranty of the Work shall continue for a period of one (1) year from the date of Final Completion status. If the Smithsonian takes partial occupancy before Final Completion, then the warranty for that portion shall be in effect for a period of one (1) year beginning on the date of Substantial Completion for that portion of the Work

2.8 FACILITY ASSET DATA

A. The following building information, obtained and developed by the Architect, Engineer(s) and/or SI during the design phase, may be available to the Contractor:
   1. SI Facility Asset Data Spreadsheet (.xlsx)

B. Collect, verify, and provide Facility Asset Data for import by the SI into the TRIRIGA Facility Center data system. Utilizes templates as provided by SI and procedures described below:
   1. Contractor will complete / verify information on spreadsheet provided by SI
   2. Submit SI Facility Asset Data Spreadsheet(s) with equipment submittal(s) for review / approval.
   3. Provide monthly SI Facility Asset Data Spreadsheet updates. Spreadsheet(s) should reflect work completed the previous month. Monthly Updates to include:
      a. Attribute Updates
      b. Submittal Package approved (Yes or No)
      c. Installed Date
      d. In Service Date
      e. Out of Service Date for Assets being removed or retired.
   4. SI to review for Accuracy and Status and will upload into FC as required.
   5. Meeting between SI COTR, FM Asset Manager and Contractor to be scheduled.
      a. SI would return spreadsheet(s) and Asset Tags with Asset ID# and Asset Name
      b. Labels to be placed on equipment by FM Asset Manager in coordination with contractor and OPDC COTR.
   6. Contractor will input the required attributes into Final As-Built Model per 01 section BUILDING INFORMATION MODELING (BIM) REQUIREMENTS

C. Verify and update required data attributes for assets, as needed to conform to As-Built conditions.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare

information for each system, subsystem, and piece of equipment not part of a system.

2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

3.2 WARRANTIES

A. The Contractor shall assemble original warranty certificates or notarized copies of warranty certificates executed by the Contractor, Subcontractors, suppliers, and manufacturers

3.3 FACILITY ASSET DATA

A. Design Intent Facility Asset Data Spreadsheet will be provided to the Contractor to be used in the development of Facility Asset Data. The Design Intent Facility Asset Data Spreadsheet communicates the creative objectives of the Architect, and is not intended to be used for direct import into Facility Center in that the assets and attributes contained within it are suitable as a basis of design only, and will require verification, updating, and supplementation by the Contractor.

B. Facility Asset Data shall include attributes for assets as defined in spreadsheet(s) provided by SI. Please refer to the SI Facility Asset Data Spreadsheet for data fields (parameters) and requirements.

END OF SECTION 01 7823

SECTION 019113
COMISSIONING

Download Word document.

Bold font are notes to Design Manager (DM) and Construction Manager (CM) and must be deleted from final document.

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Smithsonian will procure the services of independent Commissioning Consultant; other terms are Commissioning Provider, Commissioning Agent, and Commissioning Authority. The Commissioning Consultant is an independent and knowledgeable third party, contracted to verify that the systems **(Smithsonian Design Manager - DM and Construction Manager -CM select from HVAC, plumbing, electrical, fire protection, security, etc. Coordinate with paragraph 1.9 A.**) work as described in the Owners Project Requirements (OPR). The Commissioning Consultant will inform the Construction Manager (CM) COTR and the Architect of the results of the commissioning and provide suggestions, as necessary, to correct deficiencies in observed performance or installation.

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

C. Various sections in the Division 23, 25 and 26 Specifications as well as specifications in other formats outline the specific commissioning responsibilities of each General Contractor and corresponding subcontractors for the division and obligate the General Contractor to coordinate and manage the commissioning responsibility of those subcontractors.

1.2 REQUIREMENTS INCLUDED

A. Duties of Contractor.

B. Duties of Commissioning Consultant.

C. Commissioning Field Notebook.

D. Acceptance Procedures.

E. Performance Period.

F. Training and Instruction.

1.3 RELATED SECTIONS

A. All Division 1 Sections and Smithsonian General Requirements

B. All Division 21 Sections

C. All Division 22 Sections

D. All Division 23 Sections

E. All Division 25 Sections

F. All Division 26 Sections

G. All Division 28 Sections

1.4 TERMS

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

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

C. Commissioning Plan: The Smithsonian's Commissioning Consultant prepares The Commissioning Plan. *The Commissioning plan is a document that outlines the organization, schedule, allocation of resources, and documentation requirements of the*

Commissioning Process (ASHRAE Guideline 0-2013). In addition, defines the scope and format of the commissioning process and the responsibilities of all involved parties. The commissioning team reviews the Commissioning Plan to inform the intent and scope of the commissioning process, to ensure inclusion in the construction project scope/schedule and to facilitate and expedite the commissioning process. The Commissioning Plan is to be distributed by the Commissioning Consultant during the first third of the construction timeframe. **(The DM to coordinate with CM to find out if the commissioning Plan should be included as an addendum in the Bid documents).**

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

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

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

G. Pre-functional Construction Checklists: Commissioning Consultant prepares Checklist for equipment of systems and assemblies. See paragraph 1. A. Checklist shall be for the systems or equipment involved in the commissioning process to verify installation and start-up of equipment is complete and verify that systems are ready for functional testing. These documents require signature by the Contractor prior to continuing with the commissioning process, and are required as a pre-condition of beginning the Functional Performance Testing.

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

1.5 DUTIES OF CONTRACTOR

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

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

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

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

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

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

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

H. Cooperate with the Commissioning Consultant's personnel.

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

J. Provide office space **(DM to coordinate with CM on the practicality of providing office space for Cx Consultant)** for Commissioning Consultant for preparation of daily reports. Dedicate space for Commissioning Field Notebook in dedicated area.

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

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

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

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

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

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

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

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

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

T. Lead verification testing of fire/smoke dampers and direct the resolution of deficiencies. Each fire/smoke damper and its functions are tracked in a matrix spreadsheet. Owner's

Authority Having Jurisdiction (OSHEM) shall witness and approve all life safety systems including fire / smoke damper operation.

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

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

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

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

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

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

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

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

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

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

1.6 DUTIES OF COMMISSIOING CONSULTANT

A. Develop the draft Commissioning Plan during Pre-Design phase. Commissioning plan updated at each design phase and construction phase. **(DM to coordinate with CM the Commissioning Plan inclusion as addendum to the Bid Documents).**

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

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

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

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

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

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

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

I. Witness a random selection of TAB readings (10**%) (DM to provide feedback to the percentage of TAB readings for the project)** performed by the TAB contractor. Coordinate with Division 23 and 25 project specifications. This witnessing activity is during the execution of regular TAB activities.

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

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

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

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

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

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

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

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

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

S. Provide technically qualified personnel when scheduled.

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

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

1.7 COMMISSIONING PLAN

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

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

1.8 COMMISSIONING FIELD NOTEBOOK

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

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

7. Provide a .pdf copy of entire completed Commissioning Field Notebook to Commissioning Consultant at conclusion of project for use in developing final Commissioning Report, prepared by the Commissioning Consultant.

1.9 SYSTEMS TO BE COMMISSIONED

A. Systems and Equipment to Be Functionally Tested: The system features are to be functionally tested and other building features will be evaluated for installation quality during construction. The functional performance testing will include the following systems and equipment. **(The following list shall be coordinated with paragraph 1.1 A. and customized by DM ad CM for the requirements of each project).**

1. Mechanical Systems:

   a. Air handling units
   b. Computer room units
   c. Fan coil units
   d. Pumps
   e. Fans
   f. Energy recovery units
   g. Air volume control boxes with reheat coils
   h. Air curtains
   i. Energy recovery tube bundles
   j. Unit heaters (all types)
   k. Condensate pumps (electric & pressure powered)
   l. Building automation system
   m. Building automation air compressors
   n. Building automation air dryers

2. Electrical Systems:

   a. Variable Frequency Controllers
   b. Lighting Control System

1.10 COMMISSIONING ACTIVITIES

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

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

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

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

E. Documentation: In addition to the Pre-functional Construction Checklists and Functional Test Procedures, written documentation will be maintained for all other commissioning activities. Project communication reports shall be issued by the Commissioning Authority to the Contractor and key members of the commissioning team to document apparent deficiencies identified during examination of design and construction documents, daily activities on-site, construction deficiencies and successful or unsuccessful functional test results. At the end of the commissioning process, all documentation will be assembled and summarized in the Final Commissioning Report.

F. Deficiency Resolution: When an Issues Log, Resolution Log or Field Report is issued to address an identified deficiency, the Contractor shall forward the reports to the appropriate parties to initiate corrective action in an expeditious manner. The designer is relied on for supplemental instructions or design modifications and issuance of final

design details and the Contractors are relied on for implementation of that design. Change orders must be issued through proper contract channels.

1.11 FUNCTIONAL TEST PROCEDURES

A. The Functional Test Procedures include, but are not limited to, the following: **(DM to expand language for the Commissioning Consultant to change this section to correspond with the project)**

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

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

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

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

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

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

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

3.2 ACCEPTANCE PROCEDURES

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

B. Contractor's Tests:

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

C. Smithsonian Institution witnessed Functional Tests:

1. Objective of these tests is to demonstrate that system is operating and complying with specified performance requirements.
2. Smithsonian Institution witnessed functional performance tests shall be performed on complete system. Each function shall be demonstrated to satisfaction of the Architect / Engineer through the CM COTR and Smithsonian Institution's Commissioning Consultant on paragraph-by-paragraph basis of Commissioning Consultant's written test procedure, developed to demonstrate conformance to requirements of the Specifications.

3. Functional performance tests shall be witnessed and endorsed by the Commissioning Consultant upon satisfactory completion.
4. Actual testing program shall be conducted in accordance with prior approved procedures and shall be documented as required herein.
5. Contractor shall notify Architect and Construction Manager COTR at least two (2) weeks prior to date of functional performance tests.

D. The functional performance testing process shall be accomplished for all equipment, sub-systems, systems and system interfaces. The order of functional performance testing shall be reflected in the Commissioning Fragnet Schedule. All must be tested for acceptances and there shall be a separate checklist for each to ensure documentation specific to each is complete.

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

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

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

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

3.3 TRAINING AND INSTRUCTION

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

3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

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

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

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

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

3.5 SCHEDULE

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

B. Note: Attention to these scheduling needs are important to prevent conflicts that have been problematic within the commissioning process **(DM CM to address duration to be customized to each particular project)** :

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

Issues Resolution	1 week	After Functional Testing	Before Government occupancy
Final Commissioning Documentation Submittal	2 weeks	After resolution of issues log	2 weeks after resolution of issues log

END OF SECTION 01 91 13

SECTION 02 82 00

ASBESTOS ABATEMENT

Download Word document.

TABLE OF CONTENTS

SECTION 02 82 00
ASBESTOS ABATEMENT

TABLE OF CONTENTS

SECTION 028200
ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 Introduction

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

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

1.2 Description of the Abatement Work

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

(a) Notification to regulatory agencies

(b) Regulatory permits, licenses and approvals

(c) Worker health and safety program

(d) Air monitoring

(e) Construction of temporary containment barrier/decontamination enclosures

(f) Preparation for abatement operations

(g) Removal of existing asbestos-containing material

(h) Transport and disposal of asbestos-containing material

(i) Decontamination and cleaning

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

(k) Removal of temporary containment barrier/decontamination enclosures

(l) Final job close-out

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

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

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

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

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

1.3 Definitions

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

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

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

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

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

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

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

1.3.8 ANSI: American National Standards Institute.

1.3.9 ASTM: American Society for Testing and Materials.

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

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

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

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

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

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

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

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

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

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

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

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

1.3.22 Critical Barrier: Those portions of the containment barrier which represent the minimum structural components necessary to maintain the asbestos removal area in airtight isolation from the surrounding areas. Critical barriers shall be placed at floors, windows, ventilation louvers and other openings as necessary to achieve abatement work area isolation before putting up the double-layer plastic sheeting containment enclosure within which abatement work is performed. If a temporary plastic sheeting/stud wall must be erected, it shall be treated as a critical barrier. The double-layer plastic sheeting containment enclosure shall then be erected on that wall. Wrappings on lights, control boxes, etc., do not constitute part of the critical barrier.

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

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

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

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

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

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

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

1.3.30 EPA: United States Environmental Protection Agency.

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

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

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

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

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

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

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

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

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

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

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

1.3.42 MSHA: Mine Safety and Health Administration:

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

1.3.44 NESHAPS: National Emissions Standard for Hazardous Air Pollutants.

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

1.3.46 NIOSH: National Institute for Occupational Safety and Health.

1.3.47 OSHA: Occupational Safety and Health Administration.

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

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

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

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

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

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

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

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

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

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

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

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

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

1.4 Regulations and References

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

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

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

(b) 29 CFR 1910.1001 and 29 CFR 1926.1101 Asbestos

(c) 29 CFR 1910.134 Respiratory Protection

(d) 29 CFR 1910.1200 Hazard Communication

1.4.1.2 U. S. Department of Transportation

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

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

1.4.1.3 U.S. Environmental Protection Agency

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

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

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

1.4.1.5 New York City Department of Environmental Protection.

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

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

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

1.4.1.9 Arizona Department of Environmental Quality.

1.4.1.10 Hawaii Department of Health.

1.4.1.11 Florida Department of Environmental Protection.

1.4.1.12 Massachusetts Department of Environmental Protection.

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

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

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

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

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

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

1.5 Submittals

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

1.5.2 Contractor's Work Plan: The Contractor shall submit a Contractor's Work Plan for asbestos abatement work within 15 calendar days after contract award to the COTR for approval. Approval of the Plan is required prior to beginning abatement work. The Plan shall be on 220 mm x 280 mm paper in a binder indexed by the subjects listed

below. Detail the procedures, instructions, and reports used to assure compliance with the contract documents.

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

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

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

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

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

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

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

1.5.2.6 Isolation of Abatement Work Areas: Methods to isolate/restrict access to abatement work areas. Include how access will be controlled, how

building HVAC ventilation systems will be isolated from abatement area. Include how security and fire systems will be maintained within the containment. Include plans for electrical lock-out and dedicated electrical systems. These requirements shall be coordinated with the COTR and facility representatives.

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

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

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

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

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

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

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

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

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

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

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

1.5.2.14 Workers' Specialized Training: Submit training course descriptions, locations, and dates. Submit to the COTR a written affidavit before start of asbestos removal as proof that all employees have had instruction on the hazards of asbestos exposure; and on all aspects of work procedures and personal protection and area protective measures as required and/or

recommended by OSHA and EPA and other applicable guide documents. The affidavit shall include course name, designation, installation, place, date taken, and student names.

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

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

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

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

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

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

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

1.6 Daily Reports

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

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

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

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

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

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

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

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

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

1.7 Product Handling

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

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

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

PART 2 - PRODUCTS

2.1 Materials

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

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

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

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

2.1.5 Plastic Sheeting: Product Standard PS 17-69 and OSHA Regulation 29 CFR 1926.1101; Polyethylene plastic sheeting material 0.15 mm thickness for covering floors and walls, providing air locks, and sealing doors and windows; supply in appropriate widths to minimize seams. Must be flame-resistant material and must meet test criteria in NFPA 701. Reinforced sheeting is required for applications subject to wear and tear.

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

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

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

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

2.2 Equipment

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

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

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

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

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

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

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

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

(b) GFCIs.

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

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

2.2.2 Respirators and Respirator Systems

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

PART 3 - EXECUTION

3.1 Controlled Access to Site

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

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

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

==========

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE
REQUIRED IN THIS AREA

==========

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

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

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

3.2 Worker and Visitor Protection

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

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

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

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

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

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

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

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

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

work area. These are minimum requirements. Section 3.4 of this document is to be consulted for more detail.

3.3 Abatement Work Area Entry and Exit Procedures

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

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

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

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

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

3.3.2.4 Personnel shall shower thoroughly before entering the clean room.

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

3.4 Respiratory Protection

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

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

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

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

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

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

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

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

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

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

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

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

3.5 Air Monitoring; Stop Action and Clearance Levels

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

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

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

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

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

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

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

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

3.5.7 Abatement Work Area Final Clearance Levels:

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

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

3.5.7.3 Final air clearance requirements of specific state and local regulations that exceed the requirements of 3.5.7.1 and 3.5.7.2 will be utilized (e.g., in the

District of Columbia, at least two PCM samples per 2,500 square feet of floor are required).

3.6 Initial Isolation of Abatement Work Area

3.6.1 Contractor shall completely separate the abatement work area from other portions of the building, and the outside, by sealing all openings (windows, doorways, elevator openings, corridor entrances, drains, ducts, grill, diffusers, skylights, etc.) with barriers of 0.15 mm polyethylene sheeting and tape, or by sealing cracks leading out of the abatement work area. Contractor shall caulk the joints and seal holes in that portion of the walls, ceiling, and floor inside the abatement work area that could allow airborne asbestos fibers to be carried into adjoining spaces, or the exterior. Note in particular where pipes, conduit, and ductwork penetrate walls, ceilings and floor. Doorways and corridors which will not be used for passage during work must be sealed with 9.5 mm plywood, wood framing and plastic sheeting with tape.

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

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

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

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

3.7 Preparation of Abatement Work Area and Temporary Enclosures

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

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

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

the removal work with materials, finishes, and workmanship to match existing installations before start of work.

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

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

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

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

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

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

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

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

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

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

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

3.7.15 Provide emergency exiting from the enclosure as required by NFPA 101, Life Safety Code. Arrange exit door(s) so that it is secure from outside the abatement work area but permits exiting from the abatement work area. Mark outline of door on barriers with luminescent paint at least 250 mm wide. Hang a razor knife on a string beside outline. Post a sign identifying "EMERGENCY EXIT", using letters at least 150 mm high, inside outline with luminescent paint. Arrows shall be taped on the polyethylene wall covering at eye level and at floor level to indicate location of exits. At entrance to decontamination chamber, post building floor plan and escape routes, plus locations of nearest exist and phone numbers of SI security. Emergency lighting shall be required, in accordance with the Life Safety Code.

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

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

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

3.7.19 Provide GFCI protection for all electrical equipment.

3.7.20 Provide temporary lighting inside the decontamination enclosure facility.

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

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

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

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

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

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

3.8.2.3 Provide GFCI protection for all electrical equipment.

3.8.2.4 Provide temporary lighting inside the decontamination enclosure facility.

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

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

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

by COTR) hot and cold water and drainage, as necessary for a complete and operable shower.

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

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

3.8.5 The Equipment Room shall have two airlocks, one adjacent to the abatement work area and one adjacent to the shower room. The room shall be of sufficient size so as to accommodate at least one worker to change clothes, and temporarily house any equipment which the contractor wishes to store when not in use. The area shall have facilities for decontaminating material and equipment, and a container lined with 0.15 mm polyethylene bag for collection of disposable coveralls and foot coverings.

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

3.9 Air Circulation Inside Containment Barrier

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

==========

CALCULATE	Volume of abatement work area (CF)
MULTIPLY BY	Number of air changes per hour, four to ten.
MULTIPLY BY	1/60 (hr/minutes)
DIVIDE BY	Capacity of air filtration unit fully loaded with all filters (pressure differential activates warning light for loaded filters)
DIVIDE BY	80% expected efficiency

ADD		one additional unit as backup for machine failure or shutdown
EQUALS		minimum number of units required

==========

3.9.2 Supplemental Makeup Air Inlets: As necessary to achieve air flow throughout the abatement work area, locate auxiliary makeup air inlets as far away as possible from the air filtration units, preferably near the ceiling and away from barriers that separate the containment barriers and enclosures from surrounding areas. Cover inlet with plastic sheeting flaps to reseal automatically if the pressure differential system should shut down for any reason. Provide rigid framing around the opening. Spray the flap and around opening with spray adhesive so that if flap closes, the meeting surfaces are both covered with adhesive. Use adhesive that forms contact bond when dry. If used during clearance monitoring, tape or seal HEPA filters over inlets.

3.9.3 Penetrations through masonry and/or fire walls, required for improving air circulation, shall be protected with a fire damper.

3.9.4 Accomplish the pressure differential by exhausting a sufficient volume of HEPA filtered air from the abatement work area. Efforts to achieve pressure isolation shall first address:

3.9.4.1 Establishing required air circulation

3.9.4.2 Verifying seals are complete as practical

3.9.4.3 Establishing increased pressure in adjacent areas, if available

3.9.4.4 Exhausting sufficient volume of HEPA filtered air with additional air filtration units.

3.9.4.5 Decreasing the size of abatement work area to affect a smaller volume required for filtration

3.10 Placement of Air Filtration System Units

3.10.1 Equipment shall be located so as to optimize air movement throughout the abatement work area by positioning air filtration units as far away as practical from the access opening or other supplemental make-up air inlets.

3.10.2 The auxiliary air-filtration unit shall be located on site and available and ready to run at any time.

3.10.3 Air movement shall be established in such a way that air borne fibers will be carried away from workers' breathing zones.

3.10.4 Dead air pockets shall be minimized by proper ducting of make-up air if necessary, and by optimum location of the negative air filtration units.

3.10.5 The Contractor shall use smoke tubes to determine if dead air spots are present, and shall take corrective action as outlined above when they are found. Report such actions to the COTR immediately.

3.10.6 The air filtration units shall be placed so that access for changing the filters is inside the containment barrier. The unit is to run continuously during filter changing. A supply of filters shall be kept on site outside of containment area. If a unit must be turned off for servicing, an auxiliary unit must be in place and turned on.

3.10.7 Vent to the outside of the building, whenever practical, as determined by the COTR. Units may be vented inside the building only if outside venting is impractical. Units venting inside a building must be vented through an expansion chamber or diffuser system (self-contained water baffle) to reduce exhaust air velocity. A secondary HEPA unit may also be used after the expansion chamber/diffuser. Terminal exhaust ductwork must be placed as far away as possible from occupied areas. Special provisions for air monitoring shall be implemented by the SI air monitoring firm.

3.10.8 Mount units to exhaust directly or through disposable ductwork. Use ductwork and fittings of same diameter or larger than discharge connection on fan unit. Use spiral wire-reinforced flex duct in lengths not greater than 15 meters. If direction of discharge from fan unit is not aligned with duct use sheet metal elbow to change direction. Use six feet of spiral wire reinforced flex duct after direction change.

3.10.9 All HEPA units shall be tested in-place before removal begins. Test will be the responsibility of the contractor.

3.11 Pressure Differential Isolation

3.11.1 The abatement work area and the decontamination enclosure system shall be maintained at a negative pressure relative to adjacent areas. The relative pressure differential when measured across any physical or critical barrier must continuously equal or exceed a static pressure of 0.5 mm of water. Measurement shall be by manometer or magnahelic gage.

3.11.2 Minimum 4 air changes per hour. Continuous HEPA filtered exhaust unit is to be in operation until job is completed.

3.11.3 Make-up air shall be obtained only through the decontamination enclosure facilities, or as provided in Section 3.9.2 of these specifications.

3.11.4 Where asbestos-containing material covers an opening or joint, provide negative air pressure sufficient to draw air from the adjoining space into the containment barrier when the opening or joint is exposed after asbestos removal. Seal newly exposed openings and joints immediately to prevent contamination of adjoining spaces.

3.11.5 Supply sufficient pre-filters to allow frequent changes.

3.11.6 During and after the pre-abatement test, run the air filtration units continuously to maintain a constant pressure differential and air circulation until decontamination, cleaning, and encapsulation of the abatement work area is complete.

3.11.7 The HEPA-filtered units shall be left on continuously until after final clearance air measurement of 0.01 f/cc or the pre-removal background level, whichever is lower is achieved, and the COTR authorizes the shut-down of the units. Where feasible, the units shall be left on until the enclosure is completely removed.

3.11.8 HEPA units must be set up to cause an alarm-bell or buzzer to sound should the HEPA filter become clogged or the exhaust unit fails in operation after working hours. The alarm must be loud enough to alert a SI Security Officer of the equipment failure. The guard will phone a previously designated contractor employee whose 24-hour number shall have been recorded at the beginning of the project. The notified contractor will immediately dispatch a repair crew to the job site. A spare HEPA unit shall always be available to immediately restore negative air pressure.

3.11.9 If the pressure differential between inside and outside the containment barrier drops to 0.4 mm of water, the Contractor will immediately inspect the containment for sources of pressure leaks and report actions taken to the SI IH and COTR. The system warning alarm shall sound if pressure drops below 0.03 mm of water, and work shall stop.

3.12 Pre-Abatement Inspection, Testing, and Approval

3.12.1 Pre-Abatement Testing Requirements: Contractor must demonstrate with continuous data log that abatement work area can hold negative pressure of 0.5 mm of water for a minimum of 2 hours, prior to commencement of actual asbestos removal, unless the system is exhausted through an isolated ventilation system. In this case, the test period shall be long enough to ensure that the lock-out ventilation controls are not over ridden and the HVAC system does not reactivate. As a minimum, the Contractor shall make all arrangements and demonstrate satisfactory equipment operation and set-up for compliance with these specifications.

3.12.1.1 Show proper condition of equipment seals including results of in-place HEPA-filter testing.

3.12.1.2 Show proper operation of safety and warning devices.

3.12.1.3 Show proper operation and calibration of instrumentation.

3.12.1.4 Show identification of equipment unit and fan capacity.

3.12.1.5 Use smoke tubes to demonstrate adequate air circulation, elimination of dead air pockets, and positive air motion through the decontamination enclosure system into the abatement work area.

3.12.1.6 Show the installation method for pre-filters and the HEPA primary filter in the air filtration unit. Show supply of filters available on site.

3.12.1.7 Demonstrate and record that a minimum 0.50 mm of water pressure differential has been achieved and can be maintained.

3.12.1.8 Demonstrate procedures for how workers will enter and exit the decontamination enclosure system.

3.12.1.9 Demonstrate procedures for handling emergencies and for the prevention of contamination of surrounding areas.

3.12.1.10 With COTR and Building Representative, identify disabled building ventilation systems and the positive means that will prevents accidental or premature restarting. Confirms means to have unit restarted at the conclusion of the abatement work. With COTR and Building Representative, verify that all equipment affected is secured at the main breaker.

3.12.1.11 Demonstrate how contaminated shower water is filtered and drained.

3.12.1.12 Use a pressure differential meter or manometer to demonstrate the required pressure differential at every barrier separating the abatement work area from the balance of the building, equipment, ductwork or outside.

3.12.1.13 Demonstrate that each air filtration unit is serviced by a dedicated minimum 115V-20A circuit with GFCI protection.

3.12.1.14 Demonstrate how asbestos will be removed and bagged for transport. Identify procedures for hauling through the building to the loading dock.

3.13 Maintenance of Containment Barrier and Enclosures

3.13.1 Ensure that the containment barrier, decontamination enclosure rooms, and other sealed doors, vents, etc., and plastic linings are effectively sealed and taped for the duration of the abatement work.

3.13.2 Repair damaged barriers and remedy defects immediately upon discovery. Visually inspect enclosure at the beginning of each work period.

3.13.3 Damaged or deteriorating materials shall not be used and shall be removed from the premises. Material that becomes exposed to and contaminated with asbestos shall be decontaminated or disposed of in accordance with the applicable regulations and special requirements.

3.13.4 Clean debris and residue from inside of the decontamination enclosure system on a daily basis. Damp wipe or hose down all surfaces after each shift change. Clean debris from shower pans on a daily basis.

3.13.5 Maintain floors in the clean room and airlocks as dry as possible to minimize slips and trips. Damp wipe all surfaces twice after each shift change with a disinfectant solution.

3.14 Removal of Asbestos-Containing Materials (ACM) - General

3.14.1 Prohibited Work Practices. The following methods shall not be used for work related to or disturbing asbestos, regardless of exposure level:

3.14.1.1 High-speed abrasive disc saws that are not equipped with point of cut ventilation or enclosures with HEPA-filtered exhaust air.

3.14.1.2 Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

3.14.1.3 Dry sweeping, shoveling or other dry cleanup of dust and debris containing ACM and PACM.

3.14.1.4 Employee rotation as a means of reducing employee exposure to asbestos.

3.14.2 Methods of Compliance. The following engineering controls and work practices shall be used, at a minimum, for all asbestos tasks:

3.14.2.1 HEPA-filtered vacuum cleaners.

3.14.2.2 Wet methods.

3.14.1.3 Prompt cleanup and disposal.

3.14.3 The following work shall be done only after the decontamination facilities have been constructed, the area has been isolated and can be maintained under negative air pressure as specified in the previous section, pre-abatement background sampling has been conducted, and arrangements have been made for disposing waste at an acceptable site.

3.14.4 Start abatement work at a location farthest from the fan units and proceed toward them. If an electric power failure occurs, immediately stop all abatement work and do not resume until power is restored and negative air filtration units are operating again. Immediately notify COTR of occurrence. Any torn or unsealed plastic sheeting shall be immediately repaired. Floor sheeting shall be replaced if damaged.

3.14.5 Wet Removal: Prior to stripping and/or tooling, the asbestos material shall be sprayed using an airless pump and wetting agents (amended water or removal encapsulant) to enhance penetration and reduce fiber dispersal into the air.

3.14.5.1 A fine spray of amended water shall be applied to reduce fiber release preceding the removal of the asbestos material. The material shall be sufficiently saturated to prevent emission of excessive airborne fibers.

3.14.5.2 Spray material repeatedly during the abatement work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's instructions. Perforate outer covering of any insulation which has been painted and/or jacketed in order to allow penetration of water, amended water or removal encapsulant. Where

necessary, carefully strip away while simultaneously wetting the insulation to minimize dispersal of asbestos fibers into the air.

3.14.5.3 Remove materials in manageable quantities and control the descent to the staging or floor below. If over 6 meters, use drop chutes to contain material during descent.

3.14.6 Gross removal of dust and debris from contaminated material, material containers, and equipment shall be accomplished in the containment barrier before removal to the equipment decontamination room for wet sponging before leaving the abatement work site.

3.15 Requirements for Specific ACM and Methods - Fireproofing/Soundproofing on Scratch Coat or Wire Lath

3.15.1 Spray asbestos-containing fireproofing or architectural acoustic finish with a fine mist of amended water. Allow time for amended water to saturate materials to substrate.

3.15.2 Spray the asbestos-containing material repeatedly during the abatement work to maintain wet condition but do not use excessive amounts of water that results in ponding or entry into other areas of the building.

3.15.3 Do not over-saturate to cause excess dripping. Scrape materials from substrate. Remove residue remaining on scratch coat after scraping using stiff nylon bristled hand brush. Use high pressure washer only with written authorization from the COTR.

3.15.4 Remove the saturated asbestos-containing material in small sections. Do not allow material to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness.

3.15.5 Carefully lower removed and bagged asbestos-containing material to the floor without dropping or throwing, or transport to the floor via dust-tight chutes or containers, in accordance with the procedures set forth in 40 CFR 61.147.

3.15.6 Cut wire lath into 50 mm x 150 mm sections and cut hanger wires. Roll or fold up complete with asbestos-containing material and hand place in container. Do not drop on floor. After removal of lath and asbestos-containing material remove any overspray on decking and structure above using stiff nylon bristled brush. Use one of the following methods for containing waste.

(a) Wrap material in felt and place in fiberboard drum lined with two disposal bags. Use caution to insure that all edges of wire lath that could cut plastic are covered with felt.

(b) Place material directly in a steel drum. Use waste containers which are impervious to puncture, leakage, tearing, or ripping from wire lathe.

3.16 Requirements for Specific ACM and Methods - Vinyl Asbestos Tile (VAT) and Mastic

3.16.1 Full containment barriers, with pressure differential ventilation units, shall be used. Dispose as ACM.

3.16.2 Removal of asbestos-containing floor tile and mastic shall be performed in accordance with the procedure outlined below.

(a) Prepare abatement work area as previously specified for the abatement work.

(b) Spray areas of asbestos-containing material with amended water using spray equipment capable of providing a "mist" application to reduce the release of fibers. Wet the material sufficiently to maintain dust control. Spray the asbestos-containing material repeatedly during work process to maintain wet condition but do not use excessive amounts of water.

(c) Do not break the individual tiles to remove them. Gently pry up a corner of the tile with a broad blade putty knife and slip the knife between the tile and the substrate while cutting the mastic bond.

(d) If the mastic is especially tenacious, use a heat gun to loosen the bond between the tile and the substrate and to make the tile more pliable.

(e) Non-toxic organic solvents may be used to remove mastic.

(f) Continuously use a HEPA vacuum around the individual tiles that are being removed. Do not allow any dust or debris to accumulate on the floor or other surfaces of the abatement work area.

(g) Do not allow dislodged tiles to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness. Place sealed asbestos debris in second 0.15 mm plastic bag, appropriately labeled, and remove from abatement work area.

(h) After removal of asbestos-containing material, wet-clean all surfaces in the abatement work area to remove residual accumulated material. Continue wet-cleaning until surfaces are visibly free of material.

*****OR USE THE FOLLOWING STANDARD FOR FLOOR TILE*****

3.16.3 Removal of asbestos-containing floor tile and mastic, baseboard and mastic shall be performed in accordance with the procedure outlined below.

(a) All critical barriers, including ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, speakers, and other openings into the work area shall be individually sealed with 0.15 mm plastic sheeting and tape.

Elevator doors, fire extinguisher cabinets and all other penetration in the floor, walls, or ceiling shall be sealed in the abatement work area.

(b) Prepare a worker and/or equipment decontamination and waste load-out enclosure as previously specified.

(c) Cover all walls in the abatement work area with two layers of 0.15 mm polyethylene sheeting and seal-with duct tape or spray-glue. The sheeting shall be applied to a height of 1.5 m above the floor. The seams shall be staggered and separated by at least 150 mm.

(d) Wet asbestos-containing materials with amended water to minimize fiber release during removal. Use amended water sparingly to eliminate standing water and to prevent water from traveling on the floor.

(e) Remove tiles individually and minimize breakage. Heat guns may be used to heat tile and soften the adhesive. Immediately place tiles in disposal bags.

(f) Non-toxic organic solvents may be used to remove mastic.

(g) Wet clean all surfaces to remove residual material. Continue cleaning until abatement work area is free of visible material.

(h) Proceed to clearance testing following approval from COTR that abatement work area is visually free of asbestos-containing materials.

3.17 Requirements for Specific ACM and Methods - Roofing

Use the wet removal method for ACM to eliminate visible emissions in accordance with NESHAP regulations. Controls shall be used to prevent re-entrainment into building HVAC system. Dispose as ACM.

(a) Spray large areas of asbestos-containing roofing material thoroughly with amended water using spray equipment recommended by surfactant manufacturer capable of providing a "mist" application to reduce the release of fibers. Spray the asbestos material repeatedly during the abatement work process to maintain wet conditions, but do not use excessive amounts of water that result in ponding or entry into building.

(b) Remove the asbestos-containing material in small sections. Do not allow material to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness. Place sealed asbestos debris in second 0.15 mm plastic bag, appropriately labeled, and remove from abatement work area.

(c) Carefully lower removed and bagged asbestos-containing material to the ground without dropping or throwing, or transport to the ground via dust-tight chutes or containers, in accordance with the procedures set forth in EPA 40 CFR 61.147 Code of Federal Regulations.

(d) Clean area of all debris and notify COTR for visual inspection.

3.18 Requirements for Specific ACM and Methods – Exterior and Interior Window Caulk

(a) Exterior: Work will be done from the exterior of the building. If lifts are needed, lift platforms should be covered with canvass drop cloths.
(b) Interior: If lifts are needed, lift platforms should be covered with canvass drop cloths.

(c) Cover the ground or floor area below the abatement work area with 2 layers of 0.15 mm polyethylene sheeting.

(d) Wet the asbestos-containing materials with amended water to minimize fiber and dust release during removal. Use amended water sparingly to eliminate standing water and to prevent water from traveling on the ground sheeting.

(e) Remove the window caulk in small sections using manual methods, not power tools. Keep the material wet with amended water and do not allow the material to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness, and completely seal the bag. Place sealed debris bag into a second 0.15 mm plastic bag, and completely seal the bag.

(f) Carefully lower the sealed material debris bag to the polyethylene sheeting on the ground without dropping or throwing.

(g) After removal of the sealed material debris bags from the work area, HEPA vaccum and wet-clean all surfaces and equipment in the abatement work area to remove residual accumulated material. Continue cleaning until the surfaces are visibly free of material.

(h) Place dropcloths and other abatement related disposable materials into sealable plastic bags of 0.15 mm minimum thickness, and completely seal the bag. Place sealed debris bag into a second 0.15 mm plastic bag, and completely seal the bag. Remove from the work site and dispose as asbestos waste per these specifications.

(i) Notify COTR for visual inspection.

3.19 Requirements for Specific ACM and Methods - Gypsum Wallboard Joint Compound

(a) All critical barriers, including ventilation openings supply and exhaust), lighting fixtures, clocks, doorways, windows, speaker, and other openings into the abatement work area shall be individually sealed with 0.15 mm plastic sheeting and tape. Elevator doors, fire extinguisher cabinets and all other penetrations in the floor wall, or ceiling shall be sealed in the abatement work area.

(b) Prepare worker/equipment decontamination and waste load-out enclosure as previously specified.

(c) Isolate the abatement work area by constructing a temporary double layered 0.15 mm polyethylene/stud wall.

(d) Cover the floor of the abatement work area with 2 layers of 0.15 mm polyethylene sheeting turned up at walls at least 600 mm.

(e) Wet the asbestos-containing materials with amended water to minimize fiber and dust release during removal. Use amended water sparingly to eliminate standing water and to prevent water from traveling on the floor.

(f) Remove the gypsum wallboard and joint compound in small sections. Do not allow the material to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness. Place sealed debris in a second 0.15 mm plastic bag, and remove from the work area.

(g) Carefully lower the material to the floor without dropping or throwing.

(h) After removal of the material, HEPA vacuum and wet-clean all surfaces in the abatement work area to remove residual accumulated material. Continue cleaning until the surfaces are visibly free of material.

3.20 Requirements for Specific ACM and Methods - Duct Insulation Mastic

(a) All critical barriers, including ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, speaker, and other openings into the abatement work area shall be individually sealed with 0.15 mm plastic sheeting and tape. Elevator doors, fire extinguisher cabinets and all other penetrations in the floor wall, or ceiling shall be sealed in the abatement work area.

(b) Prepare worker/equipment decontamination and waste load-out enclosure as previously specified.

(c) Isolate the abatement work area by constructing a temporary double layered 0.15 mm polyethylene/stud wall.

(d) Cover the floor of the abatement work area with 2 layers of 0.15 mm polyethylene sheeting turned up at walls at least 600 mm.

(e) Wet the asbestos-containing materials with amended water to minimize fiber and dust release during removal. Use amended water sparingly to eliminate standing water and to prevent water from traveling on the floor.

(f) Removed the duct wrap and insulation and the duct mastic in small sections. Do not allow the material to dry out. As it is removed, place the material in sealable plastic bags of 0.15 mm minimum thickness. Place sealed debris in a second 0.15 mm plastic bag, and remove from the work area.

(g) Carefully lower the material to the floor without dropping or throwing.

(h) After removal of the material, HEPA vacuum and wet-clean all surfaces in the abatement work area to remove residual accumulated material. Continue cleaning until the surfaces are visibly free of material.

3.21 Requirements for Specific ACM and Methods - Contaminated Soils

Saturate dry soil with amended water or a removal encapsulant for a depth of 75 mm. Remove the top 25mm of soil. Start removal at the point of work farthest from the entrance to the soil floor area and proceed toward the entrance. Do not permit traffic into the fresh soil surface. After the entire first layer of soil is removed, completely change coveralls and at the entrance to the soil removal area don clean boot covers. Use amended water to keep the surface of the soil continuously wet throughout removal and decontamination. Remove the second 25 mm of soil in the same manner as the first. Remove the third 25 mm of soil in the same manner as the previous 50 mm.

3.22 Requirements for Specific ACM and Methods - Contaminated Carpeting

Deface carpeting with a light coat of contrasting spray paint before the abatement work. Coat lightly enough that wetting will not be retarded. Prior to cutting, thoroughly wet the asbestos-contaminated carpeting to be removed to reduce fiber dispersal into the air. Accomplish the wetting by using a fine spray (mist) of amended water or encapsulant. Saturate material completely without causing excess dripping. Allow time for water or encapsulant to penetrate material thoroughly. Roll up carpeting and dispose of as ACM.

3.23 Requirements for Specific ACM and Methods -Removal of Asbestos-Containing Transite Panels.

(a) Develop a daily removal plan indicating the square footage of panel material that will be removed during the abatement working day.

(b) Establish a regulated area by posting necessary barricades and warning signs to isolate the abatement work area.

(c) Prior to commencing work, establish a regulated area by covering the surface with plastic sheeting a minimum of 4.5 m from the panels being removed.

(d) At all times, keep the panels misted with water.

(e) Remove the panels individually and minimize breakage.

(f) Gently place the panels in bags or wrap the panels in two layers of 0.15 mm plastic sheeting.

(g) Collect and dispose of any debris that falls on the plastic sheeting as asbestos-containing material.

(h) Wet-clean all surfaces of the structure which secured the panels to remove residual ACM.

(i) Encapsulate the structure surfaces wet-cleaned in (h) above.

(j) Wet wipe the plastic sheeting prior to disestablishing the regulated area and dispose of the sheeting as contaminated waste.

3.24 Requirements for Specific ACM and Methods - Glove-Bag Removal Method

(a) Preparation: Before any work commences, a layer of polyethylene sheeting shall be placed on the floor, as a drop cloth, beneath the glove bag abatement work area. A temporary enclosure shall be constructed around the general removal area to separate it from occupied areas of the building and to serve as a physical barrier should accidental fiber release occur. Appropriate warning signs shall be posted outside this barrier in areas of high visibility. A HEPA filtered air filtration unit shall be on-site to be used to contain an emergency fiber release.

(b) Remove asbestos-containing material inside a glove bag according to manufacturer's guidelines. Thoroughly wet material to be removed with amended water or removal encapsulant and allow to soak through to substrate.

(c) Each glovebag shall be installed so that it completely covers the circumference of pipe or other structure where the work is to be done.

(d) Glovebags shall be smoke-tested for leaks and any leaks sealed prior to use.

(e) Glovebags may be used only once and may not be moved.

(f) Glovebags shall not be used on surfaces whose temperature exceeds 65° C.

(g) Before beginning the operation, loose and friable material adjacent to the glovebag/box operation shall be wrapped and sealed in two layers of 0.15 mm plastic sheeting or otherwise rendered intact.

(h) Use two people for glove-bag operation. One shall remove insulation, the other shall operate water sprayer and repair any leaks in bag.

(i) Using a small HEPA vacuum, create a negative pressure inside the glove-bag before starting any asbestos removal and maintain throughout the use of the bag.

(j) Gently remove insulation from pipe and place it in bottom of bag.

(k) After removal of insulation, brush and wet-clean pipe to remove residual material. Continue wet cleaning until surfaces are free of visible material. Clean area of all debris and notify COTR for visual inspection.

(l) Spray all tools with water inside bag and place back in pouch.

(m) Where system uses attached waste bag, such bag shall be connected to collection bag using hose or other material which shall withstand pressure of ACM waste and water without losing its integrity.

(n) Sliding valve or other device shall separate waste bag from hose to ensure no exposure when waste bag is disconnected.

(o) Wet and seal visible ends of remaining pipe insulation.

(p) Spray the inside of the bag with amended water and remove the watering wand, taping the water sleeve closed.

(q) Tape the make-up air opening closed.

(r) Using the HEPA-vacuum, collapse bag and seal off lower portion containing asbestos-containing material and gloves of the bag.

(s) Remove bag from pipe and tools from pouch.

(t) Glove-bag shall be considered the first container for material. Dispose of properly.

(u) Encapsulate abated section of pipe and any adjacent pipe as required.

(v) Accidental Fiber Release During Glove Bag Removal: If the glove bag is accidentally cut open, duct tape from inside the bag shall be used to seal the opening. If the glove bag should rupture during abatement, the drop cloth sheeting beneath the bag shall be used to contain the bag by bringing the edges together, twisting, taping and folding over in gooseneck fashion and taping again. The area around and under this cloth shall be cleaned with a HEPA vacuum.

3.25 Requirements for Specific ACM Methods: Negative Pressure Glove Box Systems

Negative pressure glove box systems shall be used to remove ACM or PACM from pipe runs with the following specifications and work practices:

(a) Glove boxes shall be constructed with rigid sides and made from metal or other material which can withstand the weight of the ACM and PACM and water used during removal.

(b) A negative pressure generator shall be used to create negative pressure in system.

(c) An air filtration unit shall be attached to the box.

(d) The box shall be fitted with gloved apertures.

(e) An aperture at the base of the box shall serve as a bagging outlet for waste ACM and water.

(f) A back-up generator shall be present on site.

(g) Waste bags shall consist of 0.15 mm thick plastic, double-bagged before they are filled, or plastic thicker than 0.15.mm.

Work Practices:

(a) At least two persons shall perform the removal.

(b) The box shall be smoke tested prior to each use.

(c) Loose or damaged ACM adjacent to the box shall be wrapped and sealed in two layers of 0.15 mm plastic prior to the job, or otherwise made intact prior to the job.

(d) A HEPA filtration system shall be used to maintain pressure barrier in box.

3.26 Requirement for Specific ACM Methods: Water Spray Process System

A water spray process system may be used for removal of ACM and PACM from cold line piping if, employees carrying out such process have completed a 40-hour separate training course in its use, in addition to training required for employees performing Class I work. The system shall meet the following specifications and shall be performed by employees using the following work practices.

Specifications:

(a) Piping shall be surrounded on three sides by rigid framing.

(b) A 360 degree water spray, delivered through nozzles supplied by a high pressure separate waterline, shall be formed around the piping.

(c) The spray shall collide to form a fine aerosol which provides a liquid barrier between workers and the ACM and PACM.

Work Practices:

(a) The system shall be run for at least ten minutes before removal begins.

(b) All removal shall take place within the water barrier.

(c) The system shall be operated by at least three persons, one of whom shall not perform removal, but shall check equipment, and ensure proper operation of the system.

(d) After removal, the ACM and PACM shall be bagged while still inside the water barrier.

3.27 Requirement for Specific ACM Methods: Mini Enclosure

A small walk-in enclosure which accommodates no more than two persons may be used if the disturbance or removal can be completely contained by the enclosure with the following specification and work practices.

Specifications:

(a) The fabricated or job-made enclosure shall be constructed of 0.15 mm plastic or equivalent.

(b) The enclosure shall be placed under negative pressure by means of a HEPA filtered vacuum or similar ventilation unit.

Work Practices:

(a) Before use, the mini-enclosure shall be inspected for leaks and smoke tested to detect breaches, and breaches sealed.

(b) Before reuse, the interior shall be completely washed with amended water and HEPA-vacuumed.

(c) During use air movement shall be directed away from the employee's breathing zone within the mini-enclosure.

3.28 Requirements for Specific ACM and Methods - Dry-Removal of Electrical Equipment

Do not begin dry removal work until authorized in writing by the EPA NESHAP coordinator and the COTR. A State regulatory authority waiver may be required and if so shall be obtained by the contractor. Use where wetting may create a hazard for workers or damage equipment or finishes, such as electrical closets, transformer vaults, high pressure steam lines, etc. Work on active electrical equipment is to be performed by qualified trades person with prior experience in the installation or repair of the involved equipment. Restrict access to electrical equipment.

3.29 Post Removal: Cleaning and Clearance

3.29.1 Provide general clean-up of abatement work area concurrent with the removal of all asbestos-containing materials. Do not permit accumulation of debris on workspace floor.

3.29.2 Do not perform dry dusting or dry sweeping.

3.29.3 Maintain the minimum required pressure differential of 0.50 mm of water inside the abatement work area enclosure at all times, and until the COTR authorizes the Contractor to remove the enclosure.

3.29.4 During decontamination of automatic sprinkler and smoke detectors, the Smithsonian security office must be contacted for possible nuisance alarms. Care must be taken in the wiping down of the sprinkler heads and smoke detectors so as not to damage them. Smoke detectors must be vacuumed clean as directed by the Fire Alarm Shop, Office of Physical Plant.

3.29.5 Initial Phase Cleanup Sequence

(a) Remove all visible accumulations of asbestos-containing material and debris.

(b) Wet clean and HEPA-vacuum all surfaces in the abatement work area.

(c) Clean all equipment (excluding that which will be needed for further cleaning phases) used in the abatement work area and remove from abatement work area via the Equipment Decontamination Enclosure.

(d) Remove the top layer (secondary barrier) of plastic sheeting, change all air filtration system pre-filters, and proceed with the second cleaning.

(e) Replace all HEPA-filters and pre-filters in air filtration air machines with clean filters. Clean all air filtration machines.

(f) Notify SI IH for observation of cleaning to determine completeness. Plastic sheeting surfaces will be considered clean when free from dust, dirt, residue, film, or discoloration resultant from abatement operations or other activities subordinate to these operations.

(g) Perform no activity in abatement work area for at least 12 hours in order to allow settlement of airborne fibers. No reduction in this settling period will be allowed.

3.29.6 Secondary Phase Cleanup Sequence

(a) Wet clean and HEPA-vacuum all surfaces in abatement work area at least one more time.

(b) Notify SI IH for observation to determine completeness of cleaning.

(c) SI IH will perform a visual observation of the abatement work area in general accordance with ASTM 1368, *Standard Practice for Visual Inspection of Asbestos Abatement Projects.*

(d) If visual clearance is not attained, then subsequent re-cleaning will be required. This sequence will continue until visual clearance is attained.

(e) When visual clearance has been obtained, the plastic barriers down to the critical barriers may be removed.

3.29.7 Final Air Clearance Testing.

(a) SI IH will test for the final air clearance levels, in accordance with 3.5.7 of this specification, when areas have passed the visual clearance phase. Final air testing shall be performed using aggressive air sampling techniques.

(b) Re-clean and continue to clean at Contractor's expense, areas which do not comply with the specified final clearance level.

3.29.8 Consider abatement work areas and all other decontaminated and cleaned areas clean when:

(a) All phases of clean up have been completed and level of cleanliness is approved by COTR.

(b) All asbestos final clearance testing results will be as specified in 3.5.7 of this specification.

3.29.9. After area passes final air clearance dismantle Decontamination Enclosure Systems and thoroughly HEPA-vacuum and wet clean immediate areas.

3.29.10 Dispose of debris from removal operation, used cleaning materials, unsalvageable materials used for sturdy barriers, and any other remaining materials. Consider the materials to be contaminated, and dispose of accordingly.

3.29.11 The "COTR's Certification of Visual Inspection and Final Air Sampling for Asbestos Abatement" form (see page 45) or equivalent shall be completed, signed by the Contractor, SI IH, COTR and included with the COTR project records. The COTR shall

provide written results of all visual inspections and final clearance testing to the facility safety coordinator.

3.30 Post Clearance: Application of Lockdown Encapsulant To Base Material

3.30.1 Pre-Lockdown Encapsulant Mock-up Test: Prior to beginning lockdown encapsulant work, provide a sample area for approval by the COTR. Notify the COTR a minimum of 72 hours in advance to schedule the test. Lockdown encapsulant shall be applied using methods set forth in ASTM Proposed Specification P-189 "Specification for Encapsulants for Friable Asbestos Containing Building Materials". The test must be witnessed by the COTR or as otherwise designated by the COTR. The approved procedures and materials shall serve as a standard for the balance of the lockdown encapsulant work.

3.30.2 Apply encapsulant only when environmental conditions in the abatement work area are as required by the manufacturer's instructions and the COTR. Prior to applying any encapsulant, ensure that its application will not cause the base material to fail and allow the encapsulated material to fall of its own weight or separate from the substrate.

3.30.3 Apply encapsulant with an airless spray gun with air pressure and nozzle orifice or as otherwise recommended by the encapsulant manufacturer.

3.30.4 Encapsulant Application to Plaster Scratch Coat: Apply two coats of encapsulant to the scratch coat plaster after all ACM has been removed. Apply in strict accordance with the manufacturer's printed instructions. Any deviations from such printed instructions must be approved by the COTR in writing prior to commencing work.

3.30.4.1 Apply the first coat of encapsulant while the plaster scratch coat is still damp from the asbestos removal procedures. If the surface has been permitted to dry, vacuum surface with a HEPA vacuum prior to applying the encapsulant.

3.30.4.2 Apply second coat over first coat in strict conformance with manufacturer's instructions.

3.30.4.3 Color the encapsulant with contrasting colors in alternate coats so that visual confirmation of complete and uniform coverage of each coat is possible. Adhere to manufacturer's instructions for coloring. At the completion of work, the encapsulated surface must be a uniform third color produced by the mixture.

3.30.4.4 Sealing Exposed ACM edges: Prior to encapsulation, permit the exposed edges to dry completely to permit penetration of the encapsulant. Seal edges of ACM with two coats of encapsulant. Label the joint for the portions which are asbestos and non-asbestos.

3.31 Containment Barrier Removal

3.31.1 Following area final clearance and lockdown encapsulation, leave pressure differential units running as long as feasible during containment barrier removal.

3.31.2 Equipment, machinery, scaffolding, tools, etc., within the abatement work area shall not be removed without first being thoroughly cleaned with amended water or in the case of delicate items susceptible to rust, an acceptable substitute.

3.31.3 After the abatement work area is found to be in compliance, the remaining sealed areas and exits are unsealed and the plastic sheeting, tape, and any other trash and debris are disposed of in sealable plastic bags and treated as asbestos waste. The SI IH will conduct a final walkthrough and document results for the COTR.

3.31.4 Before removal from the abatement work area, remove and properly dispose of pre-filter, decontaminate exterior of machine and seal intake to the machine with 0.15 mm polyethylene to prevent environmental contamination from the filters.

3.31.5 The contractor shall patch and paint and repair all damaged areas and restore them to their original, pre-contract condition.

3.32 Waste Disposal

3.32.1 The COTR reserves the right to restrict when containerized ACM will be moved outside of the abatement work area and pass through the building. Times chosen to move containerized ACM in the building shall be during non-public hours and when limited staff is in attendance or under other appropriate conditions as determined by the COTR.

3.32.2 Asbestos-contaminated waste that has been containerized shall be transported out of the abatement work area either through the personnel/equipment decontamination enclosure or through a separate waste load-out enclosure. Waste load-out procedures shall be performed by two teams. The team inside the abatement work area shall clean the outside of properly labeled asbestos waste containers using HEPA vacuums and/or wet wiping, and place them into the waste load-out enclosure. No personnel from the inside team shall exit any further from the abatement work area. The team inside the waste load-out area (wearing protective clothing and respirators) shall retrieve the waste containers from the load-out enclosure, double-bag the waste and pass them to an uncontaminated area outside the enclosure. No unprotected personnel from the outside team shall enter this enclosure. As applicable, routes to the elevator, the elevator itself, and route to covered carts shall be lined with polyethylene sheeting.

3.32.3 For Amosite Fibers: If the material contains amosite fibers, evacuate air from disposal bags with a HEPA vacuum before sealing.

3.32.4 Water not disposed of with the asbestos-containing materials shall be filtered to remove asbestos fibers and debris before disposal into sanitary sewer.

3.32.5 Do not store containerized materials outside of the abatement work area. Take containers from the abatement work area directly to a sealed truck or dumpster.

3.32.6 Bulk and containerized asbestos waste shall be packed, labeled, and transported according to DOT Regulations 49 CFR 173.216 and 49 CFR 173.240. All removed ACM, plastic sheeting, tape, cleaning material, clothing, and all other disposable material or items used in the abatement work area shall be packed into double bagged sealable

0.15 mm plastic bags or double containerized with one bag and one drum. The bags shall be marked with the labels required by OSHA 29 CFR 1910.1001 and/or 1910.1200, and 1926.1101.

3.32.6.1 If the asbestos waste can reasonably be expected to damage double bagged 0.15 mm plastic bags, the following barrel decontamination procedures shall be followed.

(a) Line barrels with a 0.15 mm plastic liner to prevent leaking of contaminated material from the containers.

(b) As bags are moved out through the decontamination system, wet wipe bags to remove all contamination from them before they are moved into an uncontaminated space.

(c) Place bagged waste into appropriately labeled barrels for transport to landfill.

(d) After bagged contaminated waste is placed in barrels, seal lids on barrels.

3.32.6.2 Minimum labeling required:

First Label:

==========
DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
==========

Second Label:

==========
PROVIDE IN ACCORDANCE WITH U.S. DEPARTMENT OF TRANSPORTATION REGULATION ON HAZARDOUS WASTE MARKING. 49 CFR PART 172, SUBPART D: "RQ ASBESTOS NA 2212". PROVIDE A "CLASS 9" LABEL, PER 49 CFR PART 172, SUBPART E.
==========

3.32.6.3 Notify COTR prior to removing each trailer or other waste transport from the jobsite.

3.32.6.4 Notify COTR not less than 48 hours prior to the proposed time of delivery of contaminated waste to the landfill. Owner may elect to observe this operation.

3.32.6.5 The Contractor shall transport the approved sealed drums to an approved waste disposal site.

3.32.6.6 Allow only sealed plastic bags or impermeable containers to be deposited in landfill. Leave damaged, broken, or leaking plastic bags in the impermeable container and deposit entire barrel in landfill.

3.32.6.7 Ensure that there are no visible emissions to the outside air from site where materials and waste are deposited.

3.32.7 Contractor shall submit a disposal certificate from the EPA approved landfill confirming final disposal in accordance with EPA standards and regulations before final payment. Retain receipts from landfill or processor for materials disposed off. At completion of hauling and disposal of each load, submit copy of waste manifest, chain of custody form, and landfill receipt to the COTR.

3.32.8 The COTR shall provide copies of all hazardous waste disposal manifests to the facility hazardous waste coordinator.

3.33 Job Close-Out

3.33.1 The Contractor shall submit to the COTR, Post Abatement Drawings to indicate location of the asbestos material removed. If required, the Contractor may edit the Project Drawing to show the actual or additional abatement work completed.

3.33.2 The Contractor shall remove from the site all other debris and rubbish resulting from removal and disposal operations and the temporary construction of containment barriers and enclosures.

3.33.3 The Contractor shall use positive means to demonstrate to the COTR that any building utilities that were temporarily disabled are now in full service. Notify the COTR when disabled building ventilation, systems, electrical power, smoke detectors, building access/egress passages may safely be re-started or used.

**** END OF SECTION 028200 ****

CERTIFICATION OF VISUAL INSPECTION AND FINAL AIR SAMPLING FOR ASBESTOS ABATEMENT

The COTR, Contractor, and SI Industrial Hygienist hereby certify that the abatement work areas have been visually inspected (all surfaces including pipes, beams, ledges, walls, ceiling and floor, plastic sheeting, etc.) and there is no dust, debris, or residue. The COTR also certifies that final air sample results meet abatement work area clearance specifications.

OEDC Project No_____ SI Contract No._____

Project Title/Location_____

_____

Date of Inspection_____

Date and results of final air sample

ASBESTOS ABATEMENT CONTRACTOR
Firm_____
Print Name_____
Print Title_____
Signature_____

SI INDUSTRIAL HYGIENIST
Firm_____
Print Name_____
Print Title_____
Signature_____

SI COTR
Firm_____
Print Name_____
Print Title_____
Signature_____

SECTION 02 83 00
WORK ACTIVITIES IMPACTING LEAD-CONTAINING MATERIALS

Download Word document.

TABLE OF CONTENTS

TABLE OF CONTENTS - continued

SECTION 028300
Work Activities Impacting Lead-Containing Materials

PART 1 - GENERAL

1.1 INTRODUCTION

A. The Contractor shall perform all planning, administration, execution, and cleaning necessary to safely perform work activities impacting lead-containing materials (LCM).

B. The approval of or acceptance by the COTR of various work activities or methods proposed by the Contractor does not constitute an assumption of liability either by the COTR or the Smithsonian Institution for adequacy or adverse consequences of said activities or methods.

1.2 WORK INCLUDED

****
Design Manager needs to add appropriate language pertaining to whether or not encapsulation and/or enclosure can be used by the contractor as abatement options for the project.
****

A. Work activities, e.g., demolition, construction, renovation, abatement, and routine maintenance, that will impact lead-containing material, assumed lead-containing material, or other lead-related hazards.

B. General requirements include, but are not necessarily limited to:

1. Notification to regulatory agencies.

2. Regulatory permits, licenses, and approvals.

3. Worker health and safety program.

4. Establishing appropriate engineering controls and utilizing good work practices to prevent migration of lead in air from work areas and properly cleaning work areas prior to release to other tradesworkers, SI employees, the public, etc.

5. Contractor shall be responsible for personnel exposure monitoring as required by regulatory agencies for the safety of its employees as indicated in 29 CFR 1926.62.

6. Contractor shall be responsible for retaining a third-party industrial hygienist to provide project monitoring services during work activities that are subject to this specification section.

7. If required in the project scope of work, abatement of existing lead-containing material.

8. If required in the project scope of work, performing the interim control of existing lead-containing material or lead-related hazards.

9. Transport and disposal of lead-containing or lead-contaminated material.

10. Performance of incidental mechanical and electrical work necessary for conducting the Work.

11. Decontamination and cleaning.

12. Removal of engineering controls, including teardown of containment and decontamination unit.

13. Final job close-out.

C. The Contractor shall review all contract documents and make a site visit to make its own determination about quantity values prior to applying for the required federal, state, or local permits from agencies having authority or jurisdiction.

D. Drawings of the project area and the reference locations within the building may be provided by SI upon request, to assist in the Contractor's planning of the Work for protection of occupants and contents.

E. Work not included:

1. Concurrently with this contract, the Smithsonian Institution reserves the right to collect and analyze samples or retain an independent industrial hygiene firm to provide supplemental sampling services. These services will in no way relieve the Contractor from compliance or liability, nor from providing the testing required by these Specifications, or any other requirements of other agencies with jurisdiction.

2. The Smithsonian Institution has contracted an independent industrial hygiene firm to provide monitoring and testing services. The Contractor shall use a different firm for their personnel exposure monitoring and any other environmental or industrial hygiene related testing performed on this project.

1.3 PERFORMANCE OF WORK

Work activities impacting lead-containing material must be conducted by personnel trained and accredited in accordance with state or federal requirements for the location where the work is being performed. At a minimum lead awareness training must be provided in accordance with OSHA Standard 29 CFR 1926.62, Lead in Construction.

At a minimum, all renovation, repair and painting work disturbing lead-based paint (LBP), or paint that has not been tested for lead content, in pre-1978 SI-owned/leased facilities, housing and child-occupied facilities, must be conducted in accordance with the requirements of the *EPA Final Rule on Lead; Renovation, Repair and Painting Program (RRP)* (40 CFR 745) and rule revisions. The rule applies to maintenance and repair activities in which 6 square feet or more of paint is disturbed in a room, or in which 20 square feet or more of paint is disturbed on the exterior. Firms/employers performing this work must be certified by EPA as Lead-Safe Certified Firms. Employees/individuals performing this work must be Certified Renovators who are trained by EPA-approved training providers to follow lead-safe work practices. When a state becomes an EPA-authorized state, firms working in those areas shall contact the appropriate state program office to ensure that applicable training, certification, and work practice requirements are being followed.

In addition, firms/employers shall ensure that lead-based paint hazards generated by renovation work are adequately cleaned after renovation work is finished and before the work areas are re-occupied. Visual inspection and dust wipe testing of the work areas after the renovations covered by the RRP rule are required. This clearance examination and dust wipe testing shall be performed by an accredited Dust Sampling Technician, Inspector Technician, or Risk Assessor in accordance with the regulations. The cleaning verification (CV) card testing option for clearance will not be accepted unless approved by OSHEM.

****

Design Manager needs to add appropriate state licensing and/or other requirements for lead activities, abatement, etc. District of Columbia requirements are included in the specification by default. If work is occurring in any other state, other than the District of Columbia, the designer shall thoroughly review the local and state regulations and edit this specification accordingly.

****

In addition, any work activities impacting lead-based paint in child occupied facilities or target housing, as defined by the District of Columbia, must be conducted by a properly licensed contractor with qualified, trained lead workers and supervisors licensed in the District of Columbia in accordance with the District of Columbia's Lead-Hazard Prevention and Elimination Act of 2008, including Section 8 of the Lead Based Paint Abatement and Control Act of 1996 and properly certified in accordance with the requirements of the *EPA Final Rule on Lead; Renovation, Repair and Painting Program (RRP)* (40 CFR 745). The District of Columbia currently defines lead-based paint as any paint or other surface coating containing lead or lead in its compounds in any quantity exceeding 0.5% of the total weight of the material or more than one milligram per square centimeter (1.0 mg/cm2), or in any quantity sufficient to constitute a health or environmental hazard.

Any renovation, remodeling, repair, or demolition on or around any structure with lead-based paint must be performed by workers with a minimum of 16 hours of Lead-Based Paint Abatement Worker training by an EPA and District of Columbia accredited training provider. In addition, a project supervisor with a minimum of 32 hours of Lead-Based Paint Abatement Supervisor training by an EPA and District of Columbia accredited training provider must be present on site during all aspects of the project work. In addition, all personnel shall possess current lead worker and supervisor licensure from the District of Columbia prior to conducting work activities impacting lead-based paint on the project site, unless a written variance is provided by the local jurisdiction and is approved by the COTR.

A. The contractor or subcontractor to conduct work activities impacting lead-based paint (LBP) shall be an Environmental Protection Agency accredited and/or locally-accredited lead abatement contractor and shall meet the following requirements:

1. Have a record of not less than five years successful experience in work similar in scope and magnitude to this project.

2. Maintain one Superintendent, to remain on site at all times that work is in progress. Superintendent must be approved by the COTR prior to the start of the Work and shall not be changed without prior approval from the COTR. Superintendent shall be a Competent Person and Lead Abatement Supervisor as defined in the Specifications and as required by OSHA and EPA. The COTR reserves the right to reject and require replacement of the Superintendent because of lack of required experience, unsatisfactory performance, or if the Superintendent is deemed to be not in the best interest of the project.

3. Provide one experienced, EPA accredited and locally-licensed lead abatement supervisor Foreman for every eight (8) lead abatement workers utilized on the project. The Foremen shall remain inside the work area at all times that work is in progress and shall direct the work of the lead abatement workers while inside the work area. The COTR reserves the right to reject and require replacement of a Foreman because of lack of required experience, unsatisfactory performance, or if the Foreman is deemed to be not in the best interest of the project.

4. Use only trained and experienced lead abatement workers and supervisors to perform the Work. All lead abatement workers and supervisors assigned to tasks within the Smithsonian Institution shall be certified and licensed lead abatement workers and/or supervisors through an EPA and state accredited curriculum.

B. Submittals required by Section 1.6 of this specification shall be signed by an EPA accredited and locally-licensed Lead Supervisor or Lead Project Designer.

C. Other work described in the Specifications shall be performed according to applicable codes and standards, federal, state, and local regulations, and the Specifications and drawings.

D. Work activities in SI child-occupied facilities and target housing that impact lead-containing materials must be conducted in accordance with the requirements of the *EPA Final rule on Lead, Renovation, Repair and Painting Program (RRP) (*40 CFR 745*)* and rule revisions.

1.4 DEFINITIONS

A. The following definitions pertain to the Work:

1. Abatement: A measure or set of measures designed to permanently eliminate lead-containing material or lead hazards. Abatement strategies include the removal of lead from a substrate, the enclosure of lead, the removal and replacement of building components coated with lead, and the removal of lead-contaminated soil or overlaying of soil with a durable covering such as asphalt.

2. Action Level: The level above which several OSHA requirements are initiated, including, but not limited to: personnel exposure monitoring, medical surveillance, and lead training and education. The current OSHA Action Level is 30 micrograms per cubic meter (µg/m3) calculated as an

8-hour time-weighted average (TWA) without regard to the use of respiratory protection.

3. Airlock: Two curtained doorways spaced a minimum of 1.0 meter apart which form an airlock in the decontamination unit.

4. Air Filtration Unit: A local exhaust unit, utilizing HEPA filtration and capable of maintaining a minimum negative pressure differential of 0.5 mm of water gauge pressure within the containment with respect to that of the surrounding areas. Air filtration units are required in a containment where airborne lead concentrations are expected to exceed the Action Level. The Contractor must submit a negative initial exposure assessment, as required by these Specifications and OSHA, and shall obtain COTR approval when air filtration units are not provided in work areas that typically require local exhaust as an engineering control.

5. Air Monitoring: The process of measuring the airborne lead content of a specific volume of air during a stated period of time.

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

7. ANSI: American National Standards Institute.

8. ASTM: American Society for Testing and Materials.

9. Authorized Visitor: A person deemed authorized by the COTR to enter the work area during the Work. Authorized visitors are responsible for providing their own respirators, except where noted in these Specifications, and for having received proper training, medical certification, and fit-testing for the respirator used.

10. Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 15 to 23 centimeters around the nose and mouth of the face.

11. Certified Industrial Hygienist (CIH): A person who is an industrial hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene.

12. Clean Room: An uncontaminated area or room which is part of the decontamination unit, with provisions for storage of worker's or authorized visitor's street clothing and protective equipment, and other uncontaminated materials and equipment. The clean room may be used for changing clothes. Extra disposable coveralls and towels can also be stored in the clean room.

13. Cleaning Solution: Solution which contains at least one ounce or five percent trisodium phosphate (TSP) detergent to each gallon of HOT water, or an effective alternate solution approved by COTR.

14. Competent Person: An agent of the Contractor (i.e., the on-site Superintendent/Lead Supervisor) who is capable of identifying existing and predictable lead hazards in the surroundings or working conditions and has the authorization by the Contractor to take prompt corrective actions to eliminate them.

15. Contractor: Any business entity, public unit, or person performing the actual work for a LCM abatement or interim lead control project.

16. Containment: A temporary enclosure constructed with 0.15 millimeter (six-mil) thick plastic sheeting, suitable framing, and duct tape and other adhesives within the work area. The containment serves to confine the lead related work activities and to contain the release of airborne lead dust and debris through the action of pressure differential ventilation and air filtration units when required by these Specifications. The only entrance is through the decontamination unit.

17. Contracting Officer's Technical Representative (COTR): An individual representing the Smithsonian Institution as the technical advisor to the Smithsonian Institution's Contracting Officer. This individual may be an employee of the Smithsonian Institution or a consultant.

18. Critical Barrier: Those portions of the containment which represent the minimum structural components necessary to maintain the work area in airtight isolation from the surrounding areas. Examples of openings requiring critical barriers include, but are not limited to: HVAC vents and diffusers, doorways, windows, floor, wall, and ceiling penetrations, and air plenums. If a temporary polyethylene/stud wall must be erected, it shall be treated as a critical barrier. The double-layer polyethylene containment enclosure shall then be erected on that wall. Wrappings on lights, control boxes, etc., do not constitute part of the critical barrier.

19. Curtained Doorway: A passageway to allow access or egress from one room to another while permitting minimal air movement between the rooms of the decontamination unit. It is constructed by placing three overlapping sheets of 0.15 mm (six-mil) poly at least 1.0 meter wide over an existing or temporarily framed doorway. The sheets shall be weighted at the bottom so that they close quickly after being released.

20. Decontamination Unit: A series of connected rooms with curtained doorways between each room, for the decontamination of the workers, equipment and materials. The system is constructed of an air-tight, impermeable, temporary barrier. Framing for the unit shall be metal, fire retardant pressure impregnated wood, or an acceptable substitute approved by the COTR. A decontamination unit for an interior work area contains a minimum of three separate rooms (with airlocks located between the rooms) consisting of an equipment room, wash room, and clean room. A decontamination unit for an exterior work area contains a minimum of two separate rooms consisting of an equipment room and a wash room.

21. Disposal Bag: A properly labeled, minimum 0.15 mm (six-mil) thick, leak-tight poly bag used for transporting lead-containing or lead-contaminated waste from the work area to an EPA-approved disposal site.

22. DOP Penetration Test: An ASHRAE recommended test used to measure the percent penetration (equal to 100 percent minus the percent efficiency) of 0.3 µm DOP (di-octyl phthalate) particles through a filter. A HEPA filter has a minimum efficiency of 99.97 percent as measured using the DOP Penetration Test.

23. DOT: The United States Department of Transportation.

24. Encapsulation: Any covering or coating (encapsulant) that acts as a barrier between existing lead-containing material and the environment, the durability of which relies on adhesion and the integrity of the existing bonds between multiple layers of paint, and between the paint and the substrate.

25. Enclosure: The use of rigid, durable construction materials that are mechanically fastened to the substrate to act as a dust-tight, impermeable, permanent barrier between the lead-containing surface coating and the environment.

26. EPA: The United States Environmental Protection Agency.

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

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

29. Hazardous Waste: As defined in EPA regulations, hazardous waste is solid waste or a combination of solid wastes that because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause or significantly contribute to increases in mortality, serious and irreversible or incapacitating but reversible illness, or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed. As defined in the regulations, solid waste is hazardous if it meets one of four conditions: it exhibits a characteristic of hazardous waste; it has been listed as hazardous; it is a mixture containing a listed hazardous waste combined with a non-hazardous solid waste, unless the mixture is specifically excluded or no longer exhibits any of the characteristics of hazardous waste; or it is not excluded from regulation as hazardous waste. Hazardous lead waste is waste that contains greater than or equal to 5 parts per million (ppm) of leachable lead as determined by the toxicity characteristic leaching procedure (TCLP) test, or is waste that is corrosive, ignitable, or reactive and not otherwise excluded.

30. Heat Gun: A device capable of heating lead-containing material causing it to separate from the substrate. The heat stream leaving the gun shall not exceed 590 °C (1,100 °F).

31. HEPA Filter: A High Efficiency Particulate Air filter capable of trapping and retaining 99.97 percent of all mono-dispersed particles 0.3 micrometers in diameter as measured using the DOP Penetration Test.

32. HEPA Vacuum Equipment: HEPA-filtered vacuuming equipment with a filter system capable of collecting and retaining 99.97 percent of all mono-dispersed particles 0.3 micrometers in diameter as measured using the DOP Penetration Test.

33. HUD: The United States Department of Housing and Urban Development.

34. Impact Surface: An interior or exterior surface (e.g., surfaces on doors) subject to damage by repeated impact or contact.

35. Impermeable Waste Disposal Containers: Containers suitable to receive and retain any lead-containing or lead-contaminated material until disposal at an EPA-approved site. The containers shall be labeled in accordance with all applicable regulations and as directed in these Specifications.

36. Initial Exposure Assessment: For each work activity, the Contractor must submit to the COTR air monitoring data, in accordance with OSHA regulations, from a job similar in scope, magnitude, and methods to the Work. The Contractor shall base the following selections on the initial exposure assessment data: level of respiratory and other personal protection equipment, type of washing facilities provided in the decontamination unit according to the Specifications, and the installation of air filtration units in the containment according to the Specifications.

37. Interim Lead Controls: A set of measures designed to temporarily reduce human exposure or possible exposure to lead-hazards. Interim controls include paint film stabilization, encapsulation of lead-containing material, friction and impact surface treatment, dust removal and control, and interim controls of lead-contaminated soil.

38. Lead-Containing Material (LCM): Any material which contains detectable concentrations of lead.

39. Lead-Based Paint (LBP): EPA defines LBP as any paint, varnish, shellac, or other coating that contains lead greater than (>) 0.5 percent by weight as measured by laboratory analysis, or greater than or equal to (>) 1.0 milligrams per square centimeter (mg/cm2), as measured by XRF or laboratory analysis. As state and local jurisdictions may recognize lower concentrations of lead as the definition of LBP, the more stringent, i.e., lower concentration, shall take precedence.

40. Lead Hazard: A condition in which exposure to lead from lead-contaminated dust, lead-contaminated soil, or deteriorated lead-containing surface coatings would have an adverse effect on human health. Examples of lead hazards include the following: deteriorated

lead-containing paint, lead dust levels above applicable lead dust standards, and bare lead soil levels above applicable lead soil standards.

41. Lead Supervisor: An OSHA Competent Person with a minimum of three years of lead abatement experience. Must be an EPA accredited supervisor licensed by the appropriate jurisdiction as a lead supervisor. This experienced, accredited, licensed supervisor is required to be present on site full time during all lead work activities.

42. Lead Project Designer: An individual who has been trained by an accredited training program, as defined by Section 745.233 of EPA Title 40 and certified by EPA pursuant to Sec. 745.226 to prepare lead abatement project designs, occupant protection plans, and abatement reports. The project designer shall also be licensed if required by state and local jurisdiction regulations.

43. Lead work activities: Any work activities which may impact or may potentially impact lead-containing material. Examples of work activities include, but are not limited to: renovation, gross demolition, selective interior demolition, removal of building components, abatement, and surface stabilization.

44. Lead work area: Work area where lead work activities are being conducted. The area shall be temporarily demarcated with OSHA approved barrier tape or other physical barriers such as six-mil polyethylene, plywood, etc. The lead work area can also be a "regulated area" if the airborne lead concentrations inside the area are expected to exceed the OSHA Action Level.

45. Microgram (µg): The prefix "micro-" means one millionth of (1/1,000,000 of). A microgram is one millionth of a gram.

46. Mil: Equal to 0.025 mm, or one thousandth of an inch.

47. Milligram (mg): The prefix "milli-" means one thousandth of (1/1,000 of). A milligram is one thousandth of a gram.

48. Movable object: A unit of equipment or furniture in the work area which can be removed from the work area.

49. MSDS: Material Safety Data Sheet.

50. NEC: National Electrical Code.

51. NFPA: National Fire Protection Association.

52. Negative Exposure Assessment (NEA): Air monitoring results which demonstrate that employee exposure during an operation is expected to be consistently below the Permissible Exposure Limit (PEL). The air monitoring and analysis must have been performed in compliance with applicable standards. The data must be from operations performed within the previous 12 months, during operations conducted under workplace conditions "closely resembling" the processes, type of material, control methods, work practices, and environmental conditions currently used, and conducted by employees whose training and experience are no more extensive than that of employees performing the current job.

53. NIOSH: National Institute for Occupational Safety and Health.

54. OSHEM: The Smithsonian Institution Office of Safety, Health and Environmental Management.

55. Off-site paint removal: The process of removing a component from a building and stripping the paint from the component at an off-site paint-stripping facility.

56. O&M (Operations and Maintenance): Work that will generate or disturb a moderate amount of lead-contaminated dust and debris, but neither the quantities nor the duration of effort that warrants full-scale work area preparation and worker protection. A moderate amount of lead-contaminated dust is clearly visible, may contain debris and paint chips, but will not spread beyond a small area drop cloth to any other surface in the room. Airborne concentrations of lead must be maintained below the OSHA Action Level to be considered as O&M activities. Work classified as O&M includes:

    a. Sawing with manual or power tools up to 0.1 square meter.

    b. Undercutting, rounding or edge-planing one or two painted wood doors using power tools.

    c. Prying open doors, windows, and drawers that have been completely shut around the edges.

d. Drilling holes, such as those needed to pass rigid conduit through a wall.

e. Changing hardware on doors or other structural components.

f. Work techniques that have not been classified, must be submitted and approved by the COTR.

57. OSHA: Occupational Safety and Health Administration.

58. Paint Film Stabilization: An interim control method, consisting of the wet scraping of loose and flaking paint, and priming and repainting surfaces covered with lead-containing material.

59. Patch Test: A test method or procedure to assess the adhesion of an encapsulant to a substrate covered with a lead-containing surface coating.

60. Permissible Exposure Limit (PEL): The level above which special precautions and procedures must be implemented for the protection of personnel within the work area; set by OSHA at 50 μg/m3 calculated as an 8-hour TWA without regard to the use of respiratory protection.

61. Personal Monitoring: Sampling of the airborne lead concentrations within an employee's breathing zone, to determine the eight hour time-weighted average (TWA).

62. Personal Protective Equipment: Equipment for protecting the eyes, face, head, and extremities. Personal protective equipment includes protective clothing, respiratory devices, and protective shields, and is used when hazards capable of causing bodily injury or impairment are encountered.

63. Plastic Sheeting: Plastic sheet material manufactured of polyethylene or polyvinylchloride of specified thickness used for protection of walls, floors, etc., and used to seal openings into the work area. Also known as “poly sheeting” or “poly”. All poly used for Smithsonian Institution projects shall be fire retardant and a minimum of 0.15 mm (six-mil) in thickness.

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

65. Regulated Area: An area established to demarcate areas where airborne concentrations of lead exceed or can reasonably be expected to exceed the OSHA Action level. The regulated area may take the form of a containment or an area demarcated by barrier tape or some other physical barrier that controls the number of personnel who may be exposed to lead. Also referred to as the 'Lead Work Area' in these Specifications.

66. Representative Sample: A collection of the various components of an item or group of items in the same proportion as is found in the entire bulk of the item or group of items.

67. Resource Conservation and Recovery Act (RCRA): The primary federal statute governing waste management from generation to disposal. RCRA defines the criteria for hazardous and non-hazardous waste.

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

69. Smithsonian Institution Industrial Hygienist (SI IH): A third party working directly for the Smithsonian Institution with the responsibility for observing and monitoring the activities of the Contractor to document that proper work practices are used and compliance with federal, state, and local laws and regulations is maintained. The SI IH is authorized to collect lead-in-air, bulk paint, lead wipe, lead soil, and TCLP samples during the project, perform visual inspections of the work area, and to make recommendations for the approval of final clearance upon completion of the project to the COTR for approval. The SI IH will, in addition to performing routine and special testing necessary to determine general compliance with the Specifications and Drawings, observe and document, on a daily basis, the execution and progress of the Work. The SI IH is not authorized to direct the Contractor nor to act on behalf of the COTR.

70. Substrate: A surface on which paint, varnish, or other coating has been applied or may be applied. Examples of substrates include wood, plaster, metal, drywall, brick and block, stone, and concrete.

71. Toxicity Characteristic Leaching Procedure (TCLP): A laboratory test used to determine if excessive concentrations of lead or other hazardous materials could leach from a sample into groundwater; usually used to determine if waste is hazardous based on its toxicity characteristics.

72. Time-Weighted Average (TWA): The average air concentration of contaminants during a particular sampling period. The most common sampling period utilized in abatement work is eight hours, giving rise to the eight hour time-weighted average quoted in many governing regulations.

73. Trisodium Phosphate (TSP) detergent: A detergent that contains trisodium phosphate.

74. Washroom: A room between the equipment room and the clean room in the decontamination unit for employee and equipment decontamination containing either shower or hand washing facilities. The washroom shall contain shower facilities at all times that the airborne lead concentrations exceed or are expected to exceed 50 µg/m^3 inside the work area; the washroom shall, at a minimum, contain hand washing facilities when airborne lead concentrations are not expected to exceed 30 µg/m^3 inside the work area. The washroom comprises an airlock. The Contractor shall submit a negative initial exposure assessment as required by these Specifications and OSHA, and shall obtain COTR approval when shower facilities are not provided in the washroom.

75. Whole Component Removal and Replacement: A work activity that entails the removal of building components coated with lead-containing surface coatings (e.g., windows, doors, trim, etc.) and the installation of components free of lead.

76. Wet Cleaning: The process of eliminating loose lead-containing surface coatings from building surfaces and objects by using cloths, mops, or other cleaning tools dampened with water and TSP or other similar detergent. These cleaning tools shall be disposed of as lead-contaminated waste.

77. Window Sill: The portion of the horizontal window ledge, adjacent to the window sash when the window is closed, that protrudes into the interior or the room or from the exterior of the window; sometimes called the 'window stool'.

78. Window Trough: For a typical double-hung window, the portion of the exterior window sill between the interior window sill and the frame of the storm window. If there is no storm window, the window trough is the area that receives both the upper and lower window sashes when they are both lowered; sometimes called the 'window well'.

79. XRF Analyzer: An instrument that determines lead concentration in milligrams per square centimeter (mg/cm2) using the principle of x-ray fluorescence (XRF).

1. 5 CODES, REGULATIONS AND REFERENCES

A. The Contractor acknowledges, by execution of the Contract, its awareness and familiarity with the contents and requirements of the following regulations, codes, standards, and guidance documents and assumes responsibility for the performance of the Work in strict compliance with these documents and for every instance of failure to comply with these documents. The current issue of each document shall govern. Where conflict exists between these documents and the Contract Documents, the more stringent requirements shall apply.

B. The Contractor shall comply with the most current edition of all federal, state, county, and city codes and ordinances as applicable and shall make available for review at the site one copy of all applicable federal, state, county, and city regulations governing the Work, including, but not limited to:

1. OSHA:

29 CFR 1910	General Industry Standards
29 CFR 1910.1025	Lead Standard for General Industry
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1200	Hazard Communication
29 CFR 1910.245	Specifications for Accident Prevention
29 CFR 1926	Construction Industry Standards
29 CFR 1926.62	Construction Industry Lead Standard
29 CFR 1926	Subpart L-Scaffolds
29 CFR 1926	Subpart M-Fall Protection

2. United States Environmental Protection Agency:

   40 CFR Part 260-279 Standards for the Management of Hazardous Waste

   40 CFR Part 745 Lead-Based Paint Activities Regulation

3. United States Department of Transportation (DOT):

   49 CFR Parts 171-172 Hazardous Materials Regulations

4. United States Department of Housing and Urban Development (HUD):

   24 CFR Parts 35, 36, 37 HUD Lead-Based Paint Regulations

   "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing"

5. National Institute of Building Sciences: Lead-Based Paint: Operations and Maintenance Work Practices for Homes and Buildings

6. All state requirements which govern lead abatement or interim control work, or hauling and disposal of hazardous waste materials and the following District of Columbia requirements:

   - 20 DCMR 806, Control of Lead
   - DC Act 11-438
   - DC "Lead-Hazard Prevention and Elimination Act of 2008"

7. All local requirements which govern lead abatement or interim control work, or hauling and disposal of hazardous waste materials.

8. Codes and Standards:

   a. American Society for Testing and Materials (ASTM)

   b. American National Standards Institute (ANSI)

   c. National Institution for Occupational Safety and Health (NIOSH)

1. 6 SUBMITTALS

A. The Contractor shall submit three (3) complete sets of Pre-Job Submittals to the COTR for review at least ten (10) working days prior to commencement of mobilizing or three (3) working days prior to the pre-construction meeting, whichever is earlier. The Work may not proceed until the complete pre-job submittal package has been reviewed and approved by the COTR. The Contractor shall bind pre-job submittals in a three-ring binder with dividers keyed to the following items:

1. A Plan for the Work for approval by the COTR. The Contractor's Work Plan shall be prepared in accordance with OSHA and other applicable regulations, and shall include the following, as a minimum:

a. A description of specific control methods to be utilized in performing the Work. This shall include all engineering and work practice controls to be utilized during the Work. Contractor must indicate what type of washing facilities (i.e., showers or hand washing) will be installed and if negative pressure will be created in the containment as required by these Specifications. The work plan shall be specific for each type of work activity impacting lead. Negative Exposure Assessment (NEA) information associated with these activities must be submitted, if the contractor wants to rely on the NEA data with SI's approval.

b. A preliminary bar chart schedule of the Work. The schedule shall include all work, both on and off the job site, for the entire contract period.

c. A layout sketch of the decontamination unit and each work area. Describe assembly of construction, materials to be used and location of notices to be posted on the job site. Indicate which areas will be sealed off and by what means. Show locations of facilities and equipment such as showers, lockers, storage, etc. Show locations of all filtration devices to be used, their exhaust locations, and the calculations to determine the number of devices needed to provide air circulation as required in these Specifications.

d. A written description of methods to isolate/restrict access to the work areas. Indicate how access will be controlled, how building

HVAC ventilation systems will be isolated from the work area, and how security and fire systems will be maintained within the work area. Include plans for electrical lock-out and dedicated electrical systems. These requirements shall be coordinated with the COTR and the facility representative.

2. A list of specific protective clothing and equipment to be utilized during the Work.
3. A written respiratory protection plan which includes the following:

    a. An initial exposure assessment as defined in these Specifications and required by OSHA. The Contractor shall base the following selections on the initial exposure assessment data: level of respiratory and other personal protection equipment, type of washing facilities provided in the decontamination unit as required by these Specifications, and the installation of air filtration units in the containment.

    b. A proposed respiratory protection schedule indicating the specific respiratory equipment selected for use during the Work

    c. Technical data on the different types of respirators to be used in accomplishing the Work. Include model numbers and tested/certified (TC) numbers issued by NIOSH and MSHA.

    d. The Contractor's written respiratory program as required by OSHA. The written respiratory program shall provide evidence that each employee assigned to this project is medically certified to wear respiratory protection, has been successfully fit tested, and participates in the respiratory program.

4. A list of all project personnel, both on-site and office, and a statement of their responsibilities and authority for work on this project.

5. The following documentation for each and every employee assigned to the project by the Contractor or subcontractor, regardless of their role on the project. Submit this information as one package per employee, arranged alphabetically.

    a. A copy of their EPA accreditation and licensure by the appropriate jurisdiction as a Lead Worker or Supervisor when impacting lead-

based paint surfaces or when airborne lead concentrations are expected to exceed the OSHA PEL.

b. A copy of the physician's most recent written medical opinion indicating that the worker is fit to perform the Work and wear the assigned respiratory protection device.

c. Documentation per OSHA 1926.62(1), that shows that the employee has received and understands instruction on the hazards of lead exposure, personal protective equipment usage, use of decontamination showers and hand washing facilities, the procedures for entering and exiting the work areas, the purpose of the medical surveillance and medical removal programs, and on all aspects of the work procedures and protective measures to be used on this project.

d. An abbreviated resume that states the experience, qualifications, training, and currently held lead licenses for the on-site Superintendent and all Foremen assigned to the project. Furnish documentation that the Superintendent is a Competent Person as defined in these Specifications

6. A copy of the notice of impending lead work activities in writing to the appropriate agencies. If not required, so state by means of a letter of explanation signed by a company officer.

7. Current licenses and permits required by applicable Federal, state, and local jurisdictions for the lead- work activities, transportation and disposal of waste, or other regulated activity relative to the Work.

8. An insurance certificate issued to COTR by the Contractor's insurance carrier listing all coverage as specified in the General Conditions.

9. Copies of Contractor's Certifications and Licenses.

10. Information on the site location and arrangements for transporting and disposal of lead-containing or lead-contaminated waste. Include the following as a minimum:

a. The landfill selected for disposing of the lead-containing or lead-contaminated waste. Include: owner, operator, address, and telephone number of the landfill.

b. Landfill certification that shows that the selected landfill is permitted by a state or federal agency to receive lead waste.

c. Landfill certification that shows that the selected landfill will accept the lead waste.

d. Name of the disposal subcontractor. If a disposal subcontractor will not be used, so state.

e. The waste transporter's certificate of insurance and registration with the EPA. If the Contractor will be transporting the waste, then it shall submit its certification of insurance and registration with the EPA as a licensed Waste transporter.

f. All required permits for the transport and disposal of lead waste. If no permits are required, so state by means of a letter of explanation signed by a company officer.

11. Building permits required for the lead abatement and interim control, construction, or demolition work during the progress of the Work. If no permits are required, so state by means of a letter of explanation signed by a company officer.

12. A written description and sketch of the site specific Security Plan to be utilized on this project.

13. A written Contractor Health and Safety Program specifically designed for this project with evidence of comprehension of this Health and Safety Program by the employees assigned to this project.

14. An Emergency Plan which addresses the Contractor’s responses to the following: fire, accident, power failure, pressure differential system failure, supplied air system failure, or any other event that may require modification or abridgment of decontamination or work area isolation procedures. Show primary and secondary exit routes from the building, locations of the nearest manual pull stations, telephone number of the Smithsonian Institution Security Office, name of the Contractor's designated employee responsible for fire protection, fire hazards inherent to the project, and measures taken for prevention.

15. Evidence that all employees assigned to this project are familiar with the Emergency Plan, know how to activate the fire alarm, and are trained in the use of portable fire extinguishers; one on-site employee shall be designated as responsible for fire protection. The plan shall be maintained and available at the job site, and the following emergency information shall be posted at all entrances to the work area: the exit route map, and the phone number of the Smithsonian Institution Security Office.

16. Manufacturer's literature and written information for all materials and equipment, including encapsulants, primers, and paints. Submit NFPA and ASTM test reports of fire retardant materials, and MSDSs for all chemical-content supplies. Contractor shall not change materials or equipment without approval of a new submittal by the COTR.

17. Copies of notices, signs, and lead caution barrier tape to be posted at the job site, as required by the State, EPA and OSHA regulations for lead work activities.

18. A specimen of the Sign In/Sign Out Log showing the following as a minimum: date, name, social security number, entering and leaving time, company or agency represented and reason for entry for all persons entering the work area.

19. The name and qualifications of the Contractor's industrial hygiene consultant and analytical laboratory for performing personal air monitoring and analysis, as required by OSHA regulations.

20. The qualifications of the Contractor's employee blood monitoring services as required by OSHA regulations.

21. A description of any special techniques, equipment, etc., to be used on the project. If none, so state.

B. The Contractor shall correspond with the COTR for all matters related to this project, unless otherwise directed. All correspondence with the Smithsonian Institution shall be in the English language, signed, and dated by the Contractor.

1. The Contractor shall maintain results at the job site from personal air monitoring and make them available to the COTR for inspection upon request.

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

3. The Contractor shall submit to the COTR revised project schedules and manning schedules for the Work as changes mandate.

4. The Contractor shall report all accidents immediately to the Smithsonian Institution Security Office, then to the COTR. Prepare reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury is sustained, property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury. Report shall be submitted to the COTR, who will forward copies to OSHEM and the facility Safety Coordinator.

5. When an event of unusual and significant nature occurs at the site (e.g., failure of pressure differential system, rupture of temporary enclosures, equipment or power failure), the Contractor shall prepare and submit a special report to the COTR listing the chain of events, persons participating, response by the Contractor's personnel, evaluation of results or effects, and similar pertinent information.

C. Post-Job Submittals:

1. A comprehensive listing of personal air monitoring results taken in compliance with the OSHA regulations.

2. A completed copy of the Waste Control Log.

3. Submit, to the COTR, (who is to forward copies to the facility hazardous waste coordinator) copies of the following hazardous waste records for waste generated on SI property and disposed by contract personnel:

a. Hazardous Waste Manifests (signed by the SI facility hazardous waste coordinator, the waste transporter, and the disposal site)

b. Proof of recycling for lead coated metals

c. Notification and Certification Forms

d. Material Profile Sheet or Characterization

e. Container Content Sheet

f. Certificate of Disposal

4. Copies of the completed Sign In/Sign Out Logs showing the following as a minimum: date, name, social security number, entering and leaving time, company or agency represented, and reason for entry for all persons entering the work areas.

5. An alphabetical listing of all employees used on the project and the exact dates on which they were present in the work areas.

6. For each employee that worked on this project, submit a notarized letter stating that blood monitoring has been performed for the employee as required by OSHA and the Specifications.

7. Affidavit of Release of Liens.

8. Certificate of Completion.

1. 7 GENERAL INFORMATION REGARDING LEAD WORK ACTITIVIES

A. Work activities impacting lead that are assumed to expose employees above the OSHA PEL:

1. Manual demolition of structures, which includes interior selective demolition;

2. Dry, manual scraping and sanding;

3. Using a heat gun; and

4. Power tool cleaning with dust collection systems.

B. Contractor shall be responsible for maintaining surfaces free of dust, debris, and paint chips in areas outside of the lead work area where employees decontaminate, eat, or take rest breaks. In addition, egress routes to and from the lead work areas to the exterior of the building must also be free of dust, debris, and paint chips.

C. Non-lead work areas, decontamination areas, and break areas must be pre-cleaned of all visible dust, debris, and paint chips using wet wiping, sweeping, or mopping techniques with TSP or equivalent detergent. If a vacuum is to be utilized, it must be properly equipped with a HEPA filter and be designed for use on abatement projects.

D. Wet sweeping, brushing, or mopping shall only be used in circumstances where vacuuming or other equally effective methods have been tried and found not to be effective as determined by the COTR.

E. Under no circumstances shall dry sweeping, compressed air, or vacuums without HEPA filters be used to clean surfaces of dust, debris, or paint chips inside lead work areas.

F. Contractor may reduce engineering controls, worker personal protection, and training requirements with the permission of the COTR only if they can successfully establish a negative exposure assessment (NEA) in accordance with OSHA Standard 29 CFR 1926.62, paragraph (d) Exposure Assessment and these additional requirements:

1. Personal exposure air sample data must be presented from a minimum of three work shifts for each work activity or task that will be represented.

2. The personal exposure data used as a NEA must be representative of, at a minimum, 25% of the crew performing the work activity and collected during activities that would most likely generate the highest concentrations of airborne lead dust.
3. The work practices and engineering controls utilized during the NEA must be documented in detail and approved by the COTR prior to being used as valid NEA data.

PART 2 - PRODUCTS

2.1 PRODUCT HANDLING

A. The Contractor shall ensure that all materials are delivered in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

B Contractor shall schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

C. The Contractor shall coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

D. The Contractor shall inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that the products are undamaged and properly protected.

E. The Contractor shall store all materials subject to damage off the ground, away from wet or damp surfaces, under cover sufficient to prevent damage or contamination.

F. The Contractor shall remove from the premises all damaged or deteriorated materials. Dispose of materials that become contaminated with lead in accordance with applicable regulatory standards and these Specifications.

2.2 MATERIALS

A. Any substitution in materials or methods to those specified shall be approved by the COTR prior to use. Any requests for substitution shall be provided in writing to the COTR. The request shall clearly state the rationale for substitution.

B. Chemical Stripping Agent Neutralizer: Chemical stripping agent neutralizers may be used on compatible surfaces only, according to the manufacturer's instructions. Neutralizers shall be compatible with and not harmful to the substrate to which they are applied. Neutralizers shall be compatible with the stripping agent that has been applied to the surface substrate.

C. Chemical Stripping Removers: Chemical removers shall contain no methylene chloride products. Chemical removers shall be compatible with, and not harmful to, the substrate to which they are applied. Chemical removers used on masonry surfaces shall contain anti-stain formulation that inhibits discoloration

of stone, granite, brick and other masonry construction. Chemical removers used on interior surfaces shall not raise or discolor the surface being treated.

D. Cleaning Solution: Provide detergent or cleaning agent formulated to be effective in removing lead dust. Follow dilution ratio recommended by the manufacturer's instructions.

E. Encapsulant: Acrylic-based primer and top coat. Primer shall be compatible to the substrate. Acceptable manufacturers shall be pre-approved by the COTR.

F. Impermeable Containers: Shall be suitable to receive and retain lead-containing or lead-contaminated materials until disposal at an approved site, and shall be labeled in accordance with OSHA, EPA and DOT regulations. Containers shall be both air and water tight. Use two types of impermeable containers:

1. Plastic, metal, or fiber drums with tightly fitting lids, lined with 0.15 mm (six-mil) poly; and,

2. 0.15 mm (six-mil) poly bags sized to fit within the lined drums.

G. Plastic Sheeting: Polyethylene plastic material a minimum of 0.15 mm (six-mil) in thickness for covering floors and walls, providing air locks, and sealing doors and windows; supply in appropriate widths to minimize seams. Must be fire retardant, meeting NFPA/ASTM criteria. Reinforced sheeting is required for applications subject to wear and tear.

H. Surfactant (Wetting Agent): Mixture of "Dust-Set Amended Water Base" and water, mixed to the manufacturer's Specifications.

I. Tape: Tape shall be glass fiber or other type capable of sealing joints of adjacent sheets of poly and for attachment of poly sheeting to finished or unfinished surfaces under both dry and wet conditions.

J. Warning Labels and Signs: as required by OSHA.

K. Wood: Must be pressure-impregnated, fire retardant lumber.

L. The Contractor shall provide all other materials (e.g., nails, hardware, etc.) which may be required to construct and dismantle the decontamination system and the barriers that isolate the work area.

2.3 TOOLS AND EQUIPMENT

A. The Contractor shall provide air filtration units that are factory-sealed and equipped with HEPA filters (final), intermediate filters, pre-filters, instrumentation to monitor pressure differential, and safety and warning devices.

1. Units shall be equipped with electrical components approved by the National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL).

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

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

4. Provide a two-stage pre-filtration system to extend the life of the primary HEPA filter. The first-stage pre-filter shall be a low-efficiency type effective for particles 100 micrometers and larger. The second-stage (or intermediate) filter shall have a medium efficiency effective for particles down to 5 micrometers.

5. Where negative pressure enclosures are required on projects, provide units equipped with a magnehelic gauge or manometer to measure the pressure drop across filters and to indicate when filters have become loaded and need to be changed. A table indicating the usable air-handling capacity for various static pressure readings on the magnehelic gauge and the magnehelic reading indicating at what point the filters should be changed, noting quantity of air delivery at that point, shall both be affixed near the gauge for reference. Provide an elapsed time meter to show the total accumulated hours of operation.

B. The Contractor shall equip all circuits for any purpose entering work area with ground fault circuit interrupters (GFCIs). Locate GFCIs exterior to work area so that all circuits are protected prior to entry to the work area. Provide circuit breaker type GFCIs equipped with test button and reset switch for all circuits to be used for any purpose in work area, decontamination unit, exterior, or as

otherwise required by applicable regulations. Locate the panel exterior to the work area.

C. The Contractor shall comply with the applicable recommendations of NFPA's "Standard for Portable Fire Extinguishers". Locate fire extinguishers where they are most convenient and effective for their intended purpose.

D. Electrically-operated heat guns shall be flameless electrical paint softener type. Heat gun shall have electronically controlled temperature settings to allow usage below a temperature of 590^0 C (1,100º F). The heat gun shall be DI type (non-grounded) 120 V, AC application. The heat gun shall be equipped with various nozzles to cover all common applications.

E. Machine Sanding Equipment shall be the dual action, rotary action, orbital or straight line system type, fitted with HEPA filters. Air compressors utilized to operate this equipment shall be designed to continuously provide adequate pressure as required by the manufacturer.

F. Powered Air Purifying Respiratory (PAPR) equipment shall be approved by NIOSH, and equipped with HEPA filters.

G. The Contractor shall have available power cables or sources such as generators, where required.

H. Scaffolding, as required to accomplish the Work, shall meet all applicable safety regulations (29 CFR 1926, Subpart L).

I. The Contractor shall provide sufficient temporary lighting to ensure proper workmanship everywhere; by combined use of daylight, general lighting, and portable plug-in-task lighting.

J. The Contractor shall provide transportation, as required, for loading, temporary storage, transit, and unloading of contaminated waste without exposure to persons or property. Use only enclosed or covered trucks to haul waste containers to prevent loss or damage of containers in route to the landfill.

K. Vacuum units, of suitable size and capacities for the Work, shall be equipped with HEPA filters.

L. The Contractor shall utilize airless or low pressure water sprayers or hand-held spray bottles for amended water application.

PART 3 - EXECUTION

3.1 ACCESS TO WORK AREAS

A. Access to the areas where lead work activities are occurring shall be restricted to the Contractor's workers and authorized visitors, as defined in these Specifications.

B. Authorized visitors shall have access to the work site at all times, following notification to COTR. The Contractor shall supply protective clothing and equipment for authorized visitors, as necessary, except for respirators, which shall be provided by the authorized visitor in accordance with these Specifications.

C. Signage for work areas where airborne lead concentrations are known or expected to be above the OSHA Action Level: The Contractor shall prominently post signs at all entry points to the work area which clearly warn that lead abatement or interim control work is being conducted in the vicinity. Immediately inside entry point and outside critical barriers post a warning sign meeting OSHA specifications. Minimum sign size shall be 500 mm by 350 mm displaying the following legend:

WARNING
LEAD WORK AREA
POISON
UNAUTHORIZED ENTRY PROHIBITED
NO SMOKING, EATING OR DRINKING PERMITTED IN THIS AREA

Signs shall be in bold lettering a minimum of 50 mm tall.

D. Signage for lead work areas where airborne lead concentrations are known or expected to be less than the OSHA Action Level: Demarcate work area perimeter with caution tape. At entrance or along perimeter, post signs per OSHA with the following legend:

WARNING
LEAD WORK AREA
POISON
NO SMOKING, EATING, OR DRINKING

E. Required signage shall be posted immediately outside all entrances and exits to the lead work area at least 3 days in advance of work except, that in emergency situations, posting shall be done as soon as possible.

F. Where required, all workers and authorized visitors shall enter the work area through the decontamination unit only, in accordance with these Specifications.

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

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

3.2 WORKER AND VISITOR PROTECTION

A. No eating, drinking, smoking, or chewing gum is permitted within the work area. The COTR shall designate a “break area” where these activities, except for smoking, are permitted. Smoking is not permitted in Smithsonian Institution facilities.

B. Workers and authorized visitors shall be fully protected with respirators and protective clothing during any work that may disturb lead-containing material and which results or may result in airborne concentrations of lead greater than the OSHA PEL. Full protection is not required during pre-abatement inspections of the work area, before abatement or interim control work has begun.

C. The Contractor shall provide workers and authorized visitors with sufficient sets of protective full-body clothing. Such clothing shall consist of full body coveralls, headgear, foot protection, and gloves. Provide eye protection and hard hats as required by applicable safety regulations. Contractor shall have a minimum of six (6) sets of disposable protective full body clothing for COTR and authorized visitors for each work day. Street clothes may not be worn into an abatement or interim control work area. Provide storage facilities for authorized visitor's and worker's street clothing in the clean room. Workers must wear nylon shorts, ‘TYVEK’ shorts, or an acceptable substitute, under disposable suits.

1. Provide non-skid type work boots with protective shields as required by OSHA.

2. Provide hard hats that meet ANSI requirements for use where work is overhead, scaffolding is being used, or as otherwise required by OSHA.

3. Provide goggles that meet ANSI requirements as required by OSHA.

4. Provide disposable work gloves for use in the work area.

5. Provide disposable coveralls with hoods for use in the work area.

D. Contaminated, non-disposable clothing and footwear shall be stored in a controlled area adjacent to the work area until the completion of the Work. Upon completion of work such items shall be thoroughly decontaminated of all lead-containing or lead-contaminated material, or disposed of as lead-contaminated waste.

E. The Contractor shall provide washing facilities to be used by all workers for all work impacting lead-containing materials. All Lead work sites must have washing facilities.

1. Washing facilities shall contain a temporary sink with both hot and cold water. Filter all water as required in these Specifications, or dispose of as lead-contaminated waste.

2. Supply a sufficient quantity of soap and towels for the workers and authorized visitors.

F. The Contractor shall provide pre-fabricated or site-built shower facilities to be used by all workers when lead in air concentrations exceed or are expected to exceed 30 $\mu g/m^3$. The Contractor must submit a negative exposure assessment and obtain COTR approval when shower facilities are not provided.

1. Showers shall have both hot and cold water which can be controlled from inside shower. Filter all shower water as required in these Specifications, or disposed of as lead-contaminated waste.

2. Supply a sufficient quantity of soap and towels for the abatement workers and authorized visitors.

G. The Contractor shall provide suitable emergency eye flushing facilities within the work area when the eyes of employees may be exposed to injurious corrosive materials or according to OSHA requirements.

H. The Contractor shall provide medical surveillance for all workers according to OSHA requirements.

I. All workers must have baseline and post work blood lead level measurements determined by the whole blood lead method. A worker shall not be permitted to work on the project when three baseline blood sampling tests average greater than 25 μg/dL or if a single test exceeds 30 μg/dL. A formal investigation shall occur whenever a worker's post-work blood lead level rises more than 10 μg/dL above the baseline level.

J. The Contractor shall assure that in areas where employees are exposed to lead above the PEL without regard to the use of respiratory protection, the following hygiene facilities and practices be followed:

1. Clean change areas shall be provided by the Contractor for employees whose airborne exposure to lead is above the Action Level, and as interim protection for employees performing tasks as specified in paragraph (d)(2) of OSHA Standard 29 CFR 1926.62, without regard to the use of respirators;

   a. Change areas shall be equipped with separate storage facilities for protective work clothing and equipment and for street clothes, which prevent cross-contamination.

   b. The employer shall assure that employees do not leave the workplace wearing protective clothing or equipment that is required to be worn during the work shift.

2. The Contractor shall ensure that eating areas are as free as practical from lead contamination by;

   a. Assuring that employees wash their hands prior to eating, drinking, smoking, or applying cosmetics.

   b. Not permitting employees to enter eating areas with protective clothing or equipment.

3. Hand washing facilities shall be provided by the Contractor for use by employees exposed to lead in accordance with OSHA Standard 29 CFR 1926.51(f). Where showers are not provided, the Contractor shall assure that employees wash their hands and face at the end of the work shift.

K. Personnel exiting the lead work areas shall use the following decontamination procedures, unless otherwise specified herein:

1. Vacuum off work clothes with HEPA filter equipped vac

2. Remove disposable, protective clothing and place in an OSHA approved impermeable disposal bag

3. Clean exposed skin such as the face, hands, and arms, either in a shower or similar washing facility

4. Change into clean clothing prior to leaving the physical boundary designated around the work area.

3.3 RESPIRATORY PROTECTION

A. The Contractor shall instruct and train each worker involved in the Work in proper respiratory use and require that each worker wear a respirator properly during all operations which may expose the worker at or above the permissible exposure limit (PEL). Respiratory protection shall be used until the work area is completely decontaminated and final clearance testing has been performed and approved by the COTR.

B. The Contractor shall certify that all workers using respiratory protection have been medically approved to use respiratory protection.

C. The Contractor shall select respiratory protection appropriate for the lead levels encountered in the work area as outlined in OSHA regulations and these Specifications, or as required for other toxic or oxygen-deficient situations encountered. Respirators shall be selected from among those approved by NIOSH.

D. The Contractor shall select and provide respirators to each employee and shall ensure that the employee uses the respirator provided. Allow each employee to use only those respirators for which training and fit-testing have been provided. Require that each time an air-purifying respirator is put on it is checked for fit with a positive and negative pressure fit check in accordance with OSHA regulations (29 CFR 1910.134). Quantitative/qualitative fit-testing shall be repeated at least annually, and at any time a respirator is replaced.

E. Authorized visitors are responsible for providing their own respirator and replacement filters and cartridges, with the exception of Full-Face, Supplied Air

Respirators Operating in Pressure Demand Mode which shall be provided by the Contractor. Authorized visitors are also responsible for having received proper training, medical evaluation, and fit-testing for the respirator used.

F. The Contractor shall provide, for use with air-purifying respirators, HEPA-type filters certified by NIOSH for protection against lead dust. Negative-pressure, particulate filters will meet the requirements of 40 CFR Part 84 following its effective date (July 10, 1998). A sufficient quantity of HEPA filters shall be supplied such that workers may change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement or when breathing resistance is occurring. In addition, a chemical cartridge must be added, as required, for protection against chemicals used for the Work.

G. The following respirators are permitted for use for the airborne lead dust levels specified:

1. Half-Face, Air Purifying Respirators equipped with HEPA filters for airborne lead dust concentrations not in excess of 500 $\mu g/m^3$ (10 times the PEL).

2. Full-Face, Air Purifying Respirators equipped with HEPA filters for airborne lead dust concentrations not in excess of 2,500 $\mu g/m^3$ (50 times the PEL).

3. Powered Air Purifying Respirators (PAPRs) equipped with HEPA filters for airborne lead dust concentrations not in excess of 2,500 $\mu g/m^3$ (50 times the PEL).

4. Full-Face, Supplied Air Respirators Operating in Pressure Demand Mode is required when airborne lead dust concentrations are expected to meet or exceed 100,000 $\mu g/m^3$ (2,000 times the PEL).

H. Contractor shall not use or allow the use of any single-use, disposable, or quarter-face respirators or any other respirator not approved for use by NIOSH.

3.4 LEAD MONITORING, TESTING, AND ANALYSIS PROCEDURES

A. Laboratories used to conduct lead analyses shall participate in the EPA's National Lead Laboratory Accreditation Program (NLLAP).

B. Inspections and risk assessments performed in SI-owned housing shall be conducted in accordance with HUD's "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing", Chapters 5 and 7, and 40 CFR 745

C. Sampling for lead-in-paint shall be performed by persons trained and licensed by the appropriate state and local agencies to perform lead inspections. Sampling shall be performed generally following the protocols included in HUD's "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing", Chapter 7 – 1997 version using either an XRF Lead Paint Analyzer or by bulk paint chip sampling. Analysis of bulk paint chips for lead shall be performed by an accredited laboratory using either Flame Atomic Absorption Spectroscopy (FLAA) or by Inductively Coupled Plasma (ICP).

D. Sampling for lead-in-air shall be performed generally following the "Sampling Airborne Particulate for Lead (NIOSH Method 7082)" procedure as outlined in HUD's "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing". Analysis of lead-in-air samples shall be performed by an accredited laboratory using either FLAA or ICP methods.

E. Lead dust wipe sampling shall be performed generally following the ASTM method E1728 or "Wipe Sampling for Settled Lead-Contaminated Dust" procedure as outlined in HUD's "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing". Analysis of lead wipe samples shall be performed by an accredited laboratory using FLAA following NIOSH Modified Method 7082 or by ICP following Modified OSHA Method ID-125.

F. Lead-in-soil sampling shall be performed generally following the procedures outlined in HUD's "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing". Analysis of soil for lead shall be performed by an accredited laboratory by FLAA or ICP.

G. Bulk samples of waste for TCLP analysis shall be representative samples of the waste and shall be collected following the procedure indicated by the selected laboratory performing the TCLP analysis. TCLP analysis of representative samples of lead-containing or lead-contaminated waste shall be performed by an accredited laboratory following EPA Method SW-846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods". TCLP samples shall be collected by the SI IH.

3.5 BASELINE TESTING

A. Settled lead dust wipe samples will be collected in interior and exterior work areas by the SI IH prior to Contractor mobilization to the site, construction of the containment area, or any pre-cleaning activities. Baseline lead dust samples will be collected from representative components in the area, and will, at a minimum, include one sample from the following: floor inside the work area, floor outside the work area at the location of the containment entrance, and one window sill and one window trough inside the work area (actual number and specific locations of samples shall be determined by the SI IH).

B. Lead-in-soil sampling will be performed in the area adjacent to exterior work areas by the SI IH prior to Contractor mobilization to the site, construction of the work area, or any pre-cleaning activities. Baseline lead soil samples will be collected by composite sampling of areas adjacent to each exterior work area (actual number and specific locations of samples shall be determined by the SI IH).

3.6 AIR AND DUST MONITORING

A. The Contractor shall be responsible for performing personal air monitoring as required by OSHA during the Work. The results of such monitoring shall be posted, provided to individual workers, and submitted to the COTR as required in these Specifications.

B. The SI IH will perform airborne lead monitoring on a daily basis for the duration of the work both inside and outside the work area.

1. The Contractor shall utilize work practices and engineering controls that limit the quantity of airborne lead dust inside the work area. The Contractor shall strive to maintain airborne lead concentrations inside the work area below the OSHA Action Level.

2. If any air sample taken outside of the work area exceeds the Action Level of 30 $\mu g/m^3$, the Contractor shall immediately stop all work except corrective actions. The SI IH and the Contractor Superintendent will determine the source of the airborne lead.

C. The SI IH will be performing lead dust sampling at the beginning of the Work and periodically thereafter at the area immediately adjacent to the entrance of each decontamination unit. Results of lead dust samples will be compared to the baseline lead dust concentrations established in these areas (actual number and frequency of lead dust sampling to be determined by SI IH). If baseline levels are exceeded the Contractor shall immediately stop all work except corrective

actions. The SI IH and the Contractor Superintendent will determine the source of the lead dust.

3.7 GENERAL PREPARATION OF LEAD WORK AREAS

A. The Contractor shall not handle any exhibit or collection object without the approval of the COTR. The Contractor shall submit proposed methods for surface decontamination and/or disposal of unsalvageable objects to the COTR for approval.

B. The Contractor shall coordinate the sequence of lead work area preparation throughout the building with the COTR and other trades to properly segregate work areas from areas that must remain fully or partially operational or in which other construction is being performed.

C. Doorways and corridors which will not be used for passage during work shall be sealed with 13 mm thick fire retardant plywood, fire retardant wood framing, and poly sheeting with tape.

D. All heating, ventilating, and air conditioning (HVAC) components that are in, supply, or pass through the work area shall be shut down. During the Work, elevators, exhaust fans, and HVAC vents and intakes will be key locked to not operate in the work area. The Contractor shall coordinate with the COTR and the Building Manager which areas are to be shut down and for what duration.

E. The Contractor shall provide temporary power and lighting and ensure safe installation of temporary power sources and equipment in accordance with NFPA electric code requirements. Electrical power equipment shall be properly disconnected, locked out, and tagged so that the equipment can be safely serviced during the Work.

F. The Contractor shall arrange for the lead work area to be locked during non-work hours. Install temporary doors with entrance-type lock sets that are key lockable from the outside and always unlocked and operable from the inside. Remove deadbolts and padlocks. Provide one key (to be held by the Smithsonian Institution Security Office) to the COTR.

G. The Contractor shall supply water to the work area as required.

H. Isolation of the work area for O&M work may be modified, as practical, with approval of the COTR, and in accordance with the “Operations and Maintenance Procedures and Controls” section of this specification.

3.8 PREPARATION OF INTERIOR LEAD WORK AREAS WHERE AIRBORNE LEAD CONCENTRATIONS ARE KNOWN OR EXPECTED TO EXCEED THE OSHA ACTION LEVEL

A. Lead Work Area Preparation:

1. The Contractor shall not handle any exhibit or collection object without the approval of the COTR. Methods for surface decontamination and/or disposal of unsalvageable objects shall be determined by the COTR.

2. The Contractor shall clean and remove items required for access; clean all furniture, equipment, and supplies in the work area with a HEPA-filtered vacuum or by wet wiping, as directed by the COTR, prior to being moved or covered.

3. The Contractor shall clean, by HEPA-filtered vacuum or by wet wiping, and remove all electrical and mechanical items (e.g., lighting fixtures, clocks, diffusers, registers, etc.) and general construction items (e.g., cabinets casework, door and window trim, moldings, etc.) which cover the surface of the Work, as directed by the COTR. Reinstall all such materials upon completion of the Work with materials, finishes, and workmanship to match conditions existing before start of the Work.

4. The Contractor shall remove all removable furniture, equipment, and supplies that have been deemed by the COTR to be uncontaminated, or shall completely seal with two layers of 0.15 mm (six-mil) poly sheeting and duct tape. Such sealed furniture, equipment, and supplies shall be considered outside the work area unless the poly seal is breached.

5. The Contractor shall clean all surfaces in the lead work area with a HEPA-filtered vacuum or by wet wiping, as directed by the COTR.

6. The Contractor shall seal all critical barriers, including ventilation openings (supply and exhaust), seams in HVAC system components, lighting fixtures, clocks, doorways, windows, speakers, and other openings into the work area with one layer of 0.15 mm (six-mil) poly sheeting and duct tape. If a temporary poly/ wood stud wall must be erected, it shall be treated as a critical barrier.

7. The Contractor shall seal the front of any existing elevator in the work area with two layers of 0.15 mm (six-mil) poly sheeting and duct tape.

8. The Contractor shall exercise caution when sealing lighting fixtures and control boxes to avoid melting or burning of poly. The insides of lighting fixtures, control boxes, and buss lines shall be cleaned only by lead abatement workers specially certified to work on high voltage lines.

9. The Contractor shall cover the floor of the work area with two layers of 0.15 mm (six-mil) poly sheeting turned up at the walls at least 600 mm. Spray-glue and duct tape all seams in floor poly. Size to minimize number of seams. Locate seams in the top layer 2 meters from, or at right angles to, seams in bottom layer. Install poly so that the top layer can be removed independently of the bottom layer. Do not locate seams at the wall/floor interface.

10. The Contractor shall cover existing carpeting in the work area with three layers of 0.15 mm (six-mil) poly sheeting. Place one layer of 13 mm fire retardant plywood between the top and middle layers of poly.

11. The Contractor shall cover poly in areas where scaffolding is to be used with a single layer of 13 mm fire retardant plywood. Wrap edges and corners of each sheet of plywood with duct tape.

12. The Contractor shall cover all walls in the work area, including sealed critical barriers, with two layers of 0.15 mm (six-mil) poly sheeting, sealed with duct tape or spray-glue. Size to minimize number of seams. Seams shall be staggered and separated by at least 600 mm. Wall poly shall overlap floor poly by at least 400 mm beyond wall/floor interface. Tape all joints, including those joining with the floor covering, with duct tape or as otherwise indicated by the COTR.

13. The Contractor shall not cover or alter automatic sprinkler heads and fire detectors to prevent or delay operation. Smoke detectors shall be protected (but not completely sealed) to avoid nuisance alarms during paint or demolition operations. The smoke detectors shall be cleaned by wet wiping at the end of each work day.

14. The Contractor shall install an additional layer of poly on the floor as a drop cloth to protect the primary floor layers from debris. The drop cloth shall be rolled and disposed of as lead-contaminated waste at the end of each work day and a new drop cloth installed at the beginning of each work day.

15. The Contractor shall provide emergency exiting from the contained lead work area as required by NFPA. Arrange emergency exit doors to be secure from outside the work area but to permit exiting from the work area. Mark outline of door on barriers with luminescent paint at least 150 mm wide. Hang a utility knife on a string beside outline. Post a sign identifying "EMERGENCY EXIT", using letters at least 150 mm high, inside outline with luminescent paint. Arrows shall be taped on the poly wall at eye level and at floor level to indicate the location of each exit.

16. At the entrance to the lead work area, the Contractor shall post the building floor plan and escape routes, plus the locations of nearest exits and phone numbers of the Smithsonian Institution Security Office.

17. Where not provided by the Smithsonian Institution, the Contractor shall provide emergency lighting in accordance with the Life Safety Code.

18. The Contractor shall install a 4.5 kg ABC type portable fire extinguisher by each emergency exit and in the clean room of the decontamination unit.

19. The Contractor shall install inspection windows in the containment walls. Each window shall have a 600 mm x 600 mm viewing area fabricated from 6 mm clear acrylic or polycarbonate sheeting. Install each window with its top at 2 m above floor height in a manner that provides unobstructed vision from outside to inside of the work area. A sufficient number of windows shall be installed to provide observation of the entire work area. Provide for viewing to be blocked from the inside with an opaque plastic flap on each window.

20. Where the work area is immediately adjacent to or within view of occupied areas, the Contractor shall provide a visual barrier of opaque 0.15 mm (six-mil) poly so that the work procedures are not visible to building occupants. Where this visual barrier would block natural light, provide substitute barrier as directed by COTR.

21. The Contractor shall provide GFCI protection for all electrical equipment.

B. Construction of Decontamination Unit

1. The Contractor shall construct a three-stage worker/equipment decontamination unit at each location where workers and equipment will enter or exit the work area.

2. Decontamination units shall consist of a Clean Room, a Wash Area (with shower facilities when required by these Specifications), and an Equipment Room, each separated by 1.0 meter air locks (narrower air locks may be built if approved by the COTR).

3. All rooms shall be constructed of 0.15 mm (six-mil) poly sheeting and suitable framing. Seams shall be staggered and separated by at least 150 mm. Spray glue and duct tape all seams.

4. Doorways shall be constructed of three sheets of 0.15 mm (six-mil) poly from ceiling to floor. The width of these poly sheets shall be sufficient to prevent air movement through the doorways when closed. These doorways shall be the only source of make-up air for the air filtration units under normal circumstances, unless other sources are specifically approved by the COTR.

5. The Contractor shall provide temporary lighting inside the decontamination unit.

6. The Contractor shall transport properly containerized lead-containing or contaminated waste through the decontamination unit or through a separate waste load-out unit. If a separate waste load-out unit is used, it shall be built with two airlocks, with curtained doorways; one to the work area and one to an uncontaminated area outside the work area. These doorways shall be sealed except during waste load out activities.

7. Clean Room:

   a. The Contractor shall construct a clean room outside the wash area for the workers to change into protective equipment. The clean room shall have a curtained doorway leading to the outside of the work area, and an airlock leading to the wash area.

   b. The clean room shall be of sufficient size to accommodate at least one worker, a supply of clean disposable coveralls, and storage facilities for street clothing and other uncontaminated equipment.

   c. The Contractor shall not permit lead-contaminated equipment or personnel to enter the clean room. The Contractor shall ensure that employees do not leave the work area wearing protective clothing.

8. Wash Area:

   a. The Contractor shall ensure that employees wash or shower each time when leaving the work area.

   b. The Contractor shall provide shower facilities in the wash area of the decontamination unit when airborne lead concentrations exceed or are expected to exceed 30 $\mu g/m^3$. The shower facilities shall contain both cold and hot water, soap, and clean towels.

   c. The Contractor shall provide a leak-tight shower unit with an integrated drain pan fabricated from fiberglass or other durable waterproof material; equip with hose bibs for hot and cold water. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the work area. Provide splash-proof entrances.

   d. The Contractor shall provide back-flow prevention device and vacuum breaker, where required. Filter waste water using filters having a maximum pore size of 5.0 micron, or dispose of water in accordance with these Specifications. Locate filters inside shower unit so that water lost during filter changes is caught by shower pan. Change filters daily or more often if necessary.

   e. Where showers are not provided, the Contractor shall provide adequate washing facilities in the wash area of the decontamination unit.

   f. Washing facilities shall contain both cold and hot water, soap, and towels.

9. Equipment Room:

   a. The equipment room shall have two airlocks, one adjacent to the work area and one adjacent to the wash area.

   b. The equipment room shall be of sufficient size to accommodate at least one worker to change clothes, a disposable bag and container for assorted waste, and any lead-contaminated equipment which the Contractor wishes to store when not in use.

c. The equipment room shall contain facilities for decontaminating material and equipment.

C. At the COTR's approval, the Contractor may perform limited lead work activities utilizing a mini containment to isolate the work area. The mini containment shall be equipped with an adjacent wash area and be sealed at all seams to where it is attached to adjacent work surfaces. The mini-containment shall satisfy all requirements for a lead work area as outlined in these Specifications.

D. Creating Negative Pressure in Containment:

1. Negative pressure is required when airborne lead concentrations exceed or are expected to exceed the PEL, 50 µg/m^3. The Contractor shall submit a negative exposure assessment and obtain COTR approval when the work will be performed without negative pressure inside the work area.

2. The Contractor shall provide HEPA filters that have been individually tested and certified by the manufacturer to have an efficiency of not less than 99.97 percent when challenged with 0.3 µm di-octyl phthalate (DOP) particles when tested in accordance with Military Standard Number 282 and Army Instruction Manual 136-300-175A. Provide filters that bear a UL586 label to indicate ability to perform under specified conditions.

3. The number of air filtration units needed to achieve the required air circulation rate shall be determined by the following formula:

CALCULATE	Volume of Work Area (Ft^3)
MULTIPLY BY	Number of air changes per hour, minimum of ten-10 (HUD Recommended)
MULTIPLY BY	1/60 (hr/minutes) (0.0167)
DIVIDE BY	80% of capacity of the air filtration units fully loaded with all filters ADD one additional unit as backup for machine failure or shutdown
EQUALS	minimum number of units required (round up to next whole number)

4. As necessary to achieve air flow throughout the work area, the Contractor shall locate auxiliary makeup air inlets as far away as possible from the air filtration units, preferably near the ceiling and away from barriers that separate the containment from surrounding areas. Cover inlet with poly sheeting flaps to reseal automatically if the pressure differential system should shut down for any reason. Provide rigid framing around the opening. Spray flap and around opening with spray adhesive so that if flap closes meeting surfaces are both covered with adhesive. Use an adhesive that forms contact bond when dry.

E. Placement of Air Filtration Units:

1. The Contractor shall locate air filtration units to optimize air movement throughout the work area. Position air filtration units opposite the decontamination unit or other make-up air inlets.

2. The backup air filtration unit shall be located on site and be available and ready to run at any time.

3. The Contractor shall establish air movement so that airborne lead dust will be carried away from workers' breathing zones.

4. Dead-air pockets shall be minimized by proper ducting of make-up air, if necessary, and by optimum location of the air filtration units. The Contractor shall use smoke tubes to determine if dead-air pockets are present, and shall take corrective action as outlined above when they are found. Report such corrective actions to the COTR immediately.

5. The Contractor shall locate the air filtration units such that access for changing the pre-filters is from inside the containment. The units shall run continuously during pre-filter changing. A supply of filters shall be kept on site outside of containment. If a unit must be turned off for servicing, a backup unit shall be installed.

6. Mount units to exhaust directly or through disposable ductwork outside the building. Use ductwork and fittings of same diameter or larger than discharge connection on fan unit. Use spiral wire-reinforced flex duct in lengths not greater than 15 meters. If direction of discharge from fan unit is not aligned with duct, use sheet metal elbow to change direction. Use 2 meters of spiral wire reinforced flex duct after each direction change.

7. Units may be vented inside the building, as directed by the COTR, only if outside venting is impractical. Units venting inside a building must be vented through an expansion chamber or diffuser system (self-contained water baffle) to reduce the exhaust air velocity. Exhaust ductwork shall be placed as far away as possible from occupied areas.

F. Use of System During the Work:

1. The Contractor shall start air filtration units before beginning abatement work. After work has begun, run units continuously to maintain a constant pressure differential and air circulation until decontamination of the work area is complete and final clearance results have been accepted by the COTR. Do not turn off units at the end of the work shift or when work temporarily stops unless authorized by COTR.

2. The Contractor shall begin work at a location farthest from the air filtration units and proceed toward them. If an electric power failure occurs, immediately stop all work and do not resume until power is restored and air filtration units are operating again.

3.9 PREPARATION OF EXTERIOR LEAD WORK AREAS WHERE AIRBORNE LEAD CONCENTRATIONS ARE KNOWN OR ARE EXPECTED TO EXCEED THE OSHA ACTION LEVEL

A. Exterior lead work shall not be conducted if wind speeds or gusts are equal to or greater than 30 km/hr; work must stop and cleanup shall be completed before precipitation begins.

B. Exterior Lead Work Area Preparation:

1. The Contractor shall not handle any exhibit or collection object without the approval of the COTR. Methods for surface decontamination and/or disposal of unsalvageable objects shall be determined by the COTR.

2. The Contractor shall erect temporary fencing or yellow or red barrier tape at a minimum of 5 meters from the perimeter of the work area. Fencing and tape shall be a minimum height of 1.5 meters.

3. The Contractor shall post warning signs on the building exterior and along temporary fencing or tape barrier.

4. The Contractor shall clean all furniture, equipment, and supplies in the work area with a HEPA-filtered vacuum or by wet wiping, as directed by the COTR.

5. The Contractor shall clean, by HEPA-filtered vacuum or by wet wiping, and remove all electrical and mechanical items (e.g., lighting fixtures, air conditioners, etc.) and general construction items (e.g., door and window trim, moldings, etc.) which cover the surface of the Work, as directed by the COTR. Reinstall all such materials upon completion of the Work with materials, finishes, and workmanship to match conditions existing before the start of work.

6. The Contractor shall remove, to a 5-meter distance from the work area, all removable furniture, equipment, and supplies that have been deemed by the COTR to be uncontaminated, or completely cover with two layers of 0.15 mm (six-mil) poly sheeting and duct tape. Such furniture, equipment, and supplies shall be considered outside the work area unless the poly seal is breached.

7. The Contractor shall clean all surfaces in the work area with a HEPA-filtered vacuum or by wet wiping, as directed by the COTR.

8. The Contractor shall install a minimum of two layers of 0.15 mm (six-mil) poly sheeting on all critical barriers in the work area to the building interior (e.g., windows, doors, air intake grills, window air conditioning units, etc.).

9. The Contractor shall cover the floor surface of the work area with two layers of 0.15 mm (six-mil) poly sheeting, turned up at any walls at least 600 mm. Spray glue and duct tape all seams in the floor sheeting; size sheets to minimize number of seams. Locate seams in top layer 2 meters from, or at right angles to, seams in bottom layer. Install poly so that top layer can be removed independently of bottom layer. Do not locate seams at wall/floor interfaces.

10. Do not anchor ladder feet on top of poly; the poly shall be punctured to provide secure anchoring of the footings to the surface underneath. Punctures in the poly shall be resealed with a minimum of two layers of poly sheeting.

11. The Contractor shall cover poly sheeting in areas where scaffolding is to be used with a single layer of 13 mm thick fire retardant plywood. Wrap edges and corners of each plywood sheet with duct tape.

12. The Contractor shall install an additional layer of poly on the ground as a drop cloth to protect the primary floor layers from debris. The drop cloth shall be rolled and disposed as contaminated waste at the end of each work day and a new drop cloth installed at the beginning of each work day.

13. Where applicable, or as directed by COTR, the Contractor shall protect work area surfaces with 13 mm thick fire retardant plywood or appropriate substitute to protect against falling debris (e.g., nails, tools, etc.).

14. The Contractor shall install a minimum of two layers of 0.15 mm (six-mil) poly sheeting 5 meters in width around the perimeter of the work area. The sheeting shall be sufficiently weighted at all edges to prevent migration of the sheeting. The sheeting shall be placed in a manner that traps all debris and water; this is best accomplished by elevating the edges.

15. The Contractor shall install a 4.5 kg ABC type portable fire extinguisher in the clean area adjacent to the decontamination unit.

16. The Contractor shall provide GFCI protection for all electrical equipment; provide temporary lighting in the work area.

C. Construction of Decontamination Unit:

1. The Contractor shall construct a decontamination unit at each location where workers and equipment will enter or exit the work area.

2. The decontamination unit shall be directly adjacent to the work area, and shall consist of an equipment room and wash area in series. The Contractor shall ensure that employees use the decontamination unit prior to leaving the work area.

3. The Contractor shall select and designate a clean area adjacent to the entrance to the wash area for the workers to change into protective equipment. The clean area shall contain clean clothes and towels, and

storage area for HEPA vacuums, respirators, and other personal protective equipment.

4. Contaminated equipment or personnel shall not be permitted in the clean area. The Contractor shall ensure that employees do not leave the work area wearing protective clothing. Post OSHA decontamination procedures in the clean area for duration of the Work.

5. The Contractor shall provide shower facilities in the wash area of the decontamination unit when airborne lead concentrations exceed or are expected to exceed 30 $\mu g/m^3$. The shower facilities shall contain both cold and hot water, soap, and towels.

6. The Contractor shall provide a leak-tight shower unit with an integrated drain pan fabricated from fiberglass or other durable waterproof material; equip with hose bibs for hot and cold water. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the work area. Provide splash-proof entrances.

7. The Contractor shall provide back-flow prevention device and vacuum breaker, where required. Filter waste water using filters having a maximum pore size of 5.0 microns, or dispose of water in accordance with these Specifications. Locate filters inside shower unit so that water lost during filter changes is caught by shower pan. Change filters daily or more often if necessary.

8. Where showers are not provided, the Contractor shall provide adequate washing facilities in the wash area of the decontamination unit.

9. Washing facilities shall contain both cold and hot water, soap, and towels.

10. The Contractor shall filter waste water using filters having a maximum pore size of 5.0 microns, or dispose of water as lead-contaminated waste in accordance with these Specifications.

3.10 PREPARATION OF LEAD WORK AREAS WHERE THE AIRBORNE LEAD CONCENTRATIONS ARE BELOW OR EXPECTED TO BE BELOW THE ACTION LEVEL

A. The following procedures define the requirements for the preparation of an interior lead work area where work activities generate or are expected to generate concentrations of airborne lead less than the OSHA Action Level.

1. The Contractor shall not handle any exhibit or collection object without the approval of the COTR. Methods for surface decontamination and/or disposal of unsalvageable objects shall be determined with input from the COTR, the object owner, the Contractor, and the SI IH.

2. The Contractor shall clean all furniture, equipment, and supplies in the work area with a HEPA-filtered vacuum or by wet wiping, as directed by the COTR, prior to being moved or covered.

3. The Contractor shall clean, by HEPA-filtered vacuum or by wet wiping, and remove all electrical and mechanical items (e.g., lighting fixtures, clocks, diffusers, registers, etc.) and general construction items (e.g., cabinets, casework, door and window trim, moldings, etc.) which cover the surface of the Work, as directed by the COTR. Reinstall all such materials upon completion of the Work with materials, finishes, and workmanship to match conditions existing before start of the Work.

4. The Contractor shall remove all removable furniture, equipment, and supplies that have been deemed to be uncontaminated by the COTR, or with the approval of the COTR shall completely seal with two layers of 0.15 mm (six-mil) poly sheeting and duct tape. Such furniture, equipment, and supplies shall be considered outside the work area unless covering poly seal is breached.

5. The Contractor shall install an air lock at each doorway entrance to the work area. Air locks shall be constructed using two sheets of 0.15 mm (six-mil) poly sheeting. The first layer shall be sealed at the top, the floor, and each side of the doorway; cut a slit for passage down the middle of the first layer; do not cut the slit all the way to the floor. Tape the second sheet of plastic across the top of the door only, so that it acts as a flap. The flap shall open into the work area. Post lead warning signs at each doorway entry to the work area.

6. The Contractor shall seal all ventilation openings (supply and exhaust), and seams in HVAC system components with two layers of 0.15 mm (six-mil) poly sheeting.

7. The Contractor shall clean all surfaces in the work area with a HEPA-filtered vacuum or by wet wiping, as directed by the COTR.

8. The Contractor shall cover the floor of the work area with two layers of 0.15 mm (six-mil) poly sheeting as a drop cloth.

9. The Contractor shall install a 4.5 kg ABC type portable fire extinguisher at the entrance to the work area.

10. The Contractor shall provide GFCI protection for all electrical equipment.

11. The Contractor shall designate a decontamination area at the entrance to the work area and shall provide washing facilities that include both cold and hot water, soap, and a sufficient quantity of clean towels.

12. The Contractor shall filter waste water using filters having a maximum pore size of 5.0 microns, or dispose of water in accordance with these Specifications.

B. The following procedures define the requirements for the preparation of an exterior lead work area where work activities generate or are expected to generate concentrations of airborne lead less than the OSHA Action Level.

1. The Contractor shall not handle any exhibit or collection object without the approval of the COTR. Methods for surface decontamination and/or disposal of unsalvageable objects shall be determined by the COTR.

2. Exterior lead-based paint interim control work shall not be conducted if wind speeds or gusts are equal to or greater than 30 km/hr; work must stop and cleanup shall be completed before precipitation begins; work shall not begin if precipitation has been forecast to occur during the work shift.

3. The Contractor shall erect temporary fencing, or yellow or red barrier tape, at a minimum of 5 meters from the perimeter of the work area. Fencing and tape should be a minimum height of 1.5 meters.

4. The Contractor shall post warning signs on the building exterior and along the temporary fencing or tape barrier.

5. The Contractor shall clean all furniture, equipment, and supplies in the work area with a HEPA-filtered vacuum or by wet wiping, as directed by the COTR.

6. Remove to a 5-meter distance from the work area all removable furniture, equipment, and supplies that have been deemed by the COTR to be uncontaminated, or with the approval of the COTR completely cover with two layers of 0.15 mm (six-mil) poly sheeting and duct tape. Such furniture, equipment, and supplies shall be considered outside the work area unless the poly seal is breached.

7. The Contractor shall seal all ventilation openings with two layers of 0.15 mm (six-mil) poly sheeting.

8. The Contractor shall clean, by HEPA-filtered vacuum or by wet wiping, and remove all electrical and mechanical items (e.g., lighting fixtures, air conditioners, etc.) and general construction items (e.g., door and window trim, moldings, etc.) which cover the surface of the Work, as directed by the COTR. Reinstall all such materials upon completion of the Work with materials, finishes, and workmanship to match conditions existing before the start of work.

9. The Contractor shall clean all surfaces in the work area with a HEPA-filtered vacuum or by wet wiping, as directed by the COTR.

10. The Contractor shall cover the floor of the work area with two layers of 0.15 mm (six-mil) poly sheeting. An additional layer of poly sheeting shall be installed as a drop cloth. Extend poly floor layers to a 5-meter distance around the perimeter of the work area. The sheeting shall be sufficiently weighted at all edges to prevent migration of the sheeting. The sheeting shall be placed in a manner that traps all debris and water; this is best accomplished by elevating the edges.

11. The Contractor shall not place ladder footings directly on the top layer of floor poly. Rather, the poly shall be punctured to provide secure anchoring of the footings to the surface underneath. Punctures in the poly shall be resealed with two layers of 0.15 mm (six-mil) poly sheeting.

12. The Contractor shall designate a decontamination area at the entrance to the work area and shall provide washing facilities that include both cold and hot water, soap, and a sufficient quantity of clean towels.

13. The Contractor shall filter waste water using filters having a maximum pore size of 5.0 microns, or dispose of water in accordance with these Specifications.

14. The Contractor shall install a 4.5 kg ABC type portable fire extinguisher at the entrance to the work area.

15. The Contractor shall provide GFCI protection for all electrical equipment.

3.11 PRE-INSPECTION OF LEAD WORK AREAS

A. The Contractor shall perform the following actions for the SI IH and the COTR prior to beginning the work. These actions may be modified for pre-inspection of O&M work areas, per the "Operation and Maintenance Procedures and Controls" of this specification.

1. Show proper sealing of poly layers, including all critical barriers.

2. Use smoke tubes to demonstrate that air is not escaping the work area; use smoke tubes to demonstrate that the shaft of each elevator in the work area is a positively pressurized space relative to the containment.

3. Demonstrate procedures for how workers will enter and exit the decontamination unit.

4. Demonstrate procedures for handling emergencies and for the prevention of contamination of surrounding areas.

5. With the COTR, identify disabled elevators and building ventilation systems and the means that will prevent accidental or premature restarting. Confirm means to have units restarted at the conclusion of the Work. With the COTR, verify that all affected equipment is secured at the main breaker.

6. Demonstrate how lead-contaminated wash water will be filtered and drained, or collected for disposal.

7. Demonstrate how lead-containing and lead-contaminated waste will be removed for transport, where the waste will be stored, and how it will be secured during storage; identify procedures for hauling waste through the building to the loading area.

B. The Contractor shall perform the following additional actions for the COTR prior to beginning all work using negative pressure in the work area:

1. Demonstrate that the work area can maintain negative pressure of 0.5 mm of water for a minimum of 2 hours prior to commencement of the Work, unless the system is exhausted through an isolated ventilation system. In this case, the test period shall be long enough to ensure that the lock-out ventilation controls are not over ridden and the HVAC system does not reactivate. At a minimum, the Contractor shall make all arrangements and demonstrate satisfactory equipment operation and set-up for compliance with these Specifications.

2. Show proper condition of equipment seals.

3. Show proper operation of safety and warning devices.

4. Show proper operation and calibration of instrumentation.

5. Show identification of air filtration units and each unit's capacity.

6. Use smoke tubes to demonstrate that negative air pressure and adequate air circulation is being maintained in the work area and that no dead air pockets are present in the work area. Demonstrate positive air motion through the decontamination unit into the work area.

7. Show the installation method for pre-filters, and the HEPA primary filter in the air filtration unit. Show supply of filters available on site.

8. Use a pressure differential meter or manometer to demonstrate the required pressure differential at every barrier separating the work area from the balance of the building, equipment, ductwork, or outside.

9. Demonstrate that each air filtration unit is serviced by a minimum 115V-20A circuit with GFCI protection.

C. The Contractor shall begin the lead work activities only after the following criteria have been met:

1. Pre-abatement testing has been conducted.

2. The work area has been prepared according to these Specifications.

3. The prepared work area has been inspected and approved by the COTR.

4. Arrangements have been made for managing and disposing of the waste at an acceptable site.

3.12 MAINTENANCE OF LEAD WORK AREAS

A. The Contractor shall ensure that the work area isolation methods are effectively sealed and taped for the duration of the Work.

B. The Contractor shall repair damaged lead work areas and remedy defects immediately upon discovery. Visually inspect each lead work area containment at the beginning, middle, and end of each work shift. Use smoke tubes to test the effectiveness of the containment on a daily basis and when requested by the COTR or SI IH.

C. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Material that becomes exposed to and contaminated with lead shall be decontaminated or disposed of as lead-contaminated waste in accordance with the procedures outlined in these Specifications.

D. The Contractor shall clean debris and residue inside of the decontamination unit on a daily basis. Clean debris from shower pans on a daily basis.

E. The Contractor shall maintain dry floors in the clean room and airlocks to minimize slips and trips.

F. The Contractor shall maintain emergency and fire exits from the work area, or establish alternative exits satisfactory to the COTR. Maintain appropriate fire extinguishers in all work areas for the duration of the Work.

3.13 PROHIBITED LEAD WORK METHODS

A. Open Flame Burning or Torching, unless appropriate engineering controls as well as PPE are utilized in accordance with 29 CFR 1926.353 and 354 and approved by SI-OSHEM:

1. Burning, torching, fossil fuel-powered heat plates, welding, and cutting torches are prohibited because of the high temperatures generated in the process; at these temperatures, lead fumes may be produced.

2. Using cutting torches to remove fire escapes, railings, or other metal components coated with lead-paint is prohibited unless the lead-paint is removed first, in accordance with these Specifications.

3. Welding of painted metal components (e.g., pre-primed structural steel) is prohibited by OSHA regulations.

B. Heat Guns Operating Above 590 °C (1,100 ºF):

1. Electric heat guns operating at temperatures greater than 590 °C and 1,100º F are prohibited because of the high temperatures generated in the process; at these temperatures, lead fumes may be produced.

C. Machine Sanding or Grinding Without a HEPA Exhaust Tool:

1. Machine sanding or grinding is prohibited (regardless of the grit used) because of the large volume of leaded dust generated.

2. Extensive dry hand sanding is not permitted, but limited dry sanding or scraping near electrical circuits may be permitted when directed by the COTR.

D. Uncontained Hydroblasting or High-Pressure Water Wash:

1. Uncontained hydroblasting and high-pressure water washing are prohibited due to the large quantity of uncontained lead-contaminated waste water generated.

E. Abrasive Blasting or Sandblasting:

1. Traditional abrasive blasting or sandblasting is prohibited due to the large quantity of lead dust produced.

F. Chemical Paint Removal Using Methylene Chloride-Based Paint Strippers:

1. Chemical paint removers containing methylene chloride are prohibited due to the potential health effects caused by the use of methylene chloride.

G. Dry Scraping:

1. Dry scraping is not permitted because of the large volume of leaded particulate matter generated. However, The COTR may authorize the use of dry scraping in limited surface areas around electrical outlets, where appropriate.

2. Dry scraping is permitted when performed in conjunction with heat gun removal as discussed in Section 3.14.5.B of these Specifications.

3.14 ENGINEERING CONTROLS AND WORK PRACTICES FOR SPECIFIC WORK ACTIVITIES IMPACTING LEAD

3.14.1 Interior Selective Demolition and Whole Component Removal Work Activities

A. Contractor shall prepare work areas where demolition and/or whole building component removal work activities are occurring as work areas exceeding the OSHA Action Level unless the Contractor can provide a NEA for the specific work activity demonstrating that the documented engineering controls and work practices are effective in controlling airborne lead concentrations below the OSHA Action Level as specified in these Specifications.

B. Interior Selective Demolition and Whole Component Work Practices

1. Surfaces to be demolished and/or removed shall be misted with water prior to impacting them.

2. Building components shall be demolished and/or removed in a manner as to minimize the generation of dust within the work area.

3. The work area shall be misted with water as necessary to keep airborne dust levels to a minimum.

4. Using a utility knife or other sharp instrument, the Contractor shall carefully score all affected painted seams. This will provide space for a pry instrument to remove the component and will minimize paint chipping and dust generation during removal.

5. The Contractor shall carefully remove loose and flaking paint by wet scraping or wet sanding, as directed by the COTR. HEPA vacuum and wet wipe the surface.

6. The Contractor shall remove any screws or other fasteners. Using a flat pry instrument and a hammer, carefully pry the selected building component away from the surface to which it is attached. The pry bar shall be inserted into the seam at the nail (or other fastening device) at

one end of the component and pressure applied to the pry bar. This process shall be repeated at other fastening locations until the end of the component is reached. By prying in this manner, the component will be removed intact and paint chip and dust generation will be minimized. A pry point pad or softener may be required to minimize damage to adjoining substrates.

7. The Contractor shall carefully remove, or bend back, all nails (or other fastening devices) and place the component in an impermeable waste disposal container, as defined in these Specifications.

8. The Contractor shall deliver the properly sealed component to an off-site paint stripping facility, as directed by the COTR, or dispose of in accordance with these Specifications.

9. Stripped component, or new lead-free component shall not be installed until the work area has been cleaned in accordance with these Specifications, the area has been visually inspected by the SI IH and approved by the COTR, and clearance sampling results have been accepted by the COTR.

10. When lead-free building components are being installed, the lead-free components shall be back caulked prior to installation (back caulk means to apply caulk to underside of the components).

11. Prior to the end of each work shift, the Contractor shall clean the work area floors using wet sweeping/mopping techniques. If a vacuum is to be utilized, it shall be equipped and exhausted through a HEPA filter.

12. Prior to reoccupancy by trade workers or personnel without a minimum of lead awareness training, the work area shall be cleaned and properly cleared for reoccupancy based upon final clearance testing as specified herein.

3.14.2 Interim Controls and Surface Stabilization of Lead-Containing Surfaces for New Finishes

A. Contractor shall prepare work areas where interim controls and surface stabilization work activities are occurring as work areas exceeding the OSHA Action Level unless the Contractor can provide a NEA for the specific work activity demonstrating that the documented engineering controls and work practices are effective in controlling airborne lead concentrations below the OSHA Action Level as specified in these Specifications.

B. Surface Stabilization Work Practices.

1. General Requirements:

a. All loose surface material should be removed by hand treatments (i.e., wet scraping and wet sanding).

b. Surface contaminants that prevent adhesion of new finishes should be eliminated by cleaning (i.e., chemical degreasing, trisodium phosphate washing, or other equivalent detergent followed by thorough rinsing).

c. Surface gloss should be eliminated by chemical etching or wet sanding. All solvents and/or chemicals used on-site are to be pre-approved by the COTR prior to being brought to project site.

d. Adhesion of new finishes to the substrates may be enhanced by chemical etching, spot sealing, and/or wet sanding.

2. Surfaces shall be misted with water prior to scraping or conduct wet scraping techniques.

3. Wet Scraping:

a. Wet scraping of lead-containing material shall be conducted to remove loose or flaking paint prior to repainting, encapsulation, or enclosure of the lead-containing material. Wet scraping shall not be employed as an abatement technique over a large surface area without approval from the COTR.

b. Working one square meter at a time, the Contractor shall lightly mist the surface with amended water using an airless sprayer or hand-held spray bottle. Using a paint scraper, loose lead-containing material shall be scraped from the surface. The Contractor shall use extreme caution not to damage the existing substrate or the integrity of intact lead-containing surface coatings.

c. Scraper blades shall be kept sharp to minimize surface abrasion and gouging of the substrate. The Contractor shall have sufficient

additional blades on site; scraper blades shall be selected for the surface being abated.

d. To obtain a smooth finish, the Contractor may need to follow wet scraping activities by wet sanding or HEPA-sanding the surface following procedure outlined in these Specifications, as directed by the COTR.

4. Wet Sanding:

a. Wet sanding shall be employed to remove loose or flaking lead-containing materials prior to repainting, encapsulation, or enclosure of the lead-containing material. Wet sanding shall not be conducted as an abatement technique over a large surface area without approval from the COTR.

b. Working one square meter at a time, the Contractor shall lightly mist the surface with amended water using an airless sprayer or hand-held spray bottle. Loose lead-containing material shall then be sanded from the surface. The Contractor shall exercise extreme caution not to damage the substrate or the integrity of intact lead-containing surface coatings.

c. The Contractor shall maintain a slightly wet substrate surface during all wet sanding.

C. Paint film stabilization involves the priming and repainting of lead-containing surface coatings and typically includes performing corrective work or repairs to the building which caused the existing lead-containing surface coating to fail (e.g., moisture problems, mechanically damaged paint, chemical incompatibility, poor surface preparation, aging paint, etc.). These repairs and defects must be specifically addressed prior to paint stabilization.

D. The Contractor shall perform paint film stabilization as an interim lead-control according to the following general guidelines, and as directed by the COTR:

1. Perform all corrective work or repairs to the building which caused the existing lead-containing surface coating to fail. Repair all rotted structural, siding, or railing components; defective plaster; missing door hardware; loose siding or trim; loose wallpaper; etc., as directed by COTR.

2. Prepare the surface by wet scraping or wet sanding, following the procedures in these Specifications, to remove loose, flaking, and deteriorated paint.

3. HEPA vacuum and wet wipe all work area surfaces to remove the paint chips, debris, and dust generated during the Work.

4. Clean, de-gloss, neutralize, and rinse surfaces. Surfaces must be dry before priming or repainting. HEPA vacuum surface after drying.

5. Select primer and topcoat by considering longevity, moisture resistance, and organic compound content with low volatility. Paint film stabilization involves the application of at least two coats (the primer and the topcoat); use a primer/topcoat system from the same manufacturer to ensure compatibility.

6. Apply all paints at thickness according to manufacturer's directions. Apply paint only during proper temperature, wind, and humidity conditions, according to the manufacturer's directions. Allow sufficient time for each coat to dry fully.

7. The COTR will conduct regular evaluations of the stabilized area and report defects or deterioration to the Contractor for re-stabilization.

E. Friction and Impact Surface Treatment of Lead-Containing Surface Coatings

1. Friction surfaces are those surfaces painted with lead-containing material that are subject to abrasion (e.g., window components, tight-fitting doors, cabinet doors, stairway treads and railings, etc.), resulting in the generation of lead-contaminated dust; impact surfaces are protruding surfaces that tend to be bumped or banged (e.g., doors and doorjambs, wall corners, chair rails, baseboards, etc.), causing small chips of lead-containing material to dislodge and fall to the floor.

2. For windows, remove stop bead and parting strip and dispose of properly. Wet scrape deteriorated lead-containing material in accordance with these Specifications. If the window trough is badly weathered, cap with back-caulked, aluminum coil stock. If necessary, repair the window weight and pulley system, as directed by the COTR. Install new window channel or slide system and replace stop bead (and parting strip if required).

3. For doors, remove the doorstop and dispose of properly. Remove door by pulling out hinge pins. Mist and plane door to eliminate friction points. Reinstall door and install new doorstop.

4. For stairs, install a hard, cleanable covering on treads (e.g., rubber tread guards). Carpeting may be used instead, but it must be securely fastened so that it does not cause abrasion. Stabilize paint on banisters, balusters, and newel posts.

5. For baseboards, remove and dispose of shoe molding and replace, as directed by the COTR.

6. For abraded outside wall corners, install new plastic or wood corner protector, as directed by the COTR.

7. Perform the removal of lead-contaminated dust, as directed by the COTR, in accordance with these Specifications.

8. Prior to reoccupancy by trade workers or personnel without a minimum of lead awareness training, the work area shall be cleaned and properly cleared for reoccupancy based upon final clearance testing as specified herein.

3.14.3 Stripping of Lead-Containing Surface Coatings with a Chemical Solvent

A. Contractor shall prepare work areas where stripping LCM using chemical solvents is occurring as work areas exceeding the OSHA Action Level unless the Contractor can provide a NEA for the specific work activity demonstrating that the documented engineering controls and work practices are effective in controlling airborne lead concentrations below the OSHA Action Level as specified in these Specifications.

B. Chemical stripping agents shall contain no methylene chloride products. Chemical stripping agents shall be compatible with, and not harmful to the substrate to which they are applied. The Contractor shall comply with the manufacturer's recommendations for use of the stripping agent.

C. The Contractor shall carefully consult the MSDS for the stripping agent selected to determine potential chemical hazards and appropriate personal protective equipment. The Contractor shall provide sufficient quantities of personal

protective equipment, as required by OSHA and in accordance with the manufacturer's Specifications, when performing chemical stripping. The following personal protective equipment shall be supplied, at a minimum:

1. chemically resistant clothing
2. long neoprene, rubber, or PVC gloves
3. face shields
4. eyewash station with an abundant source of water
5. an abundant source of running water to flush chemicals from the skin
6. proper secondary chemical respiratory filters, in addition to those for lead dust

D. The Contractor shall apply the chemical stripping agent to the building component surface to be abated. The stripping agent shall be applied with a spatula, trowel, brush, or spray gun, in accordance with the manufacturer's Specifications. Spray gun use is permitted only with prior approval of the COTR. The Contractor shall exercise extreme caution when applying the stripping agent to overhead surfaces to avoid dripping onto workers below.

E. The Contractor shall allow the stripping agent to remain on the lead-containing surface coating for the manufacturer's recommended time period. The stripping agent shall not be allowed to dry out, and shall be covered with a poly or paper blanket that is pressed to the surface to prevent drying.

F. The Contractor shall manually remove the treated paint from the substrate using a scraper or a putty knife. The Contractor shall exercise extreme care not to damage the substrate.

G. Scraper blades shall be kept sharp to minimize surface abrasion and gouging of the substrate. The Contractor shall have sufficient additional blades on site; scraper blades shall be selected for the surface being abated.

H. The Contractor shall thoroughly scrub the surface with a solution of glacial acetic acid to neutralize the abated substrate and remove residual residue (wood surfaces shall not be permitted to dry). The use of vinegar as a neutralization agent is prohibited. The Contractor shall carefully consult the MSDS for the

neutralization agent and shall provide personal protective equipment accordingly to the abatement workers.

I. Following neutralization, the damp surface shall be thoroughly scrubbed with a high-phosphate detergent or other acceptable cleaner. Scrubbing should continue until no visible residues remain. The cleaning solution must be changed regularly.

J. The Contractor shall scrub the surface with clean water to remove residue. The pH of the water wash shall be checked after use. If the pH of the water wash exceeds 8.0, further neutralization of the surface with the acetic acid solution is necessary; an alkaline surface (pH of 8.0 or greater) may not be compatible with new paint.

K. For wood surfaces, if the moisture has raised the grain and sanding of the wood surface is required before repainting, a HEPA-equipped sander shall be used in accordance with these Specifications.

L. Prior to reoccupancy by trade workers or personnel without a minimum of lead awareness training, the work area shall be cleaned and properly cleared for reoccupancy based upon final clearance testing as specified herein.

3.14.4 Installation of Enclosure Systems for Lead-Containing Surfacing Coatings

A. Contractor shall prepare work areas where enclosure systems are installed as work areas exceeding the OSHA Action Level unless the Contractor can provide a NEA for the specific work activity demonstrating that the documented engineering controls and work practices are effective in controlling airborne lead concentrations below the OSHA Action Level as specified in these Specifications.

B. All soft, moveable, or otherwise structurally unsound structural members required to support the enclosure shall be repaired prior to enclosure. If repair is not feasible, enclosure will not be possible and an alternative abatement method shall be selected, as directed by the COTR.

C. Prior to enclosure, the Contractor shall label the lead-containing surface to be enclosed, approximately every 1.0 meter, horizontally and vertically, with a warning: “Danger: Lead-Containing Surface Coatings”. The stamp lettering should be done in permanent ink.

D. When enclosing lead-containing floors, the Contractor shall remove all dirt and debris with a HEPA vacuum prior to installing the enclosure to avoid lumps in the new flooring.

E. When installing enclosures directly to a lead-containing surface, the Contractor shall use both an adhesive and mechanical fasteners (e.g., nails, screws, etc.) to anchor the enclosure.

F. The following are acceptable enclosure materials and general procedures for installing these materials. Actual enclosure material selected to be authorized by the COTR (additional materials not listed here may be acceptable; the Contractor shall coordinate with the COTR for use of materials and procedures not provided in these Specifications):

1. Wood Paneling:

a. Prior to installation of enclosure, the Contractor shall carefully remove flaking and loose areas of lead-containing material by wet scraping or wet sanding, as directed by the COTR. Allow intact paint with good adhesion to remain

b. The Contractor shall caulk all seams in the lead-containing painted component to be enclosed.

c. The Contractor shall anchor wood paneling to the substrate with both adhesive and mechanical fastener, as directed by COTR.

d. The Contractor shall scribe and cut the enclosure woodwork to fit adjoining existing work and shall refinish cut surfaces or repair damaged finish at cuts.

e. Wood paneling is not permitted as a ceiling enclosure.

2. Laminated Products:

a. Prior to installation of enclosure, the Contractor shall carefully remove areas of flaking and loose lead-paint by wet scraping or wet sanding, as directed by the COTR. Allow intact paint with good adhesion to remain.

b. Laminated products shall be anchored directly to the lead-containing surface coatings substrate.

3. Ridged Tile and Brick Veneers:

a. Prior to installation of enclosure, the Contractor shall carefully remove areas of flaking and loose lead-containing material by wet scraping or wet sanding, as directed by the COTR. Allow intact paint with good adhesion to remain.

b. Rigid tile and brick veneers shall be glued or cemented directly to the lead-containing material.

4. Drywall and Fiberboard:

a. Prior to installation of enclosure, the Contractor shall carefully remove areas of flaking and loose lead-containing material by wet scraping or wet sanding, as directed by the COTR. Allow intact paint with good adhesion to remain.

b. The Contractor shall remove any trim to be disposed of and install the drywall and fiberboard over any cavity left by the removed trim, except large cavities over 400 mm in any direction. Repair any structural deficiencies, as directed by the COTR.

c. The Contractor shall use construction adhesive to glue the drywall and fiberboard directly to the lead-containing material being enclosed.

d. The Contractor shall screw the drywall and fiberboard to the studs behind the existing wall. Caulk all seams that meet molding.

e. The Contractor shall use extension rings to bring out electrical devices flush with the new drywall and fiberboard and retrofit any HVAC registers. Caulk all seams.

f. The Contractor shall tape and finish the drywall.

5. Sheet Metal:

a. Prior to installation of enclosure, the Contractor shall carefully remove areas of flaking and loose lead-containing material by wet scraping or wet sanding, as directed by the COTR. Allow intact paint with good adhesion to remain.

b. The Contractor shall locate and place sheet metal fabrications plumb, level, and in alignment with adjacent existing building construction.

c. The Contractor shall back caulk at the perimeter of the sheet metal enclosure, sealing seams to form a continuously sealed enclosure

6. Siding:

a. Siding may be used to enclose exterior lead-containing surface coatings prior to installation of enclosure. Prior to installation, the Contractor shall carefully remove areas of flaking and loose lead-containing material by wet scraping or wet sanding, as directed by the COTR. Allow intact paint with good adhesion to remain.

b. The Contractor shall comply with the siding manufacturer's installation instructions and recommendations. Install rigid sheathing or furring strips to provide a level surface prior to the installation of siding. Do not remove the existing lead-painted siding.

c. The Contractor shall install siding and accessories to cover all lead-containing surface coatings. Field fabricated accessories that are not commercially available from sheet aluminum stock or wood. All seams shall be caulked and back-caulked.

7. Windows:

a. Prior to installation of enclosure, the Contractor shall carefully remove areas of flaking and loose lead-containing material by wet scraping or wet sanding, as directed by the COTR. Allow intact paint with good adhesion to remain.

b. Snap-in replaceable aluminum and vinyl window tracks shall be pressed into a bead of caulk at each joint.

c. Window troughs shall be covered with fitted metal and screwed into place. The metal shall be pressed into a bead of caulk at the joints and edges.

G. Following the installation of the enclosure material, the Contractor shall install extension rings for all electrical switches and outlets that will penetrate the enclosure.

H. The Contractor shall seal and back-caulk all seams and joints.

I. The COTR will evaluate the integrity of the enclosure system on a regular basis and following any significant damage due to plumbing or roof leaks, tornadoes, hurricanes, floods, earthquakes, etc. The Contractor shall immediately perform repairs to the damaged areas, as directed by the COTR.

J. Prior to reoccupancy by trade workers or personnel without a minimum of lead awareness training, the work area shall be cleaned and properly cleared for reoccupancy based upon final clearance testing as specified herein.

3.14.5 Mechanical Methods of Lead-Containing Surface Coatings Removal

A. Contractor shall prepare work areas where LBP and/or LCM are removed as work areas exceeding the OSHA Action Level unless the Contractor can provide a NEA for the specific work activity demonstrating that the documented engineering controls and work practices are effective in controlling airborne lead concentrations below the OSHA Action Level as specified in these Specifications.

B. Heat Guns:

1. The Contractor shall use heat guns operating below 590 °C (1100° F) only; the use of heat guns operating at temperatures greater than 590 °C (1100° F) is prohibited.

2. Heat gun removal may only be conducted in negative pressure containments, constructed in accordance with these Specifications.

3. The Contractor shall exercise extreme caution when performing heat gun removal around wallpaper, insulation, and other flammable materials.

4. The Contractor shall maintain a fully charged ABC-type 9 kg fire extinguisher in the work area, as required by OSHA regulations.

5. The Contractor shall allow the heat stream leaving the gun to merely soften the paint. Do not allow the paint film to scorch or smoke. At the first sign of paint softening, blistering, or bubbling, remove the heat stream and manually scrape the softened paint from the substrate. Heat gun removal shall begin at the highest point on the surface and proceed to the lowest point.

6. The Contractor shall maintain sharp scraper blades to minimize surface abrasion and gouging of the substrate. The Contractor shall have sufficient additional blades on site; scraper blades shall be selected for the surface being abated.

7. To obtain a smooth finish, the Contractor may need to follow heat gun activities by wet sanding or HEPA-sanding the surface following procedures outlined in these Specifications, as directed by the COTR.

C. HEPA Vacuum Needle Gun:

1. HEPA-equipped needle guns are permitted for abatement of lead-containing material from metal substrates only and may damage other surfaces.

2. The Contractor shall select the proper shroud as recommended by the manufacturer to match the configuration of the substrate being abated.

3. The Contractor shall operate the HEPA-vacuum attachment at all times for the duration of the lead-containing material abatement.

D. HEPA Vacuum Blasting:

1. The Contractor shall conduct blasting on flat, exterior surfaces or on surfaces compatible with available blast heads as recommended by the equipment manufacturer.

2. The Contractor shall maintain blast head in contact with the lead-containing surface to provide maximum collection of dust and debris created by the blasting operation.

E. Machine HEPA Sanding:

1. Machine sanding without a HEPA-filtered vacuum attachment is prohibited. When using a sander equipped with a HEPA-filtered vacuum, the Contractor shall strictly follow the manufacturer's operating instructions and instructions for care and maintenance.

2. During HEPA sanding, the Contractor shall maintain the operation of the HEPA-vacuum attachment during all sanding operations. The sanding surface shall be held flat to the paint surface. Sanding operations shall be conducted on flat surfaces only.

3. The Contractor shall not allow the sanding pad surface to extend beyond the surface being sanded. The potential for the production of airborne lead dust increases when the sanding disk is wider than the surface being abated.

4. HEPA sanding is not permitted on detailed moldings.

F. Prior to reoccupancy by trade workers or personnel without a minimum of lead awareness training, the work area shall be cleaned and properly cleared for reoccupancy based upon final clearance testing as specified herein.

3.14.6 Lead-Contaminated Soil Removal

A. Contractor shall prepare work areas where lead-contaminated soil is removed as work areas exceeding the OSHA Action Level unless the Contractor can provide a NEA for the specific work activity demonstrating that the documented engineering controls and work practices are effective in controlling airborne lead concentrations below the OSHA Action Level as specified in these Specifications.

B. The Contractor shall carefully remove existing fencing to allow access; erect temporary fencing, signs, and barrier tape as outlined in the Preparation of Abatement Work Area - Exterior section of these Specifications.

C. The Contractor shall tie and protect existing trees, shrubs, and bushes in the work area.

D. The Contractor shall use hand-held spray equipment to dampen soil. Do not over saturate and cause water to run onto adjacent areas.

E. The Contractor shall remove existing lead-contaminated soil using shovels or HEPA-vacuum loading equipment starting at the point farthest from the

decontamination unit. Remove a minimum depth of 150 mm of lead-contaminated soil, or as directed by the COTR.

F. Do not track through areas where soil has been removed.

G. At the end of each shift, or during periods of excessive winds, cover lead-contaminated sections of soil with one layer of 0.15 mm (six-mil) poly sheeting; anchor sufficiently to prevent the migration of the poly.

H. Replace the removed soil at proper grade to allow drainage. Replacement soil shall be at least 50 mm above existing grade to allow for settling. Soil must contain less than 400 ppm of lead.

I. Install new soil covering (e.g., grass or sod). The Contractor shall consult with the Smithsonian Institution Office of Horticulture Services when selecting an appropriate grass or sod covering.

3.14.7 Encapsulation of Lead-Containing Surface Coatings

A. Contractor shall prepare work areas where lead-containing materials are to be encapsulated as work areas exceeding the OSHA Action Level unless the Contractor can provide a NEA for the specific work activity demonstrating that the documented engineering controls and work practices are effective in controlling airborne lead concentrations below the OSHA Action Level as specified in these Specifications.

B. Encapsulation:

1. Surfaces of non-deteriorated substrates covered with intact lead-containing material may be considered for encapsulation.

2. Conduct field tests of surfaces to be encapsulated for paint film integrity. Test the adhesion by performing a minimum 150 mm x 150 mm test patch. The area must be visually clean of dust and debris before performing the test patch. Conduct a minimum of one test patch on each type of lead-containing material covered building component to which the encapsulant will be applied.

3. The following surfaces and components are typically not suitable for encapsulation. Alternate interim control or abatement methods shall be considered for the following:

a. Friction surfaces, such as window jambs and door jambs. Friction surfaces are typically subject to repeated damage, thereby compromising the integrity of the encapsulant applied.

b. Surfaces with substrates or existing coatings that have a high level of deterioration. Encapsulants on these surfaces have a high rate of failure as a result of the surface or substrate deterioration.

c. Surfaces in which there is a known incompatibility between two existing surface coating layers. This incompatibility typically cannot be determined without performing a test patch of the surface.

d. Surfaces that cannot support the additional weight stress of encapsulation due to existing paint thickness. This inability to support the additional weight of an encapsulant typically cannot be determined without performing a test patch of the surface.

e. Metal surfaces that are prone to rust or corrosion. Encapsulants on metal surfaces typically fail when the surface underneath rusts.

4. Repair all building components and substrates as needed (e.g., caulk cracks and repair sources of water leaks).

5. Prepare surfaces. Remove all dirt, grease, chalking paint, mildew and other surface contaminants, remnants of cleaning solutions, and loose paint. All surfaces shall be de-glossed, as needed.

6. Apply one of the three following types of encapsulant, as approved by OSHEM and directed by the COTR.

a. Non-reinforced liquid coatings

1. Apply using a brush, roller or spray. Non-reinforced liquid coatings are suitable for many interior and exterior substrates. Application procedures and requirements vary with specific type selected; follow manufacturer's directions during application.

b. Reinforced liquid coatings:

1. Apply using a brush, roller, spray, or trowel. Application procedures for reinforced liquid encapsulants vary with specific type selected, and may require the application of a fabric; follow manufacturer's directions during application.

NOTE: Use of liquid coatings is prohibited in the State of Maryland for residential, child-occupied, commercial and steel structures. Approval for use in other jurisdictions will be on a case-by-case basis.

c. Adhered materials (e.g., vinyl wall coverings, vinyl floor tile, etc.):

1. Contractor shall apply adhesive first, then install the selected encapsulant product. The Contractor shall carefully follow the manufacturer's directions for application of adhesive product and encapsulant selected.

7. During encapsulant application or installation, monitor air temperature and relative humidity and perform the encapsulant application according to the manufacturer's guidelines for these parameters. For liquid coatings, monitor the coating thickness to ensure that the encapsulant manufacturer's Specifications are met.

8. For liquid coating encapsulants, allow coating to cure and then visually examine it for wrinkling, blistering, cracking, bubbling, or other chemical reaction with the underlying paint. For all encapsulants, perform the appropriate adhesion tests recommended by the manufacturer.

9. The COTR will conduct regular evaluations of the encapsulated area and report defects or deterioration to the Contractor for re-stabilization.

C. Prior to reoccupancy by trade workers or personnel without a minimum of lead awareness training, the work area shall be cleaned and properly cleared for reoccupancy based upon final clearance testing as specified herein.

3.14.8 Cleaning of Lead-Contaminated Surface Dust

A. Contractor shall prepare work areas where lead-contaminated surface dust cleaning work activities are performed as work areas exceeding the OSHA Action Level unless the Contractor can provide a NEA for the specific work activity demonstrating that the documented engineering controls and work practices are effective in controlling airborne lead concentrations below the OSHA Action Level as specified in these Specifications.

B. Dust Removal and Control:

1. The removal and control of lead-contaminated dust shall be performed for those building surfaces with lead dust levels above those in the following table, and as directed by the COTR.

Surface	Leaded Dust Loading ($\mu g/ft^2$)
Bare and Carpeted Floors	40
Interior Window Sills	250
Window Troughs	400
Exterior Horizontal Surfaces	400

2. Correct any known or suspected lead-containing surface coating hazards which may be contributing to the production of lead-contaminated dust before dust removal, as directed by the COTR.

3. Visually inspect other dust traps (e.g., radiators, floor grates, etc.). If visible dust is observed, the item shall also be cleaned.

4. Clean all horizontal surfaces by HEPA vacuuming and by wet wiping techniques, as directed by the COTR.

5. Begin dust removal at the highest horizontal surface and work down. Clean windows, other dust traps, and finally the floors.

6. During wet cleaning, replace rags, sponges, and mops frequently. Change the wash water often.

7. To discard lead-contaminated carpets or other upholstered furnishings, as directed by the COTR, mist the surface with water; seal the item in plastic sheeting, bags, or containers; and discard properly.

8. To clean lead-contaminated carpets or other upholstered furnishings, HEPA vacuum each surface a minimum five times, vacuuming the bottom

of the item a minimum of three times. Also HEPA vacuum the existing floor below lead-contaminated carpeting a minimum of three times.

3.14.9 Interim Control of Lead-Contaminated Soil

A. Contractor shall prepare work areas where lead-contaminated soil cleaning work activities are performed as work areas exceeding the OSHA Action Level unless the Contractor can provide a NEA for the specific work activity demonstrating that the documented engineering controls and work practices are effective in controlling airborne lead concentrations below the OSHA Action Level as required in these Specifications.

B. Soil Interim Controls:

1. The interim control of lead-contaminated soil shall be performed for those surfaces with lead-in-soil levels below the levels in the following table, and as directed by the COTR. Interim controls are not appropriate and abatement should be considered for lead-contaminated soil with lead concentrations above the levels in the following table.

Soil Area	Lead in Soil Level (µg/g)
SI Child Care Play Areas	400
Other Soil Areas	1,200

2. Interim control measures for lead-contaminated soil include installing surface coverings (e.g., grass, gravel, etc.) or implementing land use controls in the area (e.g., fencing the area, creating alternative walkways, etc.).

3. The Contractor shall perform the interim control of lead-contaminated soil according to the following general guidelines, and as directed by COTR (the interim control of lead-contaminated soil in a selected area may involve the selection of one or a combination of a number of controls, to be coordinated with COTR):

a. If the area to be controlled is heavily traveled, grass surface coverings may not be appropriate and more durable coverings

such as gravel or pavement should be considered. Consult with the COTR.

b. When seeding or installing sod on a selected area, the Contractor shall consult with the Smithsonian Institution Office of Horticulture Services to determine what grasses are appropriate for the locale, soil type, and sun/shade characteristics. Properly prepare the soil prior to seeding or sodding.

c. When covering lead-contaminated soil with bark or gravel, apply the covering at least 150 to 300 mm deep. New bark, gravel, or other materials shall not contain more than 200 µg/g of lead. The Contractor shall test these materials for lead content prior to installation, unless previous testing data are available and provided to the COTR.

d. If the lead-contaminated soil is in a Smithsonian Institution child care recreation area, the Contractor shall comply with the Consumer Product Safety Commission standards on acceptable surface coverings in play areas.

e. Implementing land use controls to reduce exposure to the lead-contaminated soil include installing fencing, warning signs, and thorny bushes. The Contractor shall obtain COTR permission prior to implementing any land use control.

f. Control water erosion by proper grading and installation of drainage channels, as directed by the COTR.

g. Provide walk-off doormats at all adjacent building entryways to reduce the tracking of lead-contaminated soil into the building.

3.14.10 Work Activities Impacting Lead Not Addressed

A. Any work activities impacting lead that have not been addressed by these Specifications must be conducted in accordance with all applicable EPA, OSHA, and local regulations. In addition, the engineering controls and work practices for all work activities impacting lead or assumed to impact lead must be submitted in writing to the COTR for pre-approval prior to mobilization.

3.15 OPERATIONS AND MAINTENANCE PROCEDURES AND CONTROLS

A. Preparation of work area for O&M during lead-containing material penetration and cutting:

1. Move furnishings and equipment away from the work area. Objects which are fixed-in-place shall be covered with 2 layers of six-mil poly drop cloth.

2. Place 2 layers of six-mil poly drop cloth on the floor and extend cloth at least five feet (1,500mm) from all areas of lead-containing material work.

3. If wall is within 1,500mm of work area perimeter, turn drop cloth up a minimum of 300 mm from the base of the wall and seal to the wall with tape.

4. If liquid runoff is to be generated, roll up edges of drop cloth to create a berm which will contain the liquid waste and debris.

5. Limit access through the work area by demarcating entrance areas to help control traffic with OSHA approved lead caution tape.

B. Work procedures for penetrating or cutting lead-containing material covered surfaces:

1. As a minimum, disposable gloves and shoe coverings are to be worn by individuals performing O&M work to prevent the spread of lead paint dust to other areas. Eye protection, head protection (for overhead work), and full-body protection is recommended.

2. Power tools used for O&M work shall be equipped with a HEPA-filtered, shrouded exhaust. As an alternative, power tools may be used in conjunction with HEPA-filtered vacuum cleaners held in close proximity to source of dust, provided that, in the judgment of the COTR, this method is shown to result in acceptable dust suppression.

3. Initially mist the work surface area with a water and surfactant solution.

4. Use utility knife or scraper to remove any loose paint from the work surface or to slice the painted edges of the component to be removed from the work surface. Reference wet scraping procedures per this

specification to remove paint along the cutting line prior to undercutting doors.

5. Perform the required work on the surface while the surface is wet. Re-wet the surface as needed during penetrating and cutting work.

6. Disconnect power tools during wetting procedures to avoid electrical shock.

7. Ensure that during penetrating and cutting work that lead dust and debris remains on the drop cloth. If dust and debris spreads to other areas, use procedures in the specification for full-scale work area preparation, worker protection and work area cleaning.

8. After completing work, disconnect power tools and re-mist the work surfaces.

9. Clean and rinse all equipment and work surfaces using a wet wash system as covered in the Specifications.

10. Remove shoe covering when stepping off the poly drop cloth.

11. The Smithsonian Institution may conduct a visual inspection and lead clearance testing in compliance with the Specifications. The Contractor shall consult with the COTR regarding final visual inspection and clearance testing prior to start of work activities.

12. After completion of clearance testing, or notification from the COTR, drop cloths shall be rolled inward and placed in disposal bags with other waste. Waste generated during O&M work may be regulated as a hazardous waste under RCRA per this specification. The SI IH shall collect a representative sample of the generated waste for TCLP analysis.

3.16 LEAD WORK AREA CLEANING PROCEDURES

A. Daily Cleaning:

1. The Contractor shall carefully fold the drop cloth to center and dispose of the poly drop cloth as lead-contaminated waste.

2. The Contractor shall provide general clean-up of lead work area concurrent with the removal of all lead-containing or lead-contaminated materials. Do not permit accumulation of debris on the work area floor.

3. The Contractor shall perform a thorough HEPA vacuuming of the work area. In addition, the Contractor shall utilize an effective cleaning solution during the cleaning activities. Do not perform dry dusting or dry sweeping.

4. The Contractor shall reinstall a clean poly drop cloth before resuming the Work.

B. Final Cleaning at the Completion of Work:

1. The Contractor shall remove all visible accumulations of lead-containing material and debris.

2. The Contractor shall HEPA vacuum all surfaces in the work area, then wet clean the surfaces with an effective cleaning solution; HEPA vacuum all surfaces in the work area again.

3. The Contractor shall thoroughly decontaminate and remove all equipment from the work area.

4. If applicable, the Contractor shall replace all HEPA filters and pre-filters in air filtration units exhibiting diminished flow capacity with clean filters. Clean all air filtration units.

5. The Contractor shall perform no activity in the work area for a minimum of one hour to allow settlement of airborne particulate. No reduction in this settling time will be permitted.

6. The Contractor shall notify the SI IH for observation of cleaning to determine completeness. Poly surfaces will be considered clean when free from visible dust, dirt, residue, film, or discoloration resultant from the Work.

7. Following successful visual inspection as outlined in these Specifications, the Contractor shall dismantle and carefully remove remaining poly sheeting except for critical barriers.

8. The Contractor shall HEPA vacuum all surfaces in the work area, and then wet clean the surfaces with an effective cleaning solution. Allow surfaces to dry, and HEPA vacuum all surfaces in the work area again.

9. If applicable, the Contractor shall replace all HEPA filters and pre-filters in air filtration units with clean filters. Clean all air filtration units again. Notify the SI IH for observation of cleaning to determine completeness. Work area will be considered clean when free from visible dust, dirt, residue, film, or discoloration resultant from the Work.

10. Following successful visual inspection as outlined in these Specifications, the SI IH will perform appropriate clearance sampling in the work area.

3.17 LEAD WORK AREA CLEARANCE PROCEDURES

A. Visual Inspection:

1. All surfaces within the lead work area will be visually examined by the SI IH. The SI IH will examine the bare surfaces to ensure that there is no visible residue. If residue remains, the Contractor shall re-clean the component prior to repeating the visual inspection.

2. If a building component has been removed and replaced, the SI IH will examine the work area to ensure that each building component specified for removal and replacement has been completely removed.

3. If a lead-containing surface coating- enclosure system has been installed, the SI IH will examine the mechanical fastening system used to hold the enclosure to the substrate to determine that the fastening system is adequate. All seams and edges in the enclosure will be examined to ensure that they are sealed to provide a dust tight system.

4. If lead-contaminated soil abatement has been performed, the SI IH will examine the work area to ensure that no visible paint chips are present in the soil following the Work. The SI IH will examine all soil areas selected for abatement to document that each has been completely treated, or removed, as specified.

5. If an interim control method has been performed, the SI IH will examine the work area to ensure that the lead hazard control method performed (e.g., encapsulation, paint film stabilization, friction and impact surface treatment, etc.) has been completed.

6. There shall be no evidence of settled dust following the Contractor's cleanup effort regardless of activity. Any settled dust present in the lead work area during the visual inspection provides sufficient evidence that the Contractor's cleanup effort was not adequate. The areas immediately outside the lead work area will also be visually examined to confirm that no leaded dust or paint chips have been transferred outside the work area.

B. Lead Wipe Sampling:

1. For interior work, the SI IH will follow the following guidelines: a minimum of one wipe sample will be collected for every 200 square meters of floor surface area inside the work area; and a minimum of one sample will be collected from each window inside the work area, alternating between interior window sill and window trough samples (actual number and specific locations of samples will be determined by the SI IH). In addition, one wipe sample will be collected outside the work area within a 3-meter radius of the entrance to the decontamination unit.

2. For exterior work, the SI IH will follow the following guidelines: a minimum of one wipe sample will be collected for every 200 square meters of horizontal surface area (e.g., a porch floor or an entryway) inside the work area, and one wipe sample will be collected from approximately every other window trough inside the work area (actual number and specific locations of samples shall be determined by the SI IH). In addition, one wipe sample will be collected outside the work area within a 3-meter radius of the entrance to the decontamination unit.

3. Cleaning shall be considered complete when every lead dust wipe sample is below the following levels (given in micrograms of lead per square foot):

Surface	Leaded Dust Loading ($\mu g/ft^2$)
Bare and Carpeted Floors	40
Interior Window Sills	250
Window Troughs	400

Exterior Horizontal Surfaces	400

4. The Contractor shall re-clean those areas which do not comply with the specified final clearance levels. Following re-cleaning efforts, visual inspection and clearance sampling shall be performed to ensure that the re-cleaning was effective. The Contractor is responsible for the cost incurred during re-cleaning activities.

C. Lead Soil Sampling:

1. Following an exterior lead-containing material abatement or interim control, the SI IH will collect a minimum of one composite soil sample from the perimeter of the area adjacent to the exterior work area. If only selected areas of the building were abated, the composite sample will be collected from that area only. One additional composite soil sample will be collected from each adjacent area, and one will be collected from each adjacent Smithsonian Institution child care play area. During sampling, bare soil shall be collected from the sampling area. If no bare soil is present, the soil covering (e.g., grass, mulch, etc.) shall be sampled to determine if it has been contaminated by the work.

2. Abatement shall be considered complete when each composite lead soil sample is at or below the following levels (given in micrograms of lead per gram of soil):

Soil Area	Lead in Soil Level (µg/g)
SI Child Care Play Areas	400
Other Soil Areas	1,200

3. If lead in soil levels are greater than or equal to the applicable limits, additional soil treatment may be required. Additional soil treatment shall be performed according to the procedures outlined in these Specifications, and as directed by the COTR. The Contractor is responsible for the cost incurred during additional soil treatment activities.

3.18 REMOVAL OF ENGINEERING CONTROLS

A. Following successful final clearance testing and acceptance of results by COTR, the Contractor shall leave air filtration units running until critical barrier removal has been completed.

B. Equipment, machinery, scaffolding, tools, etc., within the work area shall not be removed without first being thoroughly cleaned by HEPA vacuuming and wet wiping with cleaning solution.

C. If applicable, before removing air filtration units from the work area, the Contractor shall remove and properly dispose of pre-filters, decontaminate the exterior of each air filtration unit, and seal the intake to each unit with 0.15 mm (six-mil) poly sheeting. Wrap entire unit with one additional layer of 0.15 mm (six-mil) poly sheeting.

D. After clearance results have been accepted by the COTR, the critical barrier poly seals have been removed, and the poly sheeting, tape, and any other trash and debris have been disposed of properly, the SI IH and the COTR will conduct a final walkthrough of the work area.

E. The Contractor shall repair, patch and paint all damaged areas and restore them to their original, pre-contract condition.

F. Subsequent to the lead work activities, the Contractor shall perform the following before the Work may be considered for completeness:

1. The work area has been cleaned in accordance with the procedures outlined in these Specifications.

2. Visual clearance examinations and testing have been performed and the results have been accepted by the COTR.

3. Engineering controls have been removed from the work area, and the waste generated during the Work has been removed from the site and disposed of in accordance with these Specifications.

3.19 WASTE MANAGEMENT

A. General:

1. The Contractor shall properly store and secure all waste at all times. Do not leave debris in the work area or in uncovered or unlocked trucks or dumpsters. Do not leave any waste in unsecured areas accessible to the

public. Do not incinerate debris or use any unauthorized dumpster. Do not introduce lead-contaminated water into storm or sanitary sewers. Do not permit recycling of building components coated with lead-containing material.

2. All materials, whether hazardous or non-hazardous, shall be disposed of in accordance with all applicable federal, state, and local regulations. Keep all chemicals and chemical waste in sealed and properly labeled containers. The contractor shall not discard chemicals in trash or down drain. Do not evaporate surplus waste solvents.

3. The Contractor shall maintain on site the name of and contact information for the building's designated Smithsonian Institution Hazardous Waste Coordinator (HWC).

4. The Contractor shall ensure that there is no leakage of waste or release of dust during the storage and transportation of waste.

5. The Contractor shall make every attempt to minimize the total quantities of waste generated by conducting abatement and interim control efforts that generate reduced quantities of both hazardous and non-hazardous waste for disposal, avoiding commingling of hazardous and non-hazardous waste. Painted metal components should be recycled whenever possible, with required corresponding documentation provided to SI.

B. Hazardous Waste Management:

1. The Contractor shall segregate abatement waste into distinct waste streams (e.g., disposable suits, lead-contaminated polyethylene sheeting, lead-contaminated waste water, hazardous chemical sludge, etc.). Various combinations of each in different containers will not be accepted.

2. Lead-containing or lead-contaminated waste shall be considered as hazardous waste, and labeled in accordance with this specification, unless:

   a. Lead leachate concentrations of the waste are determined to be less than 5 ppm from representative bulk samples, by TCLP analysis, following the protocol indicated in EPA regulations.

b. The waste does not meet any other regulatory definitions as "hazardous waste" per section 1.4 (A) (29) of these Specifications.

3. Waste tested which results in a lead leachate concentration of greater than or equal to 5 parts per million shall be considered hazardous, and shall be handled and disposed of as such according to local, state, and federal regulations.

4. All TCLP test results shall be permanently retained by the Smithsonian Institution.

5. Lead waste from lead abatement projects completed in residential or child-occupied facilities must be removed from the site within 48 hours after completing cleanup. All other hazardous waste must be removed from the site of a lead abatement project within 90 days of completion of the project.

6. The Contractor shall not discard chemicals in trash or down drains. Do not evaporate surplus waste solvents. Keep chemical waste in appropriate, sealed containers.

C. Containers:

1. The Contractor shall comply with EPA, DOT, and all other applicable federal, state, and local regulations for hazardous waste containers. All hazardous waste containers shall be completely sealed and shall be checked for tightness prior to removal from the work area.

2. All non-hazardous lead waste may be contained in one of the following:

a. Sealed disposal drums:

1) Contractor shall provide sufficient extra caps, rings, gaskets, etc., in the event of drum leakage. Replacement of caps, rings, gaskets, etc. shall not occur without the permission of the COTR.

2) All disposal drums shall be new; no used or damaged disposal drums are acceptable (the Contractor shall

provide sufficient dollies or other suitable means of transporting the drums as approved by the COTR).

3) Each filled, sealed drum shall be tipped by the Contractor in the presence of the SI IH prior to removal from the work area.

b. Two layers of 0.15 mm (six-mil) thick poly sheeting, sealed with adhesive spray and duct tape

c. Two layers of 0.15 mm (six-mil) thick poly disposal bags; each bag shall be sealed by 'goose-necking' the bag with duct tape.

D. Storage Requirements:

1. The Contractor shall notify the COTR, who will then notify the HWC when hazardous waste containers start being filled.

2. The Contractor shall keep all waste materials, both hazardous and non-hazardous, inside the work area during the Work.

3. Contractor shall coordinate with the COTR, if necessary, a designated storage area in the building where waste, both hazardous and non-hazardous, may be stored following removal from work area and prior to removal from site. The designated storage area shall be a secured area or lockable container that is inaccessible to all persons other than the Contractor and the COTR.

E. Labeling Requirements:

1. The Contractor shall label each hazardous waste container with the words "HAZARDOUS WASTE LEAD, EPA ID# D008.

2. The Contractor shall mark each hazardous waste container on the exterior with the accumulation start date. The accumulation start date is that date when a bulk waste disposal container starts to be filled, or when a chemical that will be disposed of is no longer needed.

F. Waste Control Logs:

1. The Contractor shall keep a Waste Control Log (SF-3) of all hazardous waste containers. The SI IH will review the log for accuracy and

completeness. The waste hauler shall include a completed copy of SF-3 when submitting the Hazardous Material Profile Sheets. Profile sheets will not be accepted without a copy of the completed log. Profile sheets shall be sent directly to the COTR.

2. All major constituents and hazardous components of the waste shall be identified by chemical name, not by acronym or trade name.

G. Transportation and Disposal:

1. The Contractor shall transport lead waste containers out of the work area either through the decontamination unit or through a separate waste load-out unit, in accordance with these Specifications.

2. Waste load-out shall be done by two teams. The team inside the work area shall clean the outside of properly labeled lead waste containers using HEPA-filtered vacuums and wet wiping, and place them into the decontamination unit. No personnel from the inside team shall exit any further from the work area. The team outside the work area (wearing appropriate protective equipment) shall retrieve the waste containers from the decontamination unit, double-bag the bagged waste, and pass the waste containers to the uncontaminated area outside the decontamination unit. No personnel from the "outside team" shall enter the work area.

3. The Contractor shall line the routes to the elevator, the elevator itself, and routes to covered carts with 0.15 mm (six-mil) poly sheeting, as applicable, and as directed by the COTR.

4. The Contractor shall perform the removal of hazardous material from public buildings after the building has closed, during non-public hours, and when limited staff is in attendance; arrange with the COTR specific schedule for the removal of hazardous waste. The Smithsonian Institution reserves the right to restrict when containerized waste will be moved outside of the work area and pass through the building.

5. The Contractor shall coordinate with the COTR within 45 days after the accumulation start date for removal from the site and disposal.

6. Prior to removal from the site, each hazardous waste container shall be weighed and its exact weight recorded on the waste manifest. Waste manifests that include estimated weights will not be accepted. Note:

Estimated weights on the Hazardous Material Profile Sheets are acceptable.

7. The Contractor shall provide one copy of the completed Hazardous Waste Manifest to the COTR no less than five days prior to the scheduled date of removal from the site; COTR will review the completed manifest for accuracy and completeness.

8. All hazardous waste shall be hauled by a licensed hazardous waste hauler with all required licenses from all state and local authorities with jurisdiction. The licensed hazardous waste hauler shall provide evidence of previous experience transporting lead-contaminated waste. The licensed hazardous waste hauler shall provide permanent labeling for all containers as required by all federal, state, and local regulations.

9. Hazardous and non-hazardous waste shall be disposed according to all federal, state and local regulations.

3.20 JOB CLOSE-OUT

A. The Contractor shall remove from the site all remaining debris and rubbish resulting from removal and disposal operations and the construction of containment's and decontamination units.

B. The Contractor shall demonstrate to the COTR that any building utilities that were temporarily disabled are now in full service. Notify the COTR when disabled building ventilation systems, electrical power, smoke detectors, and building access/egress passages may safely be re-started or used.

C. The Contractor shall replace those items that were removed from the work area prior to or during the Work.

D. The Work will not be considered complete until all submittals required by these Specifications have been provided to and approved by the COTR.

3.21 POST ABATEMENT NOTIFICATIONS - The SI will notify the appropriate jurisdiction having authority of abatement actions completed in SI-owned housing.

WASTE CONTROL LOG						
Project Location: OEDC Project:				Contractor Name:		
Container Number	Container Type	Fill Start Date	Date Sealed	Contractor Superintendent Initials	SI IH Initials	Container Contents

CERTIFICATION OF VISUAL INSPECTION AND FINAL CLEARANCE SAMPLING FOR LEAD WORK

The COTR, Contractor, and SI Industrial Hygienist hereby document that the work areas have been visually inspected and there is no visible dust, debris, or residue present in the areas. The COTR also certifies that final sampling results meet clearance Specifications.

OEDC Project No_____Smithsonian Institution Contract No._____

Project Title/Location_____

_____

Description of the Work_____

Date of Inspection_____

Date and results of final lead wipe samples_____

LEAD ABATEMENT CONTRACTOR
Firm_____
Print Name_____
Print Title_____
Signature_____

SI INDUSTRIAL HYGIENIST
Firm_____
Print Name_____
Print Title_____
Signature_____

SI COTR
Firm_____
Print Name_____
Print Title_____
Signature_____

END OF SECTION 028200

SECTION 07 81 00

SPRAYED FIRE-RESISTANT MATERIALS

EDITING NOTE

All bracketed blanks, words, phrases, sentences, and paragraphs in this specification require the editor to either include or delete the bracketed section or provide required information.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Section 051200 – Structural Steel Framing

2. Section – 078413 Penetration Firestopping

1.02 SUMMARY

A. This Section includes the following:

1. Concealed and exposed sprayed fire-resistive materials for structural steel, as required.

1.03 ALLOWANCES

[List Allowances, if included as part of the contract. Confirm with OSHEM and COTR]

1.04 UNIT PRICES

[List Unit Prices, if included as part of the contract. Confirm with OSHEM and COTR]

1.05 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. FM: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NFPA: National Fire Protection Association

G. NICET: National Institute for Certification in Engineering Technologies

H. OSHEM: Office of Safety Health and Environmental Management

I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

K. Concealed Sprayed Fire-Resistive Materials: Applied to surfaces that are concealed from view behind other construction when the Work is completed.

1.06 SYSTEM DESCRIPTION

A. Cementitious and/or sprayed fiber fire resistive materials applied to structural steel and/or floor decking to provide the required hourly – rating.

1.07 PERFORMANCE REQUIREMENTS

A. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch (9 mm), per ASTM E 605:

1. No more than ten percent (10%) of the thickness measurements of sprayed fire resistive materials shall be less than the thickness required by the approved design.

2. Where the referenced fire-resistance design lists a thickness of 1 inch (25 mm) or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch (6 mm).

3. Where the referenced fire-resistance design lists a thickness of less than 1 inch (25 mm), the minimum allowable individual thickness of sprayed fire-resistive material shall be the design thickness minus 25 percent.

4. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft. (240 kg/cu. m).

B. Bond Strength: 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736 under the following conditions:

1. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.

2. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736.

3. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch (19 mm).

4. The impact of ambient conditions (temperature, humidity, space conditions, etc.) shall be considered in the selection of fireproofing products to prevent loss of required bonding strength.

C. Compressive Strength: 5.21 lbf/sq. in. (35.9 kPa) as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch (19 mm) and minimum dry density shall be as specified, but not less than 15 lb/cu. ft. (240 kg/cu. m).

D. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

E. Deflection: No cracking, spalling, or delamination per ASTM E 759.

F. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.

G. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch (19 mm), maximum dry density is 15 lb/cu. ft. (240 kg/cu. m), test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.

H. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products

per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 10 or less.

2. Smoke-Developed Index: 0.

I. Fungal Resistance: No observed growth on specimens per ASTM G 21.

1.08 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Structural framing plans indicating the following:

1. Locations and types of surface preparations required before applying sprayed fire-resistive material.

2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:

a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.

b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.

c. Designation of restrained and unrestrained conditions based on definitions in ASTM E 119, Appendix X3 as determined by a qualified professional engineer.

3. Treatment of sprayed fire-resistive material after application.

C. Product Certificates: For each type of sprayed fire-resistive material, signed by product manufacturer.

D. Qualification Data: For manufacturer and testing agency.

E. Compatibility and Adhesion Test Reports: From sprayed fire-resistive material manufacturer indicating the following:

1. Materials have been tested for bond with substrates.

2. Materials have been verified by sprayed fire-resistive material manufacturer to be compatible with substrate primers and coatings.

3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed sprayed fire-resistive materials.

G. Research/Evaluation Reports: For sprayed fire-resistive materials.

H. Warranties: Special warranties specified in this Section.

1.09 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its sprayed fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility for designation of restrained and unrestrained conditions.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain sprayed fire-resistive materials through one source from a single manufacturer.

D. Sprayed Fire-Resistive Materials Testing: By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.

1. Sprayed fire-resistive materials are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

2. Testing is performed on specimens of sprayed fire-resistive materials that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.

3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.

E. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.

1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.

2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with sprayed fire-resistive material.

F. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing sprayed fire-resistive materials with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction, for sprayed fire-resistive material serving as direct-applied protection tested per ASTM E 119.

2. Surface-Burning Characteristics: ASTM E 84.

G. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

H. Mockups: Apply mockups to verify qualities of materials and execution and set the quality standard for fabrication and installation.

1. Locations of Mockups: As determined by COTR.

2. Extent of Mockups: As determined by COTR

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to sprayed fire-resistive materials including, but not limited to, the following:

1. Review and finalize construction schedule and verify sequencing and coordination requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.11 PROJECT CONDITIONS

[List any special project conditions and/or environmental limitations on system installation, such as temperature, humidity, ventilation, etc.]

1.12 COORDINATION

A. Sequence and coordinate application of sprayed fire-resistive materials with other related work specified in other Sections to comply with the following requirements:

1. Provide temporary enclosure as required to confine spraying operations and protect the environment.

2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.

3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.

4. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.

5. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.

6. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.13 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace sprayed fire-resistive materials that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of sprayed fire-resistive materials from substrates.

2. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

B. Warranty Period: 5 years from date of Substantial Completion.

1.14 SERVICE AGREEMENT

[List requirements, if part of the contract. Confirm with OSHEM and COTR].

1.15 EXTRA MATERIALS

[List special requirements for spare parts, if part of the contract. Confirm with OSHEM and COTR].

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.02 SPRAYED FIRE-RESISTIVE MATERIALS

A. General: For concealed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.

B. Available Products:

1. Cementitious Sprayed Fire-Resistive Material:
    a. Carboline Co., Fireproofing Products Div.; Pyrolite 15 High Yield.
    b. Grace, W. R. & Co.--Conn., Construction Products Div.; Monokote Type MK-6/HY.
    c. Isolatek International Corp., Cafco Products; Cafco 300.
    d. Southwest Vermiculite Co., Inc.; 5GP.
    e. Grace, W. R. & Co.--Conn., Construction Products Div.; Retro-Gard.
    f. Approved equal.
2. Sprayed-Fiber Fire-Resistive Material:
    a. Isolatek International Corp., Cafco Products; Cafco Blaze-Shield II.
    b. Isolatek International Corp., Cafco Products; Type JN-HD.
    c. Approved equal.

C. Material Composition: Either of the following:

1. Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
2. Sprayed-fiber fire-resistive material consisting of factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product.

D. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

1. Dry Density: 15 lb/cu. ft. (240 kg/cu. m) for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:

1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.

2. Substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.

3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

B. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of oil, rolling compounds, and other substances capable of interfering with bond.

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

3.02 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.

B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, loose mill scale, and incompatible primers, paints, and encapsulants.

C. Prime substrates where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive sprayed fire-resistive material.

D. For exposed applications, repair substrates to remove any surface imperfections that could affect uniformity of texture and thickness in finished surface of sprayed fire-resistive material. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.03 INSTALLATION, GENERAL

A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Apply sprayed fire-resistive material that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.

C. Install metal lath, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer. Attach lathing accessories where indicated or required for secure attachment to substrate.

D. Coat substrates with adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by sprayed fire-resistive material manufacturer for material and application indicated.

E. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by sprayed fire-resistive material manufacturer, install body of fire-resistive covering in a single course.

F. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

G. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply sprayed fire-resistive material that differs in color from that of encapsulant over which it is applied.

H. Where sealers are used, apply products that are tinted to differentiate them from sprayed fire-resistive material over which they are applied.

3.04 INSTALLATION, CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

A. Apply concealed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 2 "Concealed Sprayed Fire-Resistive Materials" Article.

B. Apply water overspray to concealed sprayed-fiber fire-resistive material as required to obtain designated fire-resistance rating.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: The Contractor shall hire an Owner-approved qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of completed applications of sprayed fire-resistive material shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of sprayed fire-resistive material for the next area until test results for previously completed applications of sprayed fire-resistive material show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.

1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. (93-sq. m) area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. (0.093-sq. m) sample area, with sample width of not less than 6 inches (152 mm) per ASTM E 605.

2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for

joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.

3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-sq. ft. (929 sq. m) area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.

5. If testing finds applications of sprayed fire-resistive material are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.

C. Remove and replace applications of sprayed fire-resistive material where test results indicate that it does not comply with specified requirements for cohesion and adhesion, for density, or for both.

D. Apply additional sprayed fire-resistive material per manufacturer's written instructions where test results indicate that thickness does not comply with specified requirements.

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

3.06 CLEANING, PROTECTING, AND REPAIR

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect sprayed fire-resistive material, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.

C. Coordinate application of sprayed fire-resistive material with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect sprayed fire-resistive material and patch any damaged or removed areas.

D. Repair or replace work that has not been successfully protected.

END OF SECTION 078100

SECTION 07 84 13
PENETRATION FIRESTOPPING

EDITING NOTE

All bracketed blanks, words, phrases, sentences, and paragraphs in this specification require the editor to either include or delete the bracketed section, or provide required information.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provision of Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this section.

1.02 SUMMARY

A. Firestopping is defined as furnishing and installing tested and listed firestopping systems, combinations of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

1.03 ALLOWANCES

[List Allowances, if included as part of the contract. Confirm with OSHEM and COTR]

1.04 UNIT PRICES

[List Unit Prices, if included as part of the contract. Confirm with OSHEM and COTR]

1.05 DEFINITIONS

A. COTR: Contracting Officer Technical Representative
B. FM: FM Global (Factory Mutual)
C. FPE: Fire Protection Engineer
D. Furnish: To supply the stated equipment or materials
E. Install: To set in position and connect or adjust for use
F. NFPA: National Fire Protection Association
G. NICET: National Institute for Certification in Engineering Technologies
H. OSHEM: Office of Safety Health and Environmental Management
I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

1.06 SYSTEM DESCRIPTION

A. Firestopping shall be provided in the following locations:

1. Construction Joints: includes those used to accommodate expansion, contraction, wind, or seismic displacement. The firestopping material shall be a dynamic system and shall not detract from the intended movement of the joint.

2. Penetrations through floor slabs, fire-rated partitions, fire walls, and exterior walls where rated. Firestopping shall be provided for all new penetrations; penetrations left open by demolition/removal of duct, cable, conduit, and pipe; damaged firestopping, and existing abandoned penetrations in the contract area. Unless otherwise specified or shown on the drawings, the Contractor shall assume that all floor slabs are two-hour, fire-rated. Locations of fire walls or partitions shall be indicated on the drawings.

3. Penetrations of vertical shafts: assume a two-hour fire barrier unless noted otherwise.

4. Around openings and penetrations through fire-rated floor/ceiling and roof/ceiling assemblies.

5. Joint systems for floor-to-floor, wall-to-wall, floor-to-wall, and head of wall applications.

B. Other locations shown specifically on the drawings or where called for in other sections of the specifications.

1.07 PERFORMANCE REQUIREMENTS

A. Materials or combinations of materials used for firestopping shall be noncombustible and comply with the following as a minimum:

1. Flame Spread Index: 25 or less, as measured by ASTM E-84

a. Flame Spread Index (FSI) is a relative indication of the flammability of the material of interest with respect to a red oak standard. For example, an FSI of 25 indicates that a material has approximately 25% of the standard material's flame spread characteristics.

2. Smoke Developed Index: 100 or less, as measured by ASTM E-84

a. Smoke Developed Index (SDI) is a relative indication of the amount of smoke produced by a material when exposed to a certain heat source with respect to a red oak standard. The numbers carry the same meaning as the FSI values (25 indicates 25%).

B. Firestopping shall be asbestos free and shall be non-toxic to humans during installation and fire conditions

C. Examination Of Work By The Contractor

1. It shall be the responsibility of the prime contractor to provide firestopping for the entire project. The Contractor shall examine the area to receive firestopping prior to beginning work or to submitting the data required under 1.08, Submittals.

2. Data to be submitted shall be based on the findings of the Contractor's examination.

1.08 SUBMITTALS:

A. Submit the following for approval by the COTR and the OSHEM Fire Protection Engineer. Submit applicable data for each condition specified.

1. Certificates of conformance or compliance, accompanied by classification by a nationally recognized testing lab or by other supporting evidence satisfactory to the COTR and the OSHEM Fire Protection Engineer, that the material or combination of materials used meet the requirements specified for flame spread, smoke developed, and fire resistance.

2. Manufacturer's catalog data for all materials and prefabricated devices, including descriptions sufficient to identify them on the job, and instructions for installation. This data shall also include the Flame Spread Index and the Smoke Developed Index for the materials of interest.

3. Completed construction details (as-builts) showing material, reinforcement, anchorage, fastenings and method of installation. Catalog data with installation diagrams shall also be included. Clearly show which product will be used for each application. Firestopping materials of different manufacturers shall not be intermixed. Do not submit multiple products for the same application. Details for firestopping of penetrations and joint systems shall show compliance with the appropriate UL Design Number. Drawings shall accurately reflect job conditions pursuant to paragraph 1.07 C, Examination of the Work by Contractor.

4. Provide as-built drawings showing all penetration locations on floor plans. An identification key shall provide the rating and construction of the assembly penetrated, and the firestopping assembly used at each location.

1.09 QUALITY ASSURANCE

A. Manufacturers Qualifications: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. American Society for Testing and Materials (ASTM) Publications:
    a) E84 Standard Test Method for Surface Burning Characteristics of Building Materials
    b) E119 Standard Test Method For Fire Tests of Building Construction and Materials
    c) E814 Test Method of Fire Tests of Through-Penetration Fire stops
    d) E1966 Fire Resistive Joint Systems
    e) E1399 Cyclic Movement And Measuring The Min & Max Joint Widths of Arch Joint Systems
2. Underwriters Laboratories (UL) Publications:
    a) UL-1479 Fire Tests of Through-Penetration Fire Stops
    b) UL-2079 Tests for Fire Resistance of Building Joint Systems
    c) FRD Fire Resistance Directory

B. Installer's Qualifications. Provide data to show that the firm has at least two years of experience in the installation or application of systems similar in complexity to those required for this project. In addition, provide data to show that the firm is qualified by providing at least 5 comparable scale projects using the manufacturer's systems.

C. Pre-Installation Conference
1. Conduct a pre-installation conference with all sub-contractor representatives to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials indoors, under cover, above ground, away from moisture, and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.11 PROJECT CONDITIONS

[List any special project conditions and/or environmental limitations on system installation, such as temperature, humidity, ventilation, etc.]

1.12 COORDINATION

A. Coordinate installation of all penetration firestopping systems with mechanical, electrical, fire protection, and other trades so that installation is complete and to minimize rework due to the addition of penetrants or other modifications.

1.13 WARRANTY

A. Provide a written warranty by the manufacturer against defects in manufacturing and materials and by the installer against defects in workmanship.

1.14 SERVICE AGREEMENT

[List requirements, if part of the contract. Confirm with OSHEM and COTR].

1.15 EXTRA MATERIALS

[List special requirements for spare parts, if part of the contract. Confirm with OSHEM and COTR].

PART 2 - PRODUCTS

2.01 GENERAL

A. All firestopping used throughout the project shall be the products of a single manufacturer.

2.02 MANUFACTURERS

A. Hilti

B. 3M

C. Specified Technologies, Inc.

D. Nelson

E. Any manufacturer approved by OSHEM and the COTR

2.03 FIRE RESISTANCE RATING

A. Firestop systems shall be UL Fire Resistance listed or FM P7825a approved with an “F” rating at least equal to the fire-rating of the fire wall or floor in which penetrated openings are to be protected. The “F” rating is permitted to be 3 hours in through-penetrations of 4 hour fire rated walls or floors. Firestop systems shall also have “T” rating where required by any applicable code.

1. F Rating: a rating usually expressed in hours indicating a specific length of time that a fire resistive barrier can withstand fire before being consumed or permits the passage of flame through an opening in an assembly.
2. T Rating: a rating usually expressed in hours indicating the length of time that the temperature on the non-fire side of a fire-rated assembly exceeds 325 degrees above its ambient temperature.

2.04 THROUGH-PENETRATIONS

A. Firestopping materials for through-penetrations shall provide “F” and “T” fire resistance ratings in accordance with ASTM E 814 or UL 1479.

2.05 CONSTRUCTION JOINTS AND GAPS

A. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested per ASTM E 119, ASTM E 1966 or UL 2079 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Prior to application, remove from surfaces all dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting or required fire resistance of the firestopping material for cast-in-place firestop devices. Formwork or metal deck to receive device prior to concrete placement and shall be sound and capable of supporting the device. Prepare surface as recommended by the manufacturer.

3.02 INSTALLATION:

A. Install in accordance with approved construction drawings (shop drawings), approved manufacturer's literature, installation instructions, UL Design Number or UL Report, and the following requirements:

B. Firestopping caulks must be installed in a neat and workmanlike manner. The finished installation shall have neat edge lines and a smoothed surface without excess masses of rough caulk on the surface of the wall.

C. Firestopping materials shall completely fill the void space regardless of geometric configuration, subject to tolerances established by the manufacturer when intumescent materials are used.

D. Apply firestopping materials at penetrations of insulated pipes and ducts, prior to application of the insulation. If insulation is already in place, remove it at the penetration prior to application of the firestopping materials, except where intumescent materials are used and removal is not necessary per manufacturer's instructions. Removed insulation shall be replaced with a material having equal thermal insulation characteristics and equal firestopping characteristics.

E. Firestopping for filling voids in floors, in which the smallest dimension is 101 mm (4 inches) or more, shall support the same load as the floor is designed or shall be protected by a permanent barrier to prevent loading or traffic on the fire stopped area.

F. Cable tray penetrations shall be protected by either UL-listed through penetration fire stop devices or through penetration fire stop systems that are re-enterable. Where penetrating cables in a cable tray are removed, replaced, or added, restoration shall be accomplished in an approved manner; the allowable number of penetrating items shall not be exceeded; only permitted penetrations shall be installed; and adequate clearances shall be maintained among penetrations, between penetrations, and the sides of the opening.

G. Damaged, disrupted, or removed firestopping shall be replaced with new.

H. Firestopping shall not be applied in conjunction with fire dampers, smoke dampers, or combination fire/smoke dampers unless specifically required by the damper manufacturer installation instructions.

3.03 INSPECTION

A. Approved installation instructions shall be present at each work area prior to the beginning of work and a test installation shall be produced for quality check by the COTR and OSHEM Fire Protection Engineer. The test installation shall be subject to inspection and/or test for conformance with contract requirements. Periodic quality checks shall be performed at the discretion of the COTR, and should installation prove to be substandard, all firestopping installed up to that time, not meeting approved standards, shall be replaced at no additional cost to the Government.

B. Area of work shall remain available for inspection by the COTR or his designated representative before and after application of firestopping.

C. Notification: Notify the COTR or his designated representative at least 24 hours prior to installation of firestopping in each area to allow opportunity for inspection.

D. The contractor shall submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers. Contractor records shall be maintained on site and provided to the COTR upon arrival for inspections.

3.04 ACCEPTANCE OF WORK

A. Acceptance of Work: As work is completed, remove materials, litter, and debris. All work shall be inspected and accepted by the Contracting Officer and OSHEM Fire Protection Engineer before materials and equipment are moved to the next scheduled work area. Insulation work and/or ceiling and wall close-in shall not occur before OSHEM acceptance has been obtained.

B. Labeling: Upon completion of unfinished areas only, affix label to or adjacent to each fire stopped penetration or joint assembly in fire-rated assemblies indicating material and proper replacement, if later disturbed. Suggested label is as follows:

ATTENTION

THIS IS A **FIRE-RATED ASSEMBLY**

BEFORE BREACHING

CONTACT BUILDING MANAGER AND PROJECT COTR

Hr Rating: _____ Installed by:

Install Date: _____ Company: _____

UL Design #:_____ Employee: _____

END OF SECTION 078143

SECTION 08 11 73
ROLLING FIRE DOORS

EDITING NOTES

1. **All bracketed blanks, words, phrases, sentences, and paragraphs in this specification require the editor to either include or delete the bracketed section, or provide required information.**

2. **This is not a complete specification. It contains information that must be included with a specification section on Fire Doors. Where paragraphs are listed and do not contain specific text, the information will ordinarily be found in the full Fire Door specification.**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provision of Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this section.

1.02 SUMMARY

A. This partial specification provides additional performance requirements for rolling fire doors. This information must be added to the Fire Door specification.

1.03 ALLOWANCES

[List Allowances, if included as part of the contract. Confirm with OSHEM and COTR]

1.04 UNIT PRICES

[List Unit Prices, if included as part of the contract. Confirm with OSHEM and COTR]

1.05 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. FM: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NFPA: National Fire Protection Association

G. NICET: National Institute for Certification in Engineering Technologies

H. OSHEM: Office of Safety Health and Environmental Management

I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

1.06 SYSTEM DESCRIPTION

A. Rolling fire door assemblies which comply with NFPA 80 and have been fire tested in accordance with ASTM E-152.

1.07 PERFORMANCE REQUIREMENTS

A. The door assembly shall be a complete unit, produced by one manufacturer, including hardware, accessories, mounting, and installation components.

1.08 SUBMITTALS

A. Manufacturer's Data Submit manufacturer's product data, rough-in diagram, and installation instructions for each type and size of overhead rolling door. Provide operating instructions and maintenance information, and complete information describing fire release system, including electrical rough-in instructions. Submit drawings for doors showing types, sizes, locations, metal gages, hardware provisions, installation details, and other details of construction.

1.09 QUALITY ASSURANCE

A. General: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of each publication shall apply.

B. Manufacturers Qualifications

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

a. ASTM E-152 Fire Tests of Door Assemblies

2. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

a. NFPA 70 National Electrical Code

b. NFPA 72 National Fire Alarm Code

c. NFPA 80 Fire Doors and Fire Windows

3. UNDERWRITERS LABORATORIES INC. (UL)

a. UL Building Materials Directory

4. FM GLOBAL (FACTORY MUTUAL)

1.10 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.11 PROJECT CONDITIONS

[List any special project conditions and/or environmental limitations on system installation, such as temperature, humidity, ventilation, etc.]

1.12 COORDINATION

A. Coordinate with wall and floor installation to confirm door clearance tolerances.

1.13 WARRANTY

A. Provide a written warranty by the manufacturer against defects in manufacturing and materials and by the installer against defects in workmanship.

1.14 SERVICE AGREEMENT

[List requirements, if part of the contract. Confirm with OSHEM and COTR].

1.15 EXTRA MATERIALS

[List special requirements for spare parts, if part of the contract. Confirm with OSHEM and COTR].

PART 2 - PRODUCTS

2.01 ROLLING FIRE DOOR ASSEMBLIES

A. GENERAL: Provide and install rolling fire door assemblies which comply with NFPA 80 and have been fire tested and rated in accordance with ASTM E-152. The door assembly shall be a complete unit, produced by one manufacturer, including hardware, accessories, mounting, and installation components. Each door shall bear the appropriate Underwriters Laboratory or Factory Mutual label stating the hourly fire-rating and the letter designation of location for which the assembly is designed. If the door exceeds a size that is tested and labeled, provide certification that the door and hardware are identical in design, materials, and construction to a door that has been tested and listed for the required fire rating. The construction details necessary for labeled doors shall take precedence over details indicated or specified for service doors. Fire doors shall be complete with hardware, accessories, and automatic closing devices as required by NFPA 80.

B. Automatic Closing: Provide automatic closing device and governor, activated by ordinary temperature fusible links [and [110V AC] smoke detectors [matching existing,] [connected to the [existing][new] fire alarm system and] installed in accordance with [Section 283111 and] NFPA 72]. Position links in strict compliance with the requirements and appendices of NFPA 80. Provide 2 spare fusible links for each door installed. Doors shall automatically close at a rate of descent of not less than 4 inches (152 mm) per second and not more than 24 inches (600 mm) per second, and come to rest without impact. Power operated doors shall be equipped with a releasing device that will automatically disconnect the power operator at the time of a fire, allowing the self-closing or automatic closing device to close the door irrespective of power failure or manual operations. The automatic closing mechanism shall not interfere with normal operation of the door.

C. Manual Operation: The door assembly shall be fabricated to permit the manual lifting of the door for emergency use after automatic closing, with door returning to the closed position when released.

D. The open and stop buttons shall be of the type requiring only momentary pressure to be operated. The close button shall be of the type requiring constant pressure to maintain the closing motion of the door. Push buttons shall be fully guarded to prevent accidental operation.

E. Hood Enclosure: 24 gauge (0.70 mm) thick galvanized steel; internally reinforced to maintain rigidity and shape. Provide all hoods with a flame baffle controlled by a fusible link and designed to close against the coil in the event of fire, to reduce flame and smoke spread.

2.02 INSTALLATION

A. Attachment to Wall: The door assembly shall be attached to the wall by through-wall bolts. Expansion anchors may be used for concrete, brick or filled concrete masonry wall units, when installed in accordance with the requirements of NFPA 80. Where structural steel frames are used at jambs, guides shall be secured to the frame with machine bolts of not less than .375 inch (9.5 mm) diameter.

B. Brackets: Brackets mounted on the face of the wall shall be bolted either to the wall or to an extension of the guide wall angle with not less than two-through bolts or machine bolts 12.7 mm diameter, to each bracket. Brackets mounted between jambs shall be secured to the lintel or to the side of the jambs by not less than two machine bolts of .50 inch (12.7 mm) diameter.

2.03 FIELD TESTS

A. Preliminary Tests: The following tests shall be conducted during installation and a signed test report, recording the test results, shall be submitted to the COTR prior to the scheduling of the final test.

1. Release of the door by fusible link.

2. Release of the door by smoke detector activation.

3. Release the flame baffle by fusible link.

4. Manually reopen the door after it has been released by fusible link [and smoke detector activation]. Door must automatically close after manually reopening.

B. Final Inspection and Tests: The OSHEM Fire Protection Engineer shall be notified by the COTR and shall witness all final tests and approve all doors and hardware before they are accepted. Submit a request for formal inspection at least five working days prior to the date of the inspection. During the final test, all preliminary tests shall be repeated and additional tests shall be conducted until it is demonstrated that all equipment complies with all contract requirements. Any cost incurred by the Smithsonian for repeat test(s) due to the failure of the doors and associated equipment during final testing shall be paid by the contractor.

END OF SECTION 081173

SECTION 10 44 00
FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

TABLE OF CONTENTS

SECTION 104400
FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

EDITING NOTE

All bracketed blanks, words, phrases, sentences, and paragraphs in this specification require the editor to either include or delete the bracketed section, or provide required information.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provision of Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers
2. Cabinets for portable fire extinguishers

1.03 ALLOWANCES

A. [List Allowances, if included as part of the contract. Confirm with OSHEM and COTR]

1.04 UNIT PRICES

A. [List Unit Prices, if included as part of the contract. Confirm with OSHEM and COTR]

1.05 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. FM: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NFPA: National Fire Protection Association

G. NICET: National Institute for Certification in Engineering Technologies

H. OSHEM: Office of Safety Health and Environmental Management

I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

1.06 SYSTEM DESCRIPTION

A. Portable fire extinguishers and cabinets for occupant use.

1.07 PERFORMANCE REQUIREMENTS

A. In accordance with NFPA 10.

B. Extinguishers installed throughout most occupancies shall have a minimum rating of 2A:10B:C

C. Provide type K fire extinguishers in all commercial kitchens.

D. Provide clean agent, water mist, or CO2 portable fire extinguishers and one water extinguisher for class A fires in all IT specs. Dry chemical extinguishers shall not be permitted.

E. Exhibit display areas and ordinary collection storage spaces shall be provided with water mist type portable extinguishers. Dry chemical extinguishers shall not be permitted in these spaces.

F. Wet collection storage areas shall be provided with CO_2 portable fire extinguishers.

G. Provide fire extinguishers throughout all buildings and spaced in accordance with NFPA 10.

1.08 SUBMITTALS

A. Submit manufacturers brochure and product data for each type of fire extinguisher, complete with manufacturers' warranty and inspection tag.

B. Submit data to illustrate cabinets and installation/mounting methods.

1.09 QUALITY ASSURANCE

A. American Disability Act (ADA)

1. ADA Accessibility Guidelines (ADAAG)

B. American Society for Testing and Materials (ASTM)

1. A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
2. ASTM A167-Stainless and heat resisting chromium-nickel steel plate, sheet and strip
3. ASTM A336-Cold rolled carbon steel sheets, commercial quality
4. C1036 Standard Specification for Flat Glass
5. E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops

C. National Fire Protection Association (NFPA)

1. NFPA 10 Portable Fire Extinguishers

D. Fire Extinguishers: Listed and labeled by Underwriter's Laboratory (UL) or Factory Mutual (FM) for type, rating, and classification

1. UL 8 Standard for water based agent fire extinguishers
2. UL 154 Standard for carbon dioxide fire extinguishers
3. UL 299 Standard for dry chemical fire extinguishers
4. UL 626 Standard for water fire extinguishers
5. UL 2129 Standard for halocarbon clean agent fire extinguishers

1.10 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver fire extinguishers or cabinets to site until rooms in which they are to be installed are ready to receive them.

B. Protect cabinets to avoid damage to finish.

1.11 PROJECT CONDITIONS

[List any special project conditions and/or environmental limitations on system installation, such as temperature, humidity, ventilation, etc.

1.12 COORDINATION

A. Coordinate installation with finished wall surfaces.

1.13 WARRANTY

A. Provide a warranty by the manufacturer against defects in manufacturing and materials.

1.14 SERVICE AGREEMENT

[List requirements, if part of the contract. Confirm with OSHEM and COTR].

1.15 EXTRA MATERIALS

[List special requirements for spare parts, if part of the contract. Confirm with OSHEM and COTR].

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Ansul Inc.
2. J L Industries
3. Larsen's Manufacturing Co.
4. Encon Safety Products

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A1008/A1008M, commercial quality, stretcher leveled, temper rolled.

2.03 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated. See section 1.07 for requirements for specific spaces.

1. Product: A 10-lb, multi-purpose, UL listed, dry chemical fire extinguisher with rating based on spacing and hazard.

a. [recessed] [trimless] [surface] type cabinets
b. [semi-recessed cabinet for a [4 inch] [100mm] [6inch] [150mm] wall
c. [recessed] [trimless] [surface] bubble type cabinets

B. Mounting Brackets: Manufacturer's standard steel bracket, designed to secure extinguisher, of sizes required for types and capacities of fire extinguisher indicated, with plated or baked-enamel finish.

C. Fire extinguishers installed outside shall be located in approved weather-tight fire extinguisher cabinets.

2.04 FIRE EXTINGUISHER CABINETS

A. General: Unless specified otherwise on construction drawings, provide fire extinguisher cabinet of type, size, and rating as indicated below, or equivalent.

B. Cabinet Size: The minimum inside box dimensions shall be 24”H x 9½W x 6”D for SNL Type I and Type III fire extinguishers, and 27”H x 12”W x 8”D for SNL Type II fire extinguishers.

C. Cabinet Construction: Provide manufacturer’s standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

D. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E814 for fire-resistance rating of wall where it is installed. Construct fire-rated cabinets with double walls fabricated from 0.0478-inch (1.2-mm) thick, cold-rolled steel sheet lined with minimum 5/8-inch (16-mm) thick, fire-barrier material. Provide factory drilled mounting holes.

1. Cabinet Metal: Enameled-steel sheet.
2. Shelf: Same metal and finish as cabinet.

E. Cabinet Mounting: Suitable for the following:

1. Recessed: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
2. Semirecessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated.
3. Surface Mounted: Cabinet box fully exposed and mounted directly on wall.

F. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded and ground smooth.

G. Cabinet Trim Material: Steel sheet.

H. Door Material: Steel sheet.

I. Door Glazing: Clear Float Glass, ASTM C1036, Type 1, Class 1

J. Door Style: Vertical duo panel with frame.

K. Door Construction: Provide a minimum ½-inch (13 mm) thick door frames.

L. Door Hardware: Provide manufacturer’s standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide

recessed door pull and friction latch. Provide continuous-type hinge permitting door to open 180 degrees.

M. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the exterior and interior of the cabinet and doors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed. Verify that rough openings for cabinets are correctly sized and located.

B. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged units.

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

3.02 INSTALLATION OF FIRE EXTINGUISHERS

A. Comply with manufacturer's written instructions for installing fire extinguishers and mounting brackets.

B. Mounting Height: Install extinguishers at heights indicated below.

1. Install fire extinguishers mounted on hangers or brackets attached to a wall so that the top of the fire extinguisher is not more than 3½ ft. above the floor.
2. In no case shall the clearance between the bottom of the fire extinguisher and the floor be less than 4 inches.

C. Locations: Install extinguishers at locations indicated below.

1. Install fire extinguishers at locations specified on the drawings or as directed by the authority having jurisdiction.
2. Fire extinguishers shall be conspicuously located, along normal paths of travel, including exits from areas. Extinguishers shall not be obstructed or obscured from view.

D. Install portable fire extinguishers on the hanger or in the bracket supplied, or place in the fire extinguisher cabinets provided. Verify that the extinguisher operating instructions face outward.

3.03 INSTALLATION OF FIRE EXTINGUISHER CABINETS

A. Comply with manufacturer's written instructions for installing fire extinguisher cabinets.

B. Mounting Height: Install fire extinguisher cabinets at the height required so that the top of the fire extinguisher is not more than 54 inches above the floor.

C. Install fire extinguisher cabinets at locations specified on the drawings.

D. Fire extinguisher cabinets shall protrude no more than 4 inches into corridors, passageways, or aisles.

E. Repair/paint wall surfaces surrounding fire extinguisher cabinet damaged during installation to match existing wall surface.

3.04 SIGNAGE

A. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.

B. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.

1. Application Process: Decals
2. Lettering Color: Red
3. Orientation: Vertical

C. Where space layout limits ability to see fire extinguisher location, provide a wall sign that is nominally perpendicular to the wall. Sign shall have a fire extinguisher symbol on it.

3.05 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Construction Completion.

END OF SECTION 104400

SECTION 14 21 13
ELECTRIC TRACTION FREIGHT ELEVATORS

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.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 News 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, 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.

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 any time 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 any time 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 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 flow. 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 disassociated 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 OSHEM 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.

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 14 21 23
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 News 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 any time 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 any time 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.

2. 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.

3. 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.

4. 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 flow. 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 disassociated 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.

1) The key switch in the "OFF" position deactivates the swing service hall station and operation and returns the elevator to group operation.

2) 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 OSHEM 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” than void shall be with 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 14 24 13
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 News 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 SIr'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 any time 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 any time 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: PVC.	Oil hydraulic, direct plunger with
	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 OSHEM 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.

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. 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 14 24 23
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 News 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.

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 any time 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 any time 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: PVC.	Oil hydraulic, direct plunger with
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 flow. 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 disassociated 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 OSHEM 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" than 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.

I. 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 14 31 00
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 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 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 News 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 ensure 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 any time 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 any time 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.

B. 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 of 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

SECTION 21 13 13
WET PIPE SPRINKLER SYSTEMS

TABLE OF CONTENTS

SECTION 211313
WET PIPE SPRINKLER SYSTEMS

EDITING NOTE

All bracketed blanks, words, phrases, sentences, and paragraphs in this specification require the editor to either include or delete the bracketed section, or provide required information.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. The following sections apply to the work of this section:

1. 211100 Exterior Water Supply Mains for Fire Protection Service
2. 078413 Penetration Firestopping
3. 238111 Fire Detection and Alarm Systems
4. 211000 Fire Protection General Requirements
5. 213110 Fire Pump Systems

1.02 SUMMARY

A. Scope: Provide a complete, code compliant wet pipe sprinkler system, and associated equipment, ready for operation.

B. The work includes designing and [modifying][installing] an automatic wet-pipe fire extinguishing sprinkler system for [[Ordinary Hazard II] [Extra Hazard - Group [I] [II]] [High-Piled Storage]and uniform distribution of water by hydraulic design to afford complete fire protection coverage throughout the contract area.

C. Existing Sprinkler Equipment: Existing sprinkler equipment shall be maintained fully operational until the new equipment has been tested and accepted by the COTR and OSHEM fire protection engineer. [After acceptance of the new equipment, all existing equipment so indicated shall be removed.]

D. Authority Having Jurisdiction: Any reference in the specifications or applicable codes to the "authority having jurisdiction" shall be interpreted to mean the OSHEM Fire Protection Engineer.

1.03 ALLOWANCES

[List Allowances, if included as part of the contract. Confirm with OSHEM and COTR]

1.04 UNIT PRICES

[List Unit Prices, if included as part of the contract. Confirm with OSHEM and COTR]

1.05 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. FM: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NFPA: National Fire Protection Association

G. NICET: National Institute for Certification in Engineering Technologies

H. OSHEM: Office of Safety Health and Environmental Management

I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

1.06 SYSTEM DESCRIPTION:

A. The design shall conform to NFPA 13 and the requirements specified herein. Design

of the automatic wet pipe sprinkler system shall be for [[Ordinary Hazard II] [Extra Hazard - Group [I] [II]] [High-Piled Storage] occupancy by hydraulic calculation. The design, equipment, materials, installation, workmanship, examination, inspection and testing shall be in strict accordance with NFPA 13, except as modified herein.

B. The system shall include all materials, accessories, and equipment inside and outside the building to provide a system complete and ready for use. Refer to Section 211100 for Installation of Exterior Water Supply Mains for Fire Protection Service.

C. Design and provide each system giving full consideration to obstructions, blind spaces, piping, electrical equipment, duct work and other construction and equipment in accordance with detailed drawings to be submitted for approval.

D. Equipment for fire protection service shall be UL listed or FM approved for use in wet pipe sprinkler systems.

E. In the NFPA publications referred to herein, the advisory provisions shall be considered mandatory, as though the word "shall" had been substituted for "should," wherever it appears.

1.07 PERFORMANCE REQUIREMENTS

A. Water Distribution: Distribution shall be uniform throughout the area which it is assumed the sprinkler heads will open. Variation in discharge from individual heads in the hydraulically most remote area shall be between 100 and 120 percent of the specified density.

B. Piping Restrictions: Piping is prohibited in the following areas, except when solely supplying sprinklers in such areas:

1. Transformer, switchgear, or similar rooms
2. Elevator machine rooms and elevator shafts.
3. IT Computer spaces (mission critical).
4. Collection storage rooms.

C. Clearance From Electrical Equipment: Piping and automatic sprinklers are prohibited directly over:

1. Transformers.

2. Substations.

3. Switchboards.

4. Motor control centers.

5. Emergency generators.

6. Bus Ducts.

7. Electrical panels.

D. If installing pipe over electrical equipment is unavoidable, provide drip pans under piping to protect electrical equipment.

E. [Sprinkler systems shall be designed for earthquake protection in accordance with the requirements and recommendations of NFPA 13.]

F. Location of Sprinkler Heads: Heads in relation to the ceiling and the spacing of sprinkler heads shall not exceed their listed area of coverage for [[Ordinary Hazard II] [Extra Hazard], Group [I] [II]] [High-Piled Storage]. Uniformly space sprinklers on the branch piping. Locate sprinkler heads in a consistent pattern with ceiling grid, lights, and supply air diffusers.

G. Sprinkler Discharge Area: The sprinkler discharge area shall be the hydraulically most remote areas as defined in NFPA 13. Remote area reductions permitted per NFPA 13 shall not apply.

H. [Compact Shelving: Fire sprinkler coverage for compact shelving units shall be in accordance with the SI Fire Protection and Life Safety Design Manual.]

I. Hose Allowances: System design shall include an allowance of 100 gpm (6.31 l/s) for inside hose stream, and 250 gpm (15.77 l/s) for total combined inside and outside hose streams.

J. Hydraulic Calculations: Hydraulic calculations shall be in conformance with NFPA 13 and the following requirements:

1. Water Supply: [Base hydraulic calculations on a static pressure of _ psi(kPa) with _____ gpm (LPM) available at a residual pressure of_____psi(kPa) at_____.] [The

Contractor shall determine the characteristics of the water supply and if necessary, conduct appropriate flow tests at their expense.][Provide a copy of the most recent waterflow test with the hydraulic calculations. The water supply test may be no more than 10 months old when used for hydraulic calculations.]

2. Margin of Safety: The sprinkler system shall be hydraulically designed so that the total waterflow and pressure demand is at least 10% less than the available water flow and pressure at the site.

3. Friction Losses: Calculate losses in piping in accordance with the Hazen-Williams formula with "C" value of 100 for unlined ductile iron piping, 120 for steel piping, 140 for cement-lined ductile-iron piping, 150 for copper tubing and plastic piping.

4. Flow Velocity: Piping shall be sized so that the water flow velocity does not exceed 20 ft/sec (6.1 m/s) at any point in the system during maximum water flow (including inside hose demand). Flow velocity in each pipe segment is to be provided in the calculations.

5. Test Point: Calculations shall be brought back to the flow test point.

6. Area of Coverage and Density: The area of coverage and density for each sprinkler shall be provided in the calculations.

7. Equivalent Lengths: The equivalent lengths for all types of fittings and valves used shall be provided.

8. Supply and Demand Graph(s): A graph comparing the water supply and the sprinkler and hose stream demand for each remote area shall be provided. Pressure and flow values for the supply and demand curves are to be provided on $N^{1.85}$ graph paper.

1.08 SUBMITTALS

A. Partial submittals will not be acceptable. Any installation work performed prior to the approval of the submittal shall be at the Contractor’s own risk.

B. Before any work is commenced, submit manufacturer's data (with listing or approval), system calculations, [water supply data,] and complete sets of working drawings.

C. The OSHEM Fire Protection Engineer shall review and approve submittals.

D. Manufacturers' Data: Annotate descriptive data to show the specific model, type and size of each item the Contractor proposes to furnish. Include data for proper installation of each system including:

1. Pipe and fittings
2. Alarm valves
3. Gate and check valves
4. Globe valves
5. Backflow preventers
6. Water motor alarms
7. Sprinkler heads
8. Pipe hangers and supports
9. Seismic bracing attachments and equipment
10. Pressure and waterflow switches
11. Tamper switches
12. Inspector's test station
13. Retard chamber
14. Ball drip
15. Fire department connections
16. Lubricating compound/PTFE tape.
17. Signs
18. Caps, chains
19. Cabinets

20. Hose valves

21. Drip pans

E. Shop Drawings: Prepare working drawings on sheets not smaller than 24 in by 36 in (610 mm by 914 mm), in accordance with the requirements for "Working Plans" as specified in NFPA 13. A scaled site plan, with the location and elevation of the water flow test, shall be provided on the drawings. [Drawings are to include isometric diagram of sprinkler risers and feed mains, including all control valves.]

F. As-Built (Record) Working Drawings: On a weekly basis, the Contractor Superintendent, in conjunction with the COTR, shall review and record as-built conditions on a set of drawings maintained at the job site. After completion, but before final acceptance of the work, furnish a complete set of as-built drawings for review and approval by OSHEM. Make all necessary corrections to the drawings and furnish four sets of as-built drawings for record purposes. All deviations from the approved shop drawings shall be highlighted on the as-built drawings; if required by OSHEM the Contractor shall also provide hydraulic calculations justifying deviations. The drawings shall not be smaller than 24 in by 36 in (610 mm by 914 mm) on reproducible sepia with title block similar to full size contract documents. Provide 1 compact disc containing CAD based drawings in DXF and PDF based format of all as-built drawings and schematics.

G. Operation and Maintenance Manuals: Furnish four (4) instruction manuals containing complete operation and maintenance instructions for the specific make and model of all check valves, detector check valves, alarm valves, waterflow and tamper switches, backflow preventers, and other trim furnished. Serial numbers and ordering information shall be provided. Place one copy of each instruction manual in a flexible, oil-resistant protective binder and mount in an accessible location in the vicinity of each alarm control valve. Furnish three additional copies of each instruction manual.

1.09 QUALITY ASSURANCE

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. All publications listed below refer to the most current edition.

B. Manufacturers Qualifications

1. American Society for Testing and Materials (ASTM) Publications:

a. A53 Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless

b. A135 Welded and Seamless Steel Pipe

2. Factory Mutual System (FM) Publications

a. Approval Guide

3. National Fire Protection Association (NFPA) Publications

a. 13 Standard for the Installation of Sprinkler Systems

b. 14 Standard for the Installation of Standpipe and Hose Systems

c. 70 National Electrical Code

d. 72 National Fire Alarm and Signaling Code

e. 101 Life Safety Code

f. 291 Recommended Practice for Fire Flow Testing and Marking of Hydrants

g. 1963 Standard for Fire Hose Connections

4. International Code Council (ICC)

a. International Building Code

5. Underwriters Laboratories, Inc. (UL) Publications:

a. Fire Protection Equipment Directory

b. 262 Gate Valves for Fire Protection Service

c. 789 Indicator Posts for Fire Protection Service

6. American Society of Mechanical Engineers (ASME)

a. A17.1 Safety Code for Elevators and Escalators

C. Qualifications Of Installer:

1. Prior to installation, submit data for approval by OSHEM, showing that the Contractor has successfully installed automatic wet pipe fire extinguishing sprinkler systems of at least 200 sprinkler heads each, or there is a firm contractual agreement with a subcontractor having such required experience. These systems shall be the same type and design which have been

   retrofitted into existing museums and historical buildings as specified herein. The data shall include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. The Contractor shall indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

2. Design (including hydraulic calculations) shall be by a NICET Level III or IV Technician (in automatic sprinkler system design) or a Professional Engineer (P.E.), licensed in Fire Protection Engineering. Qualifications of the designer must be submitted to OSHEM for approval. The designer's NICET or P.E. stamp shall be present on each sheet of the working drawings.

D. Service Organization: The Contractor shall furnish, to the COTR, evidence that there is an experienced and effective service organization which carries a stock of repair parts for the system in order to readily conduct repairs throughout the warranty period. Should the Contractor fail to comply with the service requirements of this section, the Government will then have the option to make the necessary repairs and back charge the Contractor without any loss of warranty or guarantee as provided by the contract documents.

1.10 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

C. Automatic sprinklers must be kept in original packaging until they are installed. Loose carrying or storage is not permitted. Loose sprinklers shall be discarded

immediately and replaced at Contractor's expense.

1.11 PROJECT CONDITIONS

[List any special project conditions and/or environmental limitations on system installation, such as temperature, humidity, ventilation, etc.]

1.12 COORDINATION

A. Coordinate sprinkler head layout with reflected ceiling plan and all ceiling – mounted equipment, including diffusers, lights, security cameras, fire alarm devices, exit signs, and other devices.

B. Coordinate major equipment and piping layouts with other trades to avoid obstructions and excessive changes in direction for piping.

1.13 WARRANTY

A. The Contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the Government.

B. Final acceptance includes, but is not limited to, the receipt and OSHEM approval of, as-built drawings and operation and maintenance manuals.

1.14 SERVICE AGREEMENT

[List requirements, if part of the contract. Confirm with OSHEM and COTR].

1.15 EXTRA MATERIALS

[List special requirements for spare parts, if part of the contract. Confirm with OSHEM and COTR].

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. All products are subject to the following listed acceptable manufacturers. If the product is not addressed herein the product shall be from a US based manufacturer and listed for fire protection use.

B. All products shall be FM approved/UL listed.

C. Double Check Detector Backflow Preventer Assembly

1. Ames
2. Watts
3. Febco
4. Hersey

D. Fire Department Connections

1. Allenco
2. Elkhart Brass
3. Potter-Roemer Inc
4. Reliable Automatic Sprinkler Co.

E. Fire Protection Valves and Drain Assemblies

1. Tyco Fire & Building Products
2. Victaulic
3. Stockham
4. Kennedy
5. Jenkins
6. Reliable Automatic Sprinkler Co.
7. Viking Corporation

F. Sprinklers

1. Tyco Fire & Building Products

2. Reliable Automatic Sprinkler Co.

3. Viking Corporation

4. Victaulic Corporation

G. Valve Supervisory Switches

1. Potter Electric Signal

2. System Sensor

3. McWane, In. Kennedy Valve Div.

2.02 ABOVEGROUND PIPING SYSTEMS

A. Provide fittings for changes in direction of piping and for all connections. Arrange piping so that it can be drained at the main riser. Make changes in piping sizes through standard tapered, reducing pipe fittings; the use of bushings is not permitted. Perform welding in the shop; field welding is not permitted.

B. Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape only, applied on the male threads.

C. Use of pipe dope is not permitted.

D. Lubricant used on gaskets for mechanical fittings must be non-petroleum based and approved by OSHEM.

E. Run piping concealed in areas with suspended ceilings, except as noted on the drawings.

F. Sprinkler Pipe and Fittings: Provide in accordance with NFPA 13, except as modified herein. Steel piping shall be Schedule 40 per ASTM A53 for sizes less than 4 inches (101.6 mm) and Schedule 10 or 40 per ASTM A53 for sizes 4 inches (101.6 mm) and larger. ASTM A135, Schedule 40 piping may be used for pipe sizes less than 2 ½ inches (63.5 mm).

1. Standard Installation:

a. Nominal pipe sizes 4 inches or larger: Schedule 10 or 40 Pipe meeting ASTM A-53, A- 135 or A-795 with factory- or field-formed, roll-grooved

for Schedule 10 or 40 ends, or cut-grooved for Schedule 40 ends.

b. Nominal pipe sizes smaller than 4-inches: Schedule 40 Pipe meeting ASTM A-53, A-135, and A-795 with factory- or field-formed threaded ends.

c. For connections between 4 inch and larger pipes on risers, feed mains, cross-mains and drain lines, the requirements are as follows: .

1) Grooved pipe couplings and fittings for grooved pipe.

2) Outlet coupling with screwed connection for grooved pipe.

d. For connections from risers, feed mains, cross-mains, or drains to branch lines, the requirements are as follows:

1) Welded outlet with screwed connection or threaded coupling or fittings.

e. For connections to and between branch line pipes less than 4 inches the requirement is as follows:

1) Threaded pipe couplings and fittings only.

f. For connections between drain pipes requirement is as follows:

1) Galvanized threaded or cut-grooved pipe couplings and fittings.

2. [Animal Holding Area/Keeper Areas:

a. Nominal pipe sizes 4-inches or larger: Schedule 10 or 40 Pipe meeting ASTM A-53, A- 135 or A-795, hot-dip galvanized and with factory- or field-formed, roll-grooved for Schedule 10 or 40 ends, or cut-grooved for Schedule 40 ends.

b. Nominal pipe sizes smaller than 4-inches: Schedule 40 Pipe meeting ASTM A-53, A-135, and A-795 hot-dip galvanized and with factory- or field-formed threaded ends.

c. For connections between 4 inch and larger pipes on risers, feed mains, cross-mains and drain lines, the requirements are as follows:

1) Galvanized grooved pipe couplings and fittings for grooved pipe.

2) Galvanized outlet coupling with screwed connection for grooved pipe.

d. For connections from risers, feed mains, cross-mains, or drains to branch lines, the requirements are as follows:

1) Galvanized welded outlet with screwed connection or threaded coupling or fittings.

e. For connections to and between branch line pipes less than 4 inches the requirement is as follows:

1) Galvanized threaded pipe couplings and fittings only.

f. For connections between drain pipes requirement is as follows:

1) Galvanized threaded or cut-grooved pipe couplings and fittings.]

3. Underground piping: Shall comply with the requirements of NFPA 24 and shall be constructed of centrifugally case ductile iron or C900 polyvinyl chloride.

4. Pressure ratings: All fittings and gaskets shall meet or exceed maximum working pressures present within the system.

5. Corrosion protection: All piping and hangers where exposed to the weather or installed in a corrosive atmosphere shall be protected against corrosion.

6. Pipe and Hanger Supports: Provide pipe supports, hangers, and clamps conforming to NFPA 13 and listed by UL or approved by FM. Provide galvanized supports, hangers, and clamps for all galvanized piping.

7. Joint Construction

a. Plain-end fittings with mechanical couplings, hole-cut mechanical threaded outlet fittings, hole-cut mechanical grooved outlet fittings, and hole-cut saddle clamp outlet fittings are not permitted for new systems. The above fitting types are only permitted on a case-by-case basis when approved by OSHEM.

b. Procedures for welding outlets shall be in strict conformance with the welding requirements of NFPA 13, including submission of welding certifications. Welding shall not be performed on-site.

c. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe with wall thickness less than Schedule 40.

d. Grooved Joints and Fittings: Assemble joints and fittings with listed coupling and gasket, lubricant, and bolts from the same manufacturer. Fittings and attached couplings shall be from the same manufacturer.

e. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.

f. If the galvanized coating on piping is found to be chipped or cracked upon grooving of joint, two coats of liquid galvanizing material shall be applied to groove. The first coat shall be thoroughly dry prior to applying the second coat.

G. Use of restriction orifices, reducing flanges, unions, and plain-end fittings is not permitted.

H. Flanged fittings shall be used in lieu of unions with the exception of drain lines.

I. The corrosion resistance ratio of pipe and fitting method shall not be less than 0.95.

J. Pipe Hangers and Supports: Provide in accordance with NFPA 13.

K. Identification Signs: Attach properly lettered approved metal or polycarbonate signs conforming to NFPA 13 to each valve and alarm device. Polycarbonate signs shall be red with engraved white letters. Signs at valves shall describe the sprinkler zone it controls and state that the valve is to remain open. Permanently affix design data nameplate to the riser of each system.

L. Inspector's Test Connection: Provide test connections no higher than 6 ft (1.83 m) above the floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device; locate at the [hydraulically most remote part of each system and at the] control valve/drain assembly. Provide combination drain valve and test connection. Discharge shall be readily visible from the inspector's test connection, either by direct observation of the discharge or through a sight glass. Discharge shall be piped to either an open building drain or to the outside. Drainage and test valves shall be bronze globe, angle, or gate valves.

M. Drains: Provide drain piping to discharge at safe points outside the building or to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure. All drain piping and fittings are to be galvanized. Provide auxiliary drains as required by NFPA 13. Splash guards are to

be provided where necessary at discharge outlets.

N. Pipe Sleeves and Seals. Provide where conduit or piping passes through walls, floors, roofs and partitions. Provide clearance between exterior of piping and interior of sleeve in accordance with NFPA 13. See Section 078413 Penetration Firestopping, for sleeves and seals through fire-rated assemblies. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through the entire thickness of walls, floors, roofs, and partitions.

1. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide ASTM A53, Schedule 40, zinc-coated steel pipe sleeves. Sleeves in floors shall project 4 inches (101.6 mm) above finished floors to prevent seepage.

2. Sleeves in Partitions and Other than Masonry and Concrete Walls, Floors and Roofs: Sleeves shall be constructed from either zinc-coated schedule 40 steel pipe or zinc-coated 26 gauge steel sheet.

O. Escutcheon Plates: Provide one piece or split-hinge-type metal plates for piping passing through floors, walls, and ceilings in exposed and concealed areas. Provide chromium-plated or color- coordinated metal plates where pipe passes through finished ceilings. Securely anchor plates in proper position. Provide sprinkler escutcheon plates to match sprinkler head finish.

2.03 BACKFLOW ASSEMBLIES

A. Backflow preventers installed in buildings within the limits of Washington DC shall comply with DC Water and Sewer Authority (DC WASA) and ASSE 1048 requirements. Backflow preventers outside of Washington DC shall comply with the requirements of the local water authority.

B. The backflow preventer shall be of the Double Check Detector Assembly (DCDA) type with bypass meter assembly, two independently operated spring-loaded check valves, top mounted test cocks, and two UL FM OS&Y resilient seated gate valves.

C. Assemblies shall be listed for fire protection use.

2.04 SPRINKLER HEADS

A. Provide quick response sprinklers in offices and all other areas where their use is listed or approved. Heads located within the air streams of unit heaters or other

heat-emitting equipment or skylights shall be selected for proper temperature rating.

B. Where only a portion of the automatic sprinklers in a space are being replaced as part of a renovation, the response characteristics of the new sprinklers shall match those existing in the space.

C. Heads shall have a nominal ½ inch (12.7 mm) orifice. Corrosion-resistant sprinkler heads shall be installed where they are exposed to the weather, moisture or corrosive vapors. Heads installed where they might receive mechanical injury or are less than 7 feet (2.13 m) above the floor level, shall be protected with approved guards in accordance with NFPA 13. Provide finish as indicated.

2.05 VALVES:

A. Provide valves as required by NFPA 13. Valves shall be UL listed or FM approved for fire protection service.

B. Gate Valves: Gate valves shall be the outside stem & yoke (OS&Y) type, and open by counterclockwise rotation. Gate valves installed higher than 7 feet (2.13 m) above the floor shall be provided with a chain drive or permanently mounted ladder. Provide a gate valve beneath each alarm valve in each riser when more than one alarm valve is supplied from the same water supply pipe. [For post indicator valves, provide operating nut located about 3 feet above finish grade. Gate valves for use with indicator posts shall conform to UL 262. Indicator posts shall conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.

C. Check Valves: Check valves shall be clear-opening, swing-check type, with a bronze or stainless steel seat ring and an EPDM rubber clapper facing. Flanged check valves of sizes 4 inch (101.6 mm) and larger shall have flanged inspection and access cover plates.

D. [Alarm Valves: Provide variable-pressure-type alarm valve complete with an alarm test valve, alarm shutoff valve, drain valve, pressure gages, accessories and appurtenances for the proper operation of the system.]

E. Butterfly valves: Butterfly valves are permitted only for pipe sizes of 4 inches (100 mm) and smaller.

F. [Floor Control Assemblies: Provide floor control valve assemblies at each floor level consisting of an indicating, supervised control valve, check valve, water flow switch, pressure gauge and test/drain assembly. The test/drain assembly must be

routed to the main drain or an open building drain.]

2.06 FIRE DEPARTMENT CONNECTION

A. The fire department connection shall be in accordance with NFPA 13, with self-closing clapper valve in each inlet. The siamese connection shall be polished brass [bronze], [with polished chromium finish].

B. Connection shall include a check valve, automatic drip (to drain to outside or building drain), bronze caps and chains, 2 ½ inch (63.5 mm) female fire hose thread connections with [National Standard][Local Fire Department] threads, and nameplate.

C. Nameplate shall be positioned so it is clearly visible and shall state the type of connection and the system(s) it serves.

2.07 ALARMS

A. [Paddle-Type Water Flow Switches: Provide paddle-type water flow switches [as indicated on the drawings]. Switches shall have sensitivity setting to signal any flow of water that equals or exceeds the discharge from one sprinkler head. Water flow switch mechanisms shall incorporate an instantly recycling, pneumatic, adjustable retard element and shall be set with a 20-second delay. Assembly shall be rated at 175 psi (1206.6 kPa) cold water pressure. Switches shall be compatible with the fire alarm system and shall be connected per Section 283111.]

B. [Pressure Switch: Provide switch [as indicated on the drawings] with circuit opener and closer for automatic transmittal of an alarm over the facility fire alarm system and connect into the fire alarm system per Section 283111. Alarm actuating device shall be of the mechanical diaphragm, controlled water, pressure-type, without retard device, which instantly recycles when pressure is released from the diaphragm. Switches shall be compatible with the fire alarm system.]

C. Water Motor Alarm: Provide a weatherproof and guarded 10 inch (254 mm) water motor alarm, to sound on the flow of water in each corresponding sprinkler system. Mount alarm on the outside of the wall of the building at a location indicated on the drawings. Provide a splash block beneath the drain for the water motor alarm. Install a permanent sign next to the water motor alarm stating the nature of the alarm and instructions for responding.

D. Valve Supervisory Switch: Valve supervisory switches shall be installed on all

sprinkler control valves. The switches shall be mounted so as not to interfere with the normal operation of the valve and shall be adjusted to operate within two revolutions of the valve control or when the stem has moved no more than 1/5 of the distance from its normal open position. The mechanism shall be contained in a weather-proof, die-cast, aluminum housing that shall be provided with a ½ inch (12.7

mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valve. Switch housing shall be finished in red baked enamel. The entire installed assembly shall be tamper- proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting. Devices shall be compatible with and connected to the fire alarm system per Section 283111.

2.08 CABINET

A. Furnish and install a metal cabinet containing a stock of spare sprinkler heads of all types and ratings installed. The cabinet shall be located near the [alarm][control] valve and where the temperature will not exceed 100ºF (37.8ºC) The number of spare sprinkler heads shall be as required by NFPA 13.

B. Provide a sprinkler head wrench in the cabinet for each type of sprinkler installed on the system.

2.09 STANDPIPE VALVES

A. General: Provide bronze hose valves that are gate or angle type with screw-in bonnets, and 2-1/2 inch threaded male outlets with 1-1/2 inch adapters. Brass caps and chains are to be provided for each outlet. Valves and adapters are to have [National Standard threads][local fire department threads].

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment, materials, installation, workmanship, examination, inspection and testing shall be in accordance with NFPA 13, except as modified herein. Install piping straight and true to bear evenly on hangers and supports. Install piping as close to the ceiling as possible, without interfering with other equipment and construction. Nipples shall be perpendicular to ceilings.

B. Accurately align sprinkler heads in suspended ceilings symmetrically with diffusers, lights, and ceiling tiles. Install sprinkler heads in the center of the ceiling

tiles unless directed otherwise. Concealed head covers shall not be installed until ceiling construction is complete and an inspection to determine height compliance has been conducted by OSHEM.

C. Keep the interior and ends of all piping affected by Contractor's operations thoroughly clean of water and foreign matter by means of plugs or other approved methods. Inspect piping before placing into position. All pipe, fittings, and gaskets are to be cleaned of oil prior to installation.

3.02 FIELD CHANGES

A. Do not make field changes in the piping layout, pipe sizes, or type of equipment, without the prior approval of the COTR.

3.03 CONNECTIONS TO EXISTING SPRINKLER SYSTEM

A. Connection to the existing sprinkler system shall be done only after successfully testing new piping. Connections shall be as shown on the drawings. The COTR shall be notified at least 4 days prior to interruption of sprinkler protection.

B. A schedule of any interruption of service shall be provided to the COTR and approval received before any service is interrupted. In no case shall the existing sprinkler system be shut off during periods other than normal Contractor construction hours.

3.04 FIELD PAINTING

A. Painting shall be per Section 099000, Painting, except as modified herein. The above-ground steel piping systems including valves, piping [in finished areas], pipe sleeves [and hangers] shall be cleaned, pre-treated, primed and painted. Coatings shall be applied only to clean, dry surfaces using clean brushes. Surfaces shall be cleaned to remove all dust, dirt, rust and loose mill scale.

B. Immediately after cleaning, provide the metal surfaces with one coat of primer, applied to a minimum dry film thickness of 1.0 to 1.5 mil. Due care shall be exercised to avoid the painting of sprinkler heads or protective devices or allowing paint to drip or splatter on any equipment, artifacts, building structures, and floors. Materials which are used to protect sprinkler heads while painting is in progress shall be removed upon completion of painting.

C. The Contractor shall remove all sprinkler heads which are painted and provide new, clean sprinkler heads of the proper type at his own expense. In addition to the primer, surfaces shall receive the following:

1. Above-Ground Piping Systems in Unfinished Areas: Unfinished areas are defined as attic spaces, mechanical equipment spaces, spaces above suspended ceilings, crawl spaces, pipe chases, and spaces where walls or ceilings are not painted or not constructed of a pre-finished material. [Provide primed surfaces with one coat of red enamel.][Provide 2 inch (50.8 mm) wide red enamel or self-adhering plastic bands on sprinkler piping, spaced at a maximum of 10 ft (3.05 m) intervals.]

2. Above-Ground Piping Systems in Other Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except valves and operating accessories shall receive one coat of red enamel. Provide piping with 2 inch (50.8 mm) wide red enamel bands or self-adhering red plastic bands spaced at a maximum of 10 ft (3.05 m) intervals. In finished areas such as offices, the red bands may be omitted.

3. All other coatings (e.g., zinc for galvanized pipe) shall be in compliance with NFPA 13.

3.05 FIELD TESTING AND FLUSHING

A. All testing shall be scheduled with the COTR.

B. At the discretion of the OSHEM Fire Protection Engineer, an air pressure test may be required prior to filling the system with water. The test shall be conducted by raising the air pressure in the system to 40 psi (275.8 kPa) and allowing it to stand for 24 hours. There shall be no loss of air pressure greater than 1.5 psi (10.34 kPa) over the 24 hour period. Air pressure during this test shall be tracked via a graph over the 24 hour period by a pressure monitoring device or pressure monitoring gauge.

C. Hydrostatic tests shall be conducted at the greater of 200 psi (1379 kPa) or the normal system pressure plus 50 psi (345 kPa) for a 2 hour period with no leakage or reduction in gage pressure. Hydrostatic test pressures shall not be maintained on the system overnight. Flush piping with potable water in accordance with NFPA 13.

D. Preliminary Tests and Procedures: Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. [Prior to the hydrostatic test, perform an air test on the system.] [In areas where piping will be concealed by ceilings, walls, or other construction before the system is complete and ready for final testing, the preliminary hydrostatic test shall be conducted prior to piping being concealed. This test shall be witnessed by the

COTR and the OSHEM Fire Protection Engineer.] When all tests and procedures are completed and corrections

made, submit a signed and dated certificate, similar to that specified in NFPA 13, with a request for formal inspection and tests.

E. Formal Inspection and Tests: At this time, all piping, sprinklers, and other system components shall be in-place and all adjustments to the system completed. The OSHEM Fire Protection Engineer shall be notified by the COTR, shall witness all tests, and shall approve all systems before they are accepted. Submit a request for a formal inspection at least five working days prior to the date the inspection is to take place. A competent representative of the sprinkler installer shall be present during testing and inspection. As-built drawings shall be on-site for the inspection. At this inspection, the system shall be hydrostatically tested. Any or all of the required tests shall be conducted by the Contractor at his own expense and additional tests made until it has been demonstrated that the systems comply with all contract requirements. The Contractor shall furnish all appliances, equipment, instruments, connecting devices and personnel for the tests. Any costs incurred by the SI for repeat tests, due to the failure of the Contractor to adequately demonstrate that the system complies with the contract requirements, shall be borne by the Contractor.

F. CONNECTIONS TO EXISTING PIPING: During air and hydrostatic testing, the Contractor shall test new piping prior to connecting to the existing system. If the Contractor chooses to test the new piping while it is connected to existing piping or valves, the Contractor shall assume responsibility for all piping and equipment which is pressurized, as well as any damage caused by the failure of existing or new sprinkler systems. The SI accepts no responsibility for existing valves' performance to withstand hydrostatic pressure testing.

END OF SECTION 211313

SECTION 21 13 16
DRY PIPE AND PREACTION SPRINKLER SYSTEM

TABLE OF CONTENTS

SECTION 211316
DRY PIPE AND PREACTION SPRINKLER SYSTEM

EDITING NOTE

All bracketed blanks, words, phrases, sentences, and paragraphs in this specification require the editor to either include or delete the bracketed section, or provide required information.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. The following sections apply to the work of this section:

1. 211100 Exterior Water Supply Mains for Fire Protection Service
2. 078413 Penetration Firestopping
3. 238111 Fire Detection and Alarm Systems
4. 211000 Fire Protection General Requirements
5. 213110 Fire Pump Systems

1.02 SUMMARY

A. Scope: Provide a complete, code compliant dry-pipe [preaction] sprinkler system, and associated equipment, ready for operation.

B. The work includes designing and [modifying][installing] an automatic dry-pipe [preaction]fire extinguishing sprinkler system for [[Ordinary Hazard II] [Extra Hazard - Group [I] [II]] [High-Piled Storage] and uniform distribution of water by hydraulic design to afford complete fire protection coverage throughout the contract area.

C. Existing Sprinkler Equipment: Existing sprinkler equipment shall be maintained fully operational until the new equipment has been tested and accepted by the COTR and OSHEM fire protection engineer. [After acceptance of the new equipment, all existing equipment so indicated shall be removed.]

D. Authority Having Jurisdiction: Any reference in the specifications or applicable codes to the "authority having jurisdiction" shall be interpreted to mean the OSHEM Fire Protection Engineer.

1.03 ALLOWANCES

[List Allowances, if included as part of the contract. Confirm with OSHEM and COTR]

1.04 UNIT PRICES

[List Unit Prices, if included as part of the contract. Confirm with OSHEM and COTR]

1.05 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. FM: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NFPA: National Fire Protection Association

G. NICET: National Institute for Certification in Engineering Technologies

H. OSHEM: Office of Safety Health and Environmental Management

I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

1.06 SYSTEM DESCRIPTION:

A. The design shall conform to NFPA 13 and the requirements specified herein. Design of the automatic dry-pipe (preaction) sprinkler system shall be for [[Ordinary Hazard II] [Extra Hazard - Group [I] [II]] [High-Piled Storage] occupancy by hydraulic calculation. The design, equipment, materials, installation, workmanship, examination, inspection and testing shall be in strict accordance with NFPA 13, except as modified herein.

B. The system shall include all materials, accessories, and equipment inside and outside the building to provide a system complete and ready for use. Refer to Section 211100 for Installation of Exterior Water Supply Main for Fire Protection Service.

C. Design and provide each system giving full consideration to obstructions, blind spaces, piping, electrical equipment, duct work and other construction and equipment in accordance with detailed drawings to be submitted for approval.

D. Equipment for fire protection service shall be UL listed or FM approved for use in [wet and] drypipe sprinkler systems.

E. In the NFPA publications referred to herein, the advisory provisions shall be considered mandatory, as though the word "shall" had been substituted for "should," wherever it appears.

1.07 PERFORMANCE REQUIREMENTS

A. Water Distribution: Distribution shall be uniform throughout the area which it

is assumed the sprinkler heads will open. Variation in discharge from individual heads in the hydraulically most remote area shall be between 100 and 120 percent of the specified density.

B. Piping Restrictions: Piping is prohibited in the following areas, except when solely supplying sprinklers in such areas:
   1. Transformer, switchgear, or similar rooms
   2. Elevator machine rooms and elevator shafts.
   3. IT Computer spaces (mission critical).
   4. Collection storage rooms.

C. Clearance From Electrical Equipment: Piping and automatic sprinklers are prohibited directly over:
   1. Transformers.
   2. Substations.
   3. Switchboards.
   4. Motor control centers.
   5. Emergency generators.
   6. Bus Ducts.
   7. Electrical panels.

D. If installing pipe over electrical equipment is unavoidable, provide drip pans under piping to protect electrical equipment.

E. [Sprinkler systems shall be designed for earthquake protection in accordance with the requirements and recommendations of NFPA 13.]

F. Location of Sprinkler Heads: Heads in relation to the ceiling and the spacing of sprinkler heads shall not exceed their listed area of coverage for [[Ordinary Hazard II] [Extra Hazard - Group [I] [II]] [High-Piled Storage]. Uniformly space sprinklers on the branch piping. Locate sprinkler heads in a consistent pattern with ceiling grid, lights, and supply air diffusers.

G. Sprinkler Discharge Area: The sprinkler discharge area shall be the hydraulically most remote areas as defined in NFPA 13. Remote area reductions permitted per NFPA 13 shall not apply.

H. [Compact Shelving: Fire sprinkler coverage for compact shelving units shall be in accordance with the SI Fire Protection and Life Safety Design Manual.]

I. Hose Allowances: System design shall include an allowance of 100 gpm (6.31 l/s) for inside hose stream, and 250 gpm (15.77 l/s) for total combined inside and

outside hose streams.

J. Hydraulic Calculations: Hydraulic calculations shall be in conformance with NFPA 13 and the following requirements:

1. Water Supply: [Base hydraulic calculations on a static pressure of _____ psi (kPa) with _____ gpm (LPM) available at a residual pressure of _____ psi (kPa) at _____.] [The Contractor shall determine the characteristics of the water supply and if necessary, conduct appropriate flow tests at their expense.] [Provide a copy of the most recent waterflow test with the hydraulic calculations. The water supply test may be no more than 10 months old when used for hydraulic calculations.]
2. Margin of Safety: The sprinkler system shall be hydraulically designed so that the total waterflow and pressure demand is at least 10% less than the available water flow and pressure at the site.
3. Friction Losses: Calculate losses in piping in accordance with the Hazen-Williams formula with "C" value of 100 for unlined ductile iron piping, 120 for steel piping, 140 for cement-lined ductile-iron piping, 150 for copper tubing and plastic piping.
4. Flow Velocity: Piping shall be sized so that the water flow velocity does not exceed 20 ft/sec (6.1 m/s) at any point in the system during maximum water flow (including inside hose demand). Flow velocity in each pipe segment is to be provided in the calculations.
5. Test Point: Calculations shall be brought back to the flow test point.
6. Area of Coverage and Density: The area of coverage and density for each sprinkler shall be provided in the calculations.
7. Equivalent Lengths: The equivalent lengths for all types of fittings and valves used shall be provided.
8. Supply and Demand Graph(s): A graph comparing the water supply and the sprinkler and hose stream demand for each remote area shall be provided. Pressure and flow values for the supply and demand curves are to be provided on $N^{1.85}$ graph paper.

1.08 SUBMITTALS

A. Partial submittals will not be acceptable. Any installation work performed prior to the approval of the submittal shall be at the Contractor's own risk.

B. Before any work is commenced, submit manufacturer's data (with listing or approval), system calculations, [water supply data,] and complete sets of working drawings.

C. The OSHEM Fire Protection Engineer shall review and approve submittals.

D. Manufacturers' Data: Annotate descriptive data to show the specific model, type and size of each item the Contractor proposes to furnish. Include data for proper installation of each system including:

1. Pipe and fittings
2. Dry pipe valves
3. Preaction valves
4. Gate and check valves
5. Globe valves
6. Backflow preventers
7. Water motor alarms
8. Sprinkler heads
9. Pipe hangers and supports
10. Seismic bracing attachments and equipment
11. Pressure and waterflow switches
12. Tamper switches
13. Inspector's test station
14. Retard chamber
15. Ball drip
16. Fire department connections
17. Lubricating compound/PTFE tape.
18. Signs
19. Caps, chains
20. Cabinets
21. Hose valves
22. Drip pans
23. Air Compressor

E. Shop Drawings: Prepare working drawings on sheets not smaller than 24 in by 36 in (610 mm by 914 mm), in accordance with the requirements for "Working Plans" as specified in NFPA 13. A scaled site plan, with the location and elevation of the water flow test, shall be provided on the drawings. [Drawings are to include isometric diagram of sprinkler risers and feed mains, including all control

valves.]

F. As-Built (Record) Working Drawings: On a weekly basis, the Contractor Superintendent, in conjunction with the COTR, shall review and record as-built conditions on a set of drawings maintained at the job site. After completion, but before final acceptance of the work, furnish a complete set of as-built drawings for review and approval by OSHEM. Make all necessary corrections to the drawings and furnish four sets of as-built drawings for record purposes. All deviations from the approved shop drawings shall be highlighted on the as-built drawings; if required by OSHEM the Contractor shall also provide hydraulic calculations justifying deviations. The drawings shall not be smaller than 24 in by 36 in (610 mm by 914 mm) on reproducible sepia with title block similar to full size contract documents. Provide 1 compact disc containing CAD based drawings in DXF and PDF based format of all as-built drawings and schematics.

G. Operation and Maintenance Manuals: Furnish four (4) instruction manuals containing complete operation and maintenance instructions for the specific make and model of all check valves, detector check valves, alarm valves, dry-pipe valve and deluge valve assemblies waterflow and tamper switches, backflow preventers, and other trim furnished. Serial numbers and ordering information shall be provided. Place one copy of each instruction manual in a flexible, oil-resistant protective binder and mount in an accessible location in the vicinity of each dry-pipe or preaction control valve. Furnish three additional copies of each instruction manual.

1.09 QUALITY ASSURANCE

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. All publications listed below refer to the most current edition.

B. Manufacturers Qualifications

1. American Society for Testing and Materials (ASTM) Publications:

   a. A53 Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless

   b. A135 Welded and Seamless Steel Pipe

2. Factory Mutual System (FM) Publications

   a. Approval Guide

3. National Fire Protection Association (NFPA) Publications

   a. 13 Standard for the Installation of Sprinkler Systems

   b. 14 Standard for the Installation of Standpipe and Hose Systems

   c. 70 National Electrical Code

d. 72 National Fire Alarm and Signaling Code

e. 101 Life Safety Code

f. 291 Recommended Practice for Fire Flow Testing and Marking of Hydrants

g. 1963 Standard for Fire Hose Connections

4. International Code Council (ICC)

a. International Building Code

5. Underwriters Laboratories, Inc. (UL) Publications:

a. Fire Protection Equipment Directory

b. 262 Gate Valves for Fire Protection Service

c. 789 Indicator Posts for Fire Protection Service

6. American Society of Mechanical Engineers (ASME)

a. A17.1 Safety Code for Elevators and Escalators

C. Qualifications Of Installer:

1. Prior to installation, submit data for approval by OSHEM, showing that the Contractor has successfully installed automatic wet pipe fire extinguishing sprinkler systems of at least 200 sprinkler heads each, or there is a firm contractual agreement with a subcontractor having such required experience. These systems shall be the same type and design which have been retrofitted into existing museums and historical buildings as specified herein. The data shall include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. The Contractor shall indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

2. Design (including hydraulic calculations) shall be by a NICET Level III or IV Technician (in automatic sprinkler system design) or a Professional Engineer (P.E.), licensed in Fire Protection Engineering. Qualifications of the designer must be submitted to OSHEM for approval. The designer's NICET or P.E. stamp shall be present on each sheet of the working drawings.

D. Service Organization: The Contractor shall furnish, to the COTR, evidence that there is an experienced and effective service organization which carries a stock of repair parts for the system in order to readily conduct repairs throughout the warranty period. Should the Contractor fail to comply with the service requirements of this section, the Government will then have the option to make the necessary repairs and back charge the Contractor without any loss of warranty

or guarantee as provided by the contract documents.

1.10 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

C. Automatic sprinklers must be kept in original packaging until they are installed. Loose carrying or storage is not permitted. Loose sprinklers shall be discarded immediately and replaced at Contractor's expense

1.11 PROJECT CONDITIONS

[List any special project conditions and/or environmental limitations on system installation, such as temperature, humidity, ventilation, etc.]

1.12 COORDINATION

A. Coordinate sprinkler head layout with reflected ceiling plan and all ceiling – mounted equipment, including diffusers, lights, security cameras, fire alarm devices, exit signs, and other devices.

B. Coordinate major equipment and piping layouts with other trades to avoid obstructions and excessive changes in direction for piping.

1.13 WARRANTY

A. The Contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the Government.

B. Final acceptance includes, but is not limited to, the receipt and OSHEM approval of, as-built drawings and operation and maintenance manuals.

1.14 SERVICE AGREEMENT

[List requirements, if part of the contract. Confirm with OSHEM and COTR].

1.15 EXTRA MATERIALS

A. [List special requirements for spare parts, if part of the contract. Confirm with OSHEM and COTR]. PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. All products are subject to the following listed acceptable manufacturers. If the product is not addressed herein the product shall be from a US based

manufacturer and listed for fire protection use.

B. All products shall be FM approved/UL listed.

C. Double Check Detector Backflow Preventer Assembly
   1. Ames
   2. Watts
   3. Febco
   4. Hersey

D. Fire Department Connections
   1. Allenco
   2. Elkhart Brass
   3. Potter-Roemer Inc
   4. Reliable Automatic Sprinkler Co.

E. Fire Protection Valves and Drain Assemblies
   1. Tyco Fire & Building Products
   2. Victaulic
   3. Stockham
   4. Kennedy
   5. Jenkins
   6. Reliable Automatic Sprinkler Co.
   7. Viking Corporation

F. Sprinklers
   1. Tyco Fire & Building Products
   2. Reliable Automatic Sprinkler Co.
   3. Viking Corporation
   4. Victaulic Corporation

G. Valve Supervisory Switches
   1. Potter Electric Signal
   2. System Sensor
   3. McWane, In. Kennedy Valve Div.

2.02 ABOVEGROUND PIPING SYSTEMS

A. Provide fittings for changes in direction of piping and for all connections. Arrange piping so that it can be drained at the main riser. Make changes in piping sizes through standard tapered, reducing pipe fittings; the use of bushings is not permitted. Perform welding in the shop; field welding is not permitted.

B. Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape only, applied on the male threads.

C. Use of pipe dope is not permitted.

D. Lubricant used on gaskets for mechanical fittings must be non-petroleum based and approved by OSHEM.

E. Run piping concealed in areas with suspended ceilings, except as noted on the drawings.

F. Sprinkler Pipe and Fittings: Provide in accordance with NFPA 13, except as modified herein. Steel piping shall be Schedule 40 per ASTM A53 for sizes less than 4 inches (101.6 mm) and Schedule 10 or 40 per ASTM A53 for sizes 4 inches(101.6 mm) and larger. ASTM A135, Schedule 40 piping may be used for pipe sizes less than 2 ½ inches (63.5 mm).

1. Standard Installation:

    a. Nominal pipe sizes 4 inches or larger: Schedule 10 or 40 Pipe meeting ASTM A-53, A- 135 or A-795 with factory- or field-formed cut-grooved ends. Roll-grooved fittings are not permitted.

    b. Nominal pipe sizes smaller than 4-inches: Schedule 40 Pipe meeting ASTM A-53, A-135, and A-795 with factory- or field-formed threaded ends.

    c. For connections between 4 inch and larger pipes on risers, feed mains, cross-mains and drain lines, the requirements are as follows:

        1) Grooved pipe couplings and fittings for grooved pipe.

        2) Outlet coupling with screwed connection for grooved pipe.

    d. For connections from risers, feed mains, cross-mains, or drains to branch lines, the requirements are as follows:

        1) Welded outlet with screwed connection or threaded coupling or fittings.

    e. For connections to and between branch line pipes less than 4 inches the requirement is as follows:

        1) Threaded pipe couplings and fittings only.

    f. For connections between drain pipes requirement is as follows:

        1) Galvanized threaded or cut-grooved pipe couplings and fittings.

2. [Animal Holding Area/Keeper Areas:

a. Nominal pipe sizes 4-inches or larger: Schedule 10 or 40 Pipe meeting ASTM A-53, A- 135 or A-795, hot-dip galvanized and with factory- or field-formed cut-grooved ends.

b. Nominal pipe sizes smaller than 4-inches: Schedule 40 Pipe meeting ASTM A-53, A-135, and A-795 hot-dip galvanized and with factory- or field-formed threaded ends.

c. For connections between 4 inch and larger pipes on risers, feed mains, cross-mains and drain lines, the requirements are as follows:

1) Galvanized grooved pipe couplings and fittings for grooved pipe.

2) Galvanized outlet coupling with screwed connection for grooved pipe.

d. For connections from risers, feed mains, cross-mains, or drains to branch lines, the requirements are as follows

1) Galvanized welded outlet with screwed connection or threaded coupling or fittings.

e. For connections to and between branch line pipes less than 4 inches the requirement is as follows:

1) Galvanized threaded pipe couplings and fittings only.

f. For connections between drain pipes requirement is as follows:

1) Galvanized threaded or cut-grooved pipe couplings and fittings.]

3. Underground piping: Shall comply with the requirements of NFPA 24 and shall be constructed of centrifugally case ductile iron or C900 polyvinyl chloride.

4. Pressure ratings: All fittings and gaskets shall meet or exceed maximum working pressures present within the system.

5. Corrosion protection: All piping and hangers where exposed to the weather or installed in a corrosive atmosphere shall be protected against corrosion.

6. Pipe and Hanger Supports: Provide pipe supports, hangers, and clamps conforming to NFPA 13 and listed by UL or approved by FM. Provide galvanized supports, hangers, and clamps for all galvanized piping.

7. Joint Construction

a. Plain-end fittings with mechanical couplings, hole-cut mechanical threaded outlet fittings, hole-cut mechanical grooved outlet fittings, and hole-cut saddle clamp outlet fittings are not permitted for new systems. The above fitting types are only permitted on a case-by-case basis when approved by OSHEM.

b. Procedures for welding outlets shall be in strict conformance with the

welding requirements of NFPA 13, including submission of welding certifications. Welding shall not be performed on site.

c. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe with wall thickness less than Schedule 40.

d. Grooved Joints and Fittings: Assemble joints and fittings with listed coupling and gasket, lubricant, and bolts from same manufacturer. Fittings and attached couplings shall be from the same manufacturer.

e. Steel Pipe: Square-cut piping as indicated. Use grooved-end fittings and rigid, grooved- end-pipe couplings, unless otherwise indicated. Roll-grooved fittings are not permitted.

f. If the galvanized coating on piping is found to be chipped or cracked upon grooving of joint, two coats of liquid galvanizing material shall be applied to groove. The first coat shall be thoroughly dry prior to applying the second coat.

G. Use of restriction orifices, reducing flanges, unions, and plain-end fittings is not permitted.

H. Flanged fittings shall be used in lieu of unions with the exception of drain lines.

I. The corrosion resistance ratio of pipe and fitting method shall not be less than 0.95.

J. Pipe Hangers and Supports: Provide in accordance with NFPA 13.

K. Identification Signs: Attach properly lettered approved metal or polycarbonate signs conforming to NFPA 13 to each valve and alarm device. Polycarbonate signs shall be red with engraved white letters. Signs at valves shall describe the sprinkler zone it controls and state that the valve is to remain open. Permanently affix design data nameplate to the riser of each system.

L. Inspector's Test Connection: Provide test connections no higher than 6 ft (1.83 m) above the floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device; locate at the [hydraulically most remote part of each system and at the] control valve/drain assembly. Provide combination drain valve and test connection. Discharge shall be readily visible from the inspector's test connection, either by direct observation of the discharge or through a sight glass. Discharge shall be piped to either an open building drain or to the outside. Drainage and test valves shall be bronze globe, angle, or gate valves.

M. Drains: Provide drain piping to discharge at safe points outside the building or to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure. All drain piping and fittings are to be galvanized. Provide auxiliary drains as required by NFPA 13. Splash guards are to be provided where necessary at discharge outlets.

N. Pipe Sleeves and Seals. Provide where conduit or piping passes through walls, floors, roofs and partitions. Provide clearance between exterior of piping and interior of sleeve in accordance with NFPA 13. See Section 078413 Penetration Firestopping, for sleeves and seals through fire-rated assemblies. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through the entire thickness of walls, floors, roofs, and partitions.

1. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide ASTM A53, Schedule 40, zinc-coated steel pipe sleeves. Sleeves in floors shall project 4 inches (101.6 mm) above finished floors to prevent seepage.
2. Sleeves in Partitions and Other than Masonry and Concrete Walls, Floors and Roofs: Sleeves shall be constructed from either zinc-coated schedule 40 steel pipe or zinc-coated 26 gauge steel sheet.

O. Escutcheon Plates: Provide one piece or split-hinge-type metal plates for piping passing through floors, walls, and ceilings in exposed and concealed areas. Provide chromium-plated or color- coordinated metal plates where pipe passes through finished ceilings. Securely anchor plates in proper position. Provide sprinkler escutcheon plates to match sprinkler head finish.

2.03 BACKFLOW ASSEMBLIES

A. Backflow assemblies installed in buildings within the limits of Washington DC shall comply with DC Water and Sewer Authority (DC WASA) and ASSE 1048 requirements. Backflow preventers outside of Washington DC shall comply with the requirements of the local water authority.

B. The backflow assemblies shall be of the Double Check Detector Assembly (DCDA) type with bypass meter assembly, two independently operated spring-loaded check valves, top mounted test cocks, and two UL FM OS&Y resilient seated gate valves. DC Water and Sewer Authority

C. Assemblies shall be listed for fire protection use.

2.04 DRY PIPE VALVE

A. Dry pipe valves shall include all trimming as required for a standard unit, that are UL listed or FM approved. Provisions shall be made to prevent excessive water accumulation. The dry pipe valve shall be fitted with an alarm bypass test connection so the waterflow device may be tested without opening the dry pipe valve.

B. Each dry pipe valve shall be equipped with an automatic air maintenance device, in addition to all other required components.

C. Provide an approved quick-opening device for dry pipe valves controlling systems

having capacity of more than 500 gallons.

2.05 AUTOMATIC AIR COMPRESSOR

A. The automatic air compressor shall have a tank capable of maintaining the required operating pressure on the dry system and shall be capable of full recovery within 30 minutes. Provide all pressure switches, flow switches, supervisory switches and low/high air pressure switches in accordance with NFPA and the manufacturer's recommendations.

B. The compressor shall operate on 208 volt, 3 phase power and shall have a horsepower rating of 1½ or less. The starter shall be provided by the Fire Protection Contractor.

C. Where the building is provided with an emergency power system, the compressor shall be connected to emergency power circuits.

2.06 PREACTION VALVE

A. Preaction valves shall be operated by a listed releasing service panel that is connected to the building fire alarm system. Preaction valve clappers shall incorporate a latching mechanism that will not be affected by pressure changes in the water system. If 6-inch valves are used on 8-inch risers, provide smoothly tapered connections. In addition to automatic operation, arrange each valve for manual release at the valve. Provide pressure gauges and other appurtenances at the preaction valves. Provide a test detection device for each actuation circuit adjacent to each valve which the device controls, as required by NFPA 13.

2.07 DETECTION SYSTEM

A. Provide a mixture of photoelectric and ionization smoke detectors for actuation of the preaction system by cross-zoning. There shall be a minimum of two detectors provided for each preaction system. Provide an independent control panel and secondary power supply. Supervise preaction sprinkler piping and detection system. A break in piping shall activate a trouble alarm. Refer to Section 283111 for specifications on the control panel, detectors, spacing of detectors, secondary power supply, and supervision. Furnish no less than two spare detectors of each type for each system.

2.08 MANUAL RELEASE STATION

A. Stations shall be surface mounted and shall not be subject to operation by jarring or vibration. Break-glass-front stations will not be permitted; however a pull-lever, break-glass-rod type is acceptable. Display operating instructions on face of station in engrave or raised letters of a contrasting color. Provide permanent metal or engraved plastic signs mounted above or beside each station, indicting which system that the station controls. Lettering shall be a minimum of 1.5 inches high.

2.09 SPRINKLER HEADS

A. Provide quick response sprinklers in offices and all other areas where their use is listed or approved. Heads located within the air streams of unit heaters or other heat-emitting equipment or skylights shall be selected for proper temperature rating.

B. Where only a portion of the automatic sprinklers in a space are being replaced as part of a renovation, the response characteristics of the new sprinklers shall match those existing in the space.

C. Heads shall have a nominal ½ inch (12.7 mm) orifice. Corrosion-resistant sprinkler heads shall be installed where they are exposed to the weather, moisture or corrosive vapors. Heads installed where they might receive mechanical injury or are less than 7 feet (2.13 m) above the floor level, shall be protected with approved guards in accordance with NFPA 13. Provide finish as indicated.

2.10 VALVES:

A. Provide valves as required by NFPA 13. Valves shall be UL listed or FM approved for fire protection service.

B. Gate Valves: Gate valves shall be the outside stem & yoke (OS&Y) type, and open by counterclockwise rotation. Gate valves installed higher than 7 feet (2.13 m) above the floor shall be provided with a chain drive or permanently mounted ladder. Provide a gate valve beneath each alarm valve in each riser when more than one alarm valve is supplied from the same water supply pipe. [For post indicator valves, provide operating nut located about 3 feet above finish grade. Gate valves for use with indicator post shall conform to UL 262. Indicator posts shall conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.

C. Check Valves: Check valves shall be clear-opening, swing-check type, with a bronze or stainless steel seat ring and an EPDM rubber clapper facing. Flanged check valves of sizes 4 inch (101.6 mm) and larger shall have flanged inspection and access cover plates.

D. Butterfly valves: Butterfly valves are permitted only for pipe sizes of 4 inches (100 mm) and smaller.

E. [Floor Control Assemblies: Provide floor control valve assemblies at each floor level consisting of an indicating, supervised control valve, check valve, water flow switch, pressure gauge and test/drain assembly. The test/drain assembly must be routed to the main drain or an open building drain.]

2.11 FIRE DEPARTMENT CONNECTION

A. Fire department connection shall be in accordance with NFPA 13, with self-closing clapper valve in each inlet. The siamese connection shall be polished brass

[bronze], [with polished chromium finish].

B. Connection shall include a check valve, automatic drip (to drain to outside or building drain), caps and chains, 2 ½ inch (63.5 mm) female fire hose thread connections with [National Standard][Local Fire Department] threads, and nameplate.

C. Nameplate shall be positioned so it is clearly visible and shall state the type of connection and the system(s) it serves.]

2.12 ALARMS

A. Pressure Switch: Provide switch with circuit opener and closer for automatic transmittal of an alarm over the facility fire alarm system and connect into the fire alarm system per Section 283111. Alarm actuating device shall instantly recycle. Switches shall be compatible with the fire alarm system.

B. Low/High Air Pressure Alarm: Provide alarm for each sprinkler system. Alarm shall give a visual and audible alarm when air pressure in the system drops halfway from the normal pressure to the tripping point and when air pressure in the system rises 10 psi above the normal pressure. Mount an alarm bell, light signal and cut-off switch for silencing the bell on the low air pressure alarm panel. Provide electrical power supply connections at the supply side of the building service panel with a separate fused safety-type switch for each connection with locked lever. [Locate the panel as indicated.]

C. [Water Motor Alarm: Provide a weatherproof and guarded 10 inch (254 mm) water motor alarm, to sound on the flow of water in each corresponding sprinkler system. Mount alarm on the outside of the wall of the building at a location indicated on the drawings. Provide a splash block beneath the drain for the water motor alarm. Install a permanent sign next to the water motor alarm stating the nature of the alarm and instructions for responding.]

D. Valve Supervisory Switch: Valve supervisory switches shall be installed on all sprinkler control valves. The switches shall be mounted so as not to interfere with the normal operation of the valve and shall be adjusted to operate within two revolutions of the valve control or when the stem has moved no more than 1/5 of the distance from its normal open position. The mechanism shall be contained in a weather-proof, die-cast, aluminum housing that shall be provided with a ½ inch (12.7 mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valve. Switch housing shall be finished in red baked enamel. The entire installed assembly shall be tamper- proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting. Devices shall be compatible with and connected to the fire alarm system per Section 283111.

2.13 CABINET

A. Furnish and install a metal cabinet containing a stock of spare sprinkler heads of all types and ratings installed. The cabinet shall be located near the [alarm][control] valve and where the temperature will not exceed 100º F (37.8º C) The number of spare sprinkler heads shall be as required by NFPA 13

B. Provide a sprinkler head wrench for each sprinkler type present in the sprinkler head cabinet.

2.14 STANDPIPE VALVES

A. General: Provide bronze hose valves that are gate or angle type with screw-in bonnets, and 2-1/2 inch threaded male outlets with 1-1/2 inch adapters. Brass caps and chains are to be provided for

each outlet. Valves and adapters are to have [National Standard threads][local fire department threads].

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment, materials, installation, workmanship, examination, inspection and testing shall be in accordance with NFPA 13, except as modified herein. Install piping straight and true to bear evenly on hangers and supports. Install piping as close to the ceiling as possible, without interfering with other equipment and construction. Nipples shall be perpendicular to ceilings.

B. Accurately align sprinkler heads in suspended ceilings symmetrically with diffusers, lights, and ceiling tiles. Install sprinkler heads in the center of the ceiling tiles unless directed otherwise. Concealed head covers shall not be installed until ceiling construction is complete and an inspection to determine height compliance has been conducted by OSHEM.

C. Keep the interior and ends of all piping affected by Contractor's operations thoroughly clean of water and foreign matter by means of plugs or other approved methods. Inspect piping before placing into position. All pipe, fittings, and gaskets are to be cleaned of oil prior to installation.

3.02 FIELD CHANGES

A. Do not make field changes in the piping layout, pipe sizes, or type of equipment, without the prior approval of the COTR.

3.03 CONNECTIONS TO EXISTING SPRINKLER SYSTEM

A. Connection to the existing sprinkler system shall be done only after successfully testing new piping. Connections shall be as shown on the drawings. The COTR shall be notified at least 4 days prior to interruption of sprinkler protection.

B. A schedule of any interruption of service shall be provided to the COTR and approval received before any service is interrupted. In no case shall the existing sprinkler system be shut off during periods other than normal Contractor construction hours.

3.04 FIELD PAINTING

A. Painting shall be per Section 099000, Painting, except as modified herein. The above-ground steel piping systems including valves, piping [in finished areas], pipe sleeves, conduit, hangers, miscellaneous metal work and accessories shall be cleaned, pre-treated, primed and painted. Coatings shall be applied only to clean, dry surfaces using clean brushes. Surfaces shall be cleaned to remove all dust, dirt, rust and loose mill scale.

B. Immediately after cleaning, provide the metal surfaces with one coat of primer, applied to a minimum dry film thickness of 1.0 to 1.5 mil. Due care shall be exercised to avoid the painting of sprinkler heads or protective devices or allowing paint to drip or splatter on any equipment, artifacts, building structures, and floors. Materials which are used to protect sprinkler heads while painting is in progress shall be removed upon completion of painting.

C. The Contractor shall remove all sprinkler heads which are painted and provide new, clean sprinkler heads of the proper type at his own expense. In addition to the primer, surfaces shall receive the following:

1. Above-Ground Piping Systems in Unfinished Areas: Unfinished areas are defined as attic spaces, mechanical equipment spaces, spaces above suspended ceilings, crawl spaces, pipe chases, and spaces where walls or ceilings are not painted or not constructed of a pre-finished material. [Provide primed surfaces with one coat of red enamel.][Provide 2 inch (50.8 mm) wide red enamel or self-adhering plastic bands on sprinkler piping, spaced at a maximum of 10 ft (3.05 m) intervals.]
2. Above-Ground Piping Systems in Other Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except valves and operating accessories shall receive one coat of red enamel. Provide piping with 2 inch (50.8 mm) wide red enamel bands or self-adhering red plastic bands spaced at a maximum of 10 ft (3.05 m) intervals. In finished areas such as offices, the red bands may be omitted.
3. All other coatings (e.g., zinc for galvanized pipe) shall be in compliance with NFPA 13.

3.05 FIELD TESTING AND FLUSHING

A. All testing shall be scheduled with the COTR.

B. At the discretion of the OSHEM Fire Protection Engineer, an air pressure test may be required prior to filling the system with water. The test shall be conducted by

raising the air pressure in the system to 40 psi (275.8 kPa) and allowing it to stand for 24 hours. There shall be no loss of air pressure greater than 1.5 psi (10.34 kPa) over the 24 hour period. Air pressure during this test shall be tracked via a graph over the 24 hour period by a pressure monitoring device or pressure monitoring gauge.

C. Hydrostatic tests shall be conducted at the greater of 200 psi (1379 kPa) or the normal system pressure plus 50 psi (345 kPa) for a 2 hour period with no leakage or reduction in gage pressure. Hydrostatic test pressures shall not be maintained on the system overnight. Flush piping with potable water in accordance with NFPA 13.

D. Preliminary Tests and Procedures: Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. [Prior to the hydrostatic test, perform an air test on the system.] [In areas where piping will be concealed by ceilings, walls, or other construction before the system is complete and ready for final testing, the preliminary hydrostatic test shall be conducted prior to piping being concealed. This test shall be witnessed by the COTR and the OSHEM Fire Protection Engineer.] When all tests and procedures are completed and corrections made, submit a signed and dated certificate, similar to that specified in NFPA 13, with a request for formal inspection and tests.

E. Formal Inspection and Tests: At this time, all piping sprinklers, and other system components shall be in-place and all adjustments to the system completed. The OSHEM Fire Protection Engineer shall be notified by the COTR, shall witness all tests, and shall approve all systems before they are accepted. Submit a request for a formal inspection at least five working days prior to the date the inspection is to take place. A competent representative of the sprinkler installer shall be present during testing and inspection. As-built drawings shall be on-site for the inspection. At this inspection, the system shall be hydrostatically tested. Any or all of the required tests shall be conducted by the Contractor at his own expense and additional tests made until it has been demonstrated that the systems comply with all contract requirements. The Contractor shall furnish all appliances, equipment, instruments, connecting devices and personnel for the tests. Any costs incurred by the SI for repeat tests, due to the failure of the Contractor to adequately demonstrate that the system complies with the contract requirements, shall be borne by the Contractor.

F. CONNECTIONS TO EXISTING PIPING: During air and hydrostatic testing, the Contractor shall test new piping prior to connecting to the existing system. If the Contractor chooses to test the new piping while it is connected to existing piping or valves, the Contractor shall assume responsibility for all piping and equipment which is pressurized, as well as any damage caused by the failure of existing or new sprinkler systems. The SI accepts no responsibility for existing valves'

performance to withstand hydrostatic pressure testing.

END SECTION 211316

SECTION 21 31 10
FIRE PUMP SYSTEM

EDITING NOTES

1. All bracketed blanks, words, phrases, sentences, and paragraphs in this specification require the editor to either include or delete the bracketed section, or provide required information.

2. Drawing Data: Contract drawings are to show the locations of obstructions, structural components, construction of walls, floors and ceilings, the location of underground or standpipe water supplies, and the location and arrangement of all control valves. Contract drawings are to also show the location and arrangement of the fire pump, driver, controller, test header, both sensing lines, jockey pump, electrical feeder, and emergency power supply (if available). A piping schematic is to be provided. See Appendix A of NFPA Standard No. 20 for guidance. Hose valve test header should be located at an exterior wall, where it is accessible for test purposes. The drawings should show drain locations for any relief valves or water measuring device drain lines. All valves controlling water supplies to the sprinkler system are to be equipped with tamper switches.

3. The designer should size the interior fire main system and the fire pump. Sizing of interior fire main piping and the fire pump should be in accordance with IBC.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and General Provision of Contract, General and Special Conditions, and requirements for the following related sections apply to work of this section:

1. 211100 Facility Fire Suppression Water Service Piping
2. 078413 Penetration Firestopping
3. 211000 Fire Protection General Requirements
4. 211313 Wet Pipe Sprinkler Systems

1.02 SUMMARY

A. Scope: Provide complete fire pump system, and associated equipment, ready for operation.

B. Description of Work: Design and [provide new] [and] [modify existing] fire pump system[s] in accordance with all required and advisory provisions of NFPA 20. Each system shall include materials, accessories, and equipment, inside and outside the building, so that the system is complete and ready for use. [In addition, the contractor shall determine the characteristics of the water supply (including static and residual water pressures.] [Design systems for earthquake protection for buildings in seismic zones 3 and 4, and for essential and high risk buildings in seismic zone 2.]

C. Existing Fire Pump Equipment: Existing fire pump equipment shall be [maintained fully operational until the new equipment has been tested and accepted by the Government] [left in-service] [re-piped] [removed] as indicated in the contract drawings].

1. [Equipment Removal: After acceptance of the new system by the Smithsonian, all existing equipment so indicated shall be removed and all damaged surfaces shall be restored as herein specified.]

D. Compliance: The entire fire pump system shall be designed, installed, tested, and maintained in accordance with NFPA 20 and NFPA 70, except as modified herein. Advisory provisions in NFPA 20 are to be considered mandatory, as though the word "shall" has been substituted for "should." Any reference to "authority having jurisdiction" shall be interpreted to mean the OSHEM Fire Protection Engineer. All materials used shall be either UL listed or FM approved.

1.03 ALLOWANCES

[List Allowances, if included as part of the contract. Confirm with OSHEM and COTR]

1.04 UNIT PRICES

[List Unit Prices, if included as part of the contract. Confirm with OSHEM and COTR]

1.05 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. M: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NFPA: National Fire Protection Association

G. NICET: National Institute for Certification in Engineering Technologies

H. OSHEM: Office of Safety Health and Environmental Management

I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

1.06 SYSTEM DESCRIPTION

1.07 PERFORMANCE REQUIREMENTS:

A. SEQUENCE OF OPERATION:

1. The fire and jockey pumps shall be capable of both manual and automatic shutoff.

2. The jockey pump shall start when pressure drops to [__] psi (kPa) and stop when pressure reaches [__] psi (kPa).

3. The fire pump shall start when pressure drops to [__] psi (kPa) and stop when pressure reaches [__] psi (kPa). [The fire pump shall automatically shut down after a run time of 10 minutes unless manually shutdown.]

B. [The [__] pump shall [be the lead pump] [automatically start upon tripping of the [_] sprinkler system] [and] [or] [manually when the starter is operated.] [Pump[s] shall continue to run until manually shut down.] [If after [_] seconds, the lead pump cannot maintain a pressure of at least [_] psi (kPa) on the system, Pump #2 shall start.] [Failure of the lead pump to start shall not prevent subsequent pumps from starting.]]

1.08 SUBMITTALS

A. Partial submittals will not be acceptable. Annotate descriptive data to show the specific model, type, size, and UL listing and/or FM approval of each item the Contractor proposes to furnish.

B. Before any work is commenced, submit the design, manufacturer's data, system calculations and complete sets of working drawings.

C. The OSHEM Fire Protection Engineer shall review and approve all submittals.

D. Equipment Submittals: Manufacturer's data shall be provided for each piece of equipment to be installed, including the following items:

1. Pumps, drivers, and controllers, [automatic transfer switches]
2. Pump characteristic performance curves, with selection points clearly indicated, and pump certification, signed by an officer of the manufacturer, stating that the pump will perform as specified.
3. Pressure maintenance (jockey) pumps
4. Check, gate, and drain valves
5. Relief valves (includes but not limited to casing relief, jockey pump relief, etc.)
6. Gauges
7. Hose valve manifold test header
8. Pressure and waterflow switches
9. Pipe, fittings, hangers, supports, and mechanical couplings
10. Tamper and flow switches
11. [Engine fuel and cooling system, including tank.]
12. All other associated equipment
13. Operating instructions (to be posted in the pump room)

E. Shop Drawings: Submit detailed shop drawings, in accordance with NFPA 13, "Working Plans", on uniform size sheets no smaller than 610 mm by 910 mm, to the COTR for review and approval. Information shall include but not be limited to the following:

1. Detailed plan view of the pump room, including elevations and sections, showing the location of fire pumps, controllers, piping, test manifold, all sensing lines and all other associated equipment.
2. Complete piping schematic, including pumps, devices, valves, fittings, and sensing lines.
3. Complete point to point electrical wiring and circuit diagrams.

4. Interior wiring diagrams of each controller and automatic transfer switch.

5. Current water flow test information

6. The signature and seal of a registered Professional Fire Protection Engineer,[registered Professional Engineer with a minimum of two years fire protection design experience], or a NICET Level III or IV Technician.

F. Posted Operating Instructions: Provide concise, easy to read instructions for operating the pumps, drivers, and controllers. Mount the instructions in an oil resistant cover adjacent to the fire pump controller.

G. Operation And Maintenance Manuals:

1. Not less than 7 calendar days prior to the final acceptance testing of the entire system, and for use during the instruction period hereinafter specified, provide 4 bound copies of an Operation and Maintenance Manual to the Contracting Officer. Each copy is to be in a flexible, oil-resistant protective binder.

2. The manual shall contain complete operation and maintenance instructions for all pumps, controllers, drivers, automatic transfer switches, and pump accessories.

3. The manual shall include an index, copies of all approved shop drawings and submittal materials (updated to as-built), and a complete parts list of all components.

4. The manual shall also include, for each item, the manufacturer's name, the serial number of the part, an ordering number, if appropriate, and a physical description of the part.

H. As-Built (Record) Drawings:

1. On a daily basis, the Contractor Superintendent, in conjunction with the COTR, shall review and record as-built conditions on a set of drawings maintained at the job site.

2. After completion, but before final acceptance of the work, furnish a complete set of full-size as-built drawings in AutoCAD and PDF format for record purposes.

3. The drawings shall not be smaller than 24 inches by 36 inches (610 mm by 910 mm) on reproducible sepia with title block similar to full size contract documents.

4. Provide 1 compact disc containing CAD based drawings in DXF and PDF based format of all as-built drawings and schematics.

1.09 QUALITY ASSURANCE

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Latest edition shall apply.

B. Manufacturers Qualifications

1. National Fire Protection Association (NFPA), latest edition, including all amendments and appendices:

a. NFPA 20 Standard for the Installation of Centrifugal Fire Pumps.

b. [NFPA 37 Stationary Combustion Engines and Gas Turbines]

c. NFPA 70 National Electrical Code.

2. International Code Council (ICC); latest edition: International Building Code.

3. Underwriters Laboratories

C. Installer Qualifications

1. Designer and Installer Requirements: Design shall be by a NICET Level III or IV Technician or a Registered Fire Protection Engineer. Installation shall be performed by a certified sprinkler contractor or a specialist who is experienced in the design and installation of automatic fire pump systems (minimum 3 years).

2. Prior to installation, submit documentation, to the Contracting Officer, showing that the Contractor has successfully installed automatic fire pump systems of comparable size and type as specified herein or that the Contractor has a firm contractual agreement with a Subcontractor having such experience. The data shall include the names and locations of at least two installations where the Contractor, or Subcontractor, installed such systems. The Contractor, or Subcontractor, shall certify that each system has performed satisfactorily for a period of not less than 18 months.

3. Service Organization: The contractor shall furnish, to the Contracting Officer, evidence that there is an experienced and effective service organization which carries a stock of repair parts for the system in order to readily effect repairs throughout the warranty period. Should the contractor fail to comply with the service requirements of this section, the government will then have the option

to make the necessary repairs and back charge the contractor without any loss of warranty or guarantee as provided by the contract documents.

1.10 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.11 PROJECT CONDITIONS

[List any special project conditions and/or environmental limitations on system installation, such as temperature, humidity, ventilation, etc.]

1.12 COORDINATION

A. Coordinate major equipment and piping layouts with other trades to avoid obstructions and excessive changes in piping configuration.

B. Coordinate all electrical connections and fire alarm interfaces.

C. Coordinate all room combustion air and ventilation cooling inlets and vents to avoid potential for pipe freeze.

1.13 WARRANTY

A. Guarantee: The contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the government. Final Acceptance includes, but is not limited to, the receipt of as-built drawings and Operation and Maintenance Manuals.

1.14 SERVICE AGREEMENT

[List requirements, if part of the contract. Confirm with OSHEM and COTR].

1.15 EXTRA MATERIALS

[List special requirements for spare parts, if part of the contract. Confirm with OSHEM and COTR].

PART 2 - PRODUCTS

(Refer to section for general requirements on piping, fittings, valves, and other components.)

2.01 ACCEPTABLE MANUFACTURERS

A. Fire Pump:

1. Aurora
2. ITT-AC
3. Patterson
4. Peerless

B. Fire Pump Controller:

1. Joslyn-Clark
2. Master
3. Hubbell
4. Firetrol

C. Electric Motor:

1. Marathon
2. US Electric

D. Diesel Engine:

1. Clarke
2. Caterpillar
3. Cummins

E. Jockey Pump

1. Aurora
2. Grundfos
3. Armstrong

2.02 VALVES

A. Provide valves as required by NFPA 20 and types UL listed or FM approved for fire protection service.

B. Gate Valves: Provide outside screw and yoke type, for all gate valves servicing the fire pump system.

C. Drainage and test valves shall be all bronze globe, angle, or gate valves.

D. Circulating Relief Valve: Provide circulating relief valves for the fire pump and jockey pump. Relief valves shall be piped to [a floor drain capable of handling the discharge.] [to the main drain line.]

E. Pressure Relief Valves: Provide a pilot operated diaphragm type pressure relief valve where required by NFPA 20. Install relief valve according to the requirements of NFPA 20. The pressure relief valve shall discharge into an [open pipe] [floor drain] or into a cone or funnel secured to the outlet of the valve. Water discharge from the relief valve shall be readily visible or easily detectable by the pump operator.

1. [The relief valve shall not be piped to the pump suction or supply connection.]

2. A shutoff valve shall not be installed in the relief valve supply or discharge piping.

3. The relief valve shall be set to prevent pressure on the fire protection system greater than it can withstand.

4. The relief valve size shall not be less than that required in NFPA 20.

2.03 IDENTIFICATION SIGNS

A. Attach properly lettered and approved metal signs to each control valve, alarm device, inspector's test valve, drain valve, and alarm bypass valve. Each sign shall indicate the normal valve position as well as the portion of the system that the valve serves.

2.04 DRAIN ASSEMBLIES

A. Provide all drain lines as required by NFPA 20. Connect all drain piping to approved drain locations and provide splash guards, where necessary, at discharge outlets. If piped to a floor drain, then floor drains must be of adequate size to readily receive the full flow from each drain line under maximum pressure. All drain discharge outlets on the outside of the building shall be located no higher than 0.3 meters above grade level.

2.05 UNDERGROUND PIPING SYSTEMS

A. (Refer to section 211100 for requirements on underground piping.)

2.06 FIRE PUMP

A. Provide [[__] electric motor driven] [and] [[__] diesel engine drive] fire pump[s]. Each pump capacity at rated head shall be [not less than that indicated] [[__]lpm at a discharge pressure of [__]kPa]. Each pump shall furnish not less than 150 percent of rated capacity at not less than 65 percent of total rated head. Pumps shall be of the centrifugal [horizontal split case with automatic air release] [water lubricated, vertical shaft turbine] type. The pump manufacturer shall have unit responsibility for the proper operation of the complete unit assembly as indicated by field acceptance tests.

B. Capacity: ___gpm,___ft,___psi; head[___]lpm, [___]m, [___]kPa head], [____]RPM, [__] HP, [___] volt, 3 phase, ___inch [__]mm suction and ___inch [__]mm discharge connections. [Pump shall be similar to [_____].]

C. Pump Design:

1. The fire pump shall be of horizontal split case, centrifugal construction, specifically labeled for fire service. The pump shall be connected to the sprinkler [/standpipe] system. The suction supply for the fire pump shall be from a service main as indicated on the drawings.

2. Centrifugal type, horizontal split case, cast iron casings, single stage, renewable bronze wearing rings, double suction enclosed bronze impeller, and bronze impeller wearing rings.

3. Extra heavy steel shaft with renewable bronze or stainless steel shaft sleeves.

4. Deep stuffing boxes with split type bronze glands and external water seal.

5. Heavy duty grease lubricated anti-friction bearings, grease fittings and drain plugs.

6. UL listed and Factory Mutual Approved.

2.07 ELECTRIC MOTOR

A. General: The pump driver shall be horizontal floor mounted ball bearing induction motor rated at [__] HP, 3 phase, [60] hertz with open drip-proof NEMA enclosure for

operating on [__]volt service. Motor horsepower shall not be less than pump horsepower requirements for all points on the pump operating curve. The motor locked rotor current shall not exceed the values stated in NFPA 20. The motor shall be mounted on a steel base common to the pump. The fire pump manufacturer shall accurately align the pump and motor shafts prior to shipment. After field installation, but prior to grouting the base, a millright or similarly qualified person shall check and verify or correct the shaft alignment.

B. Motor type: Delta-wound squirrel cage motor with all leads brought out of the motor terminal box.

C. Bearings: Grease lubricated radial and oil lubricated thrust ball bearings carrying total thrust of entire pump assembly.

D. Drip-proof with drip cover.

2.08 [DIESEL ENGINE:]

A. Shall be [of the make and horsepower rating recommended by the pump manufacturer for the pump being provided. Engine horsepower shall be adequate to drive the pump at all conditions of speed and load over the full range of the pump performance curve] [of ____ horsepower rating].

B. Diesel engine shall be of the compression ignition type with electric starting device taking current from two battery units mounted not less than 12 inches (305 mm) above the floor. Provide lead-acid batteries.

C. Fuel System External to Engine: Provide in accordance with NFPA 20 and NFPA 37. Provide vent piping with weatherproof vent cap. Provide flexible bronze or stainless steel piping connectors with single braid at each piping connection to diesel engine. Supply, return, vent, and fill piping shall be steel piping, except supply and return piping may be copper tubing.

1. Steel Pipe: Schedule 40, black steel with threaded fittings and unions.

2. Copper Tubing: Type K, soft annealed, with flared fittings.

3. Tanks: Double wall aboveground steel tanks complying with UL 80 or UL 142. Underground tanks are not permitted.

4. Valves: Provide valves suitable for fuel oil service. Valves shall have union or threaded end connections.

5. Check Valves: Shall be swing check.

6. Ball Valves: Full port design, copper alloy body, two-position lever handles.

D. Exhaust System External to Engine: Provide in accordance with NFPA 20 and NFPA 37. Provide exhaust mufflers to reduce noise levels to less than 85dBA.

1. Steel Pipe: Schedule 80, black steel with welded end connections and fittings.

2. Flanges: Provide flanges at connections to diesel engines, exhaust mufflers, and flexible connections.

3. Piping Insulation: Products containing asbestos will not be permitted. Provide exhaust piping system inside the building with ASTM C 533 calcium silicate insulation minimum of 3 inches (76.2 mm) thick; secure with not less than 0.375 inch (9.525) mm width fibrous glass reinforced waterproof tape or stainless steel bands spaced not more than 8 inch (203.2 mm) on centers. Provide one layer of asphalt-saturated felt over the insulation prior to installing aluminum jacket. Provide insulation with aluminum jacket, minimum thickness of 26 gage (.4039 mm), with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Secure jacket with stainless steel bands spaced not more than 8 inch (203.2 mm) on centers.

E. Battery Charger: Charger shall be an integral part of the controller or a separate wall-mounted unit. For each battery unit, provide voltmeter to indicate the state of the battery charge and provide ammeter to indicate rate of charge.

2.09 CONTROLLER

A. General: Controllers shall be furnished with digital display and data acquisition control panel for monitoring pump status, power supply status, leg voltage, leg current, phase reversal, fire pump set points, jockey pump set points, and, in the case of diesel controller, all associated failure modes. Control panel shall permit user modifications of settings through a password-protected login. Control panel shall include a USB connection or other digital interface for recording pump and controller status on a daily basis and for recording fire pump test data (20,000 events). Control panel shall provide an alarm for disk error or disk full.

B. Electric Motor Controller: The automatic electric motor controller shall be UL listed and FM approved specifically for fire pump service. The controller shall be arranged for automatic and manual push-button pump starting and automatic and manual push-button pump shutdown. Indicator lights shall be provided for power on and off-normal conditions. Controller shall be completely terminally wired, ready for field connections, and mounted in a NEMA [3R] moisture resistant [1] enclosure arranged so that controller current carrying parts will not be less than 12 inches (305 mm) above the floor. Controller shall be of the [solid state soft start] [across the line] [part

winding] [primary resistor] [auto transformer] [wye-delta closed transition] type with a fault current interrupting capacity determined by the manufacturer as suitable for the pump. Controller shall be sized as specified above for each building and shall be service entrance labeled. The electrical connection between the controller and the motor shall be wired by the equipment installer.

C. [Diesel Motor Controller: The automatic diesel engine controller shall be UL listed and FM approved specifically for fire pump service. Controller shall be completely terminally wired, ready for field connections, and mounted in a NEMA [3R] [1]enclosure. Mount not less than 12 inches [305 mm] above the floor. Controller shall be manual push-button and automatic starting, and manual push-button and automatic shutdown. Provide adjustable zero to 30 minute running timers. Provide two 10-Amp battery chargers with selectable AC voltage, DC voltage and battery type. Provide Minimum run timer, weekly test timer, engine run time meter, and daylight savings time option. Provide LEDs for:

1. Main Switch in Auto
2. Engine Fail to Start
3. Charger Malfunction
4. Battery #1 Trouble
5. Battery #2 Trouble
6. System Pressure Low
7. Engine Running
8. Engine Coolant Temp High
9. Engine Oil Pressure Low
10. Engine Overspeed
11. Low Fuel Level]

2.10 AUTOMATIC TRANSFER SWITCH

A. An automatic transfer switch (A.T.S.) shall be provided in accordance with NFPA 20 for the electric controllers. The A.T.S. shall be constructed by the same manufacturer as the fire pump controller and shall be UL listed and FM-approved for fire pump service.

B. The A.T.S. shall be housed in a separate NEMA [1] [3R] enclosure from the fire pump controller and labeled "Automatic Transfer Switch - Fire Pump."

C. A complete wiring diagram shall be provided for field wiring to the emergency power source and the electric fire pump controller.

D. The A.T.S. shall be rated for withstand current rating (WCR) as appropriate for the pump.

E. Engine control contacts both N.O. an N.C. shall be provided to start the generator set when the normal power source fails. These contacts shall be designed for low voltage start signals.

2.11 GAUGES

A. All gauges shall be liquid-filled type.

B. Suction gauge shall be a compound-type, to provide indication of negative suction conditions.

2.12 PREPACKAGED FIRE PUMP ENCLOSURE

A. The fire pump shall be furnished as a prepackaged assembly, with prefabricated building enclosure. The building enclosure shall have minimum dimensions of 21 ft by 12 ft (6.5 m by 3.65 m).

B. The fire pump building shall be supplied complete with all necessary component parts to form a complete building system, including, but not limited to, the following:

1. Lighting, including battery pack emergency lighting and discharge lighting

2. Ventilation and controls for combustion air and general cooling.

3. An electric draw-through unit heater with 10 adjustable power ratings from 3 kW – 50 kW. Unit heat shall be 208 volt 3-phase and have a built-in thermostat and shall have a default setting of 10°C (50ºF). Heater shall be set initially at 3kW and adjusted as recommended by the manufacturer to maintain the specified minimum temperature.

4. Fire pump

5. Fire pump controller

6. Jockey pump

7. Jockey pump controller

8. Double wall fuel tank

9. Batteries

10. Three Phase 100 Amp Circuit breaker panel. All interior equipment shall be pre-wired to the distribution panel. The panel shall be furnished with (3) spare 30 Amp 2 phase spare breakers for exterior loads.

11. Piping for pump, including suction main, control valve, relief valve, fire pump test header, and all sensing lines and drains.

12. Pump house shall come fully sprinklered and shall have sprinkler control station equipped with monitored control valve, waterflow switch, and test/drain assembly.

C. Building Design Criteria:

1. Comply with American Institute of Steel Construction (AISC) Specifications for Structural Steel Buildings and the American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Steel Members.

2. Vertical live load not less than 40 pounds per square foot applied on the horizontal projection of the roof.

3. The horizontal wind load of the building shall not be less than 110 MPH.

4. Provide an interlocking roof panel system with a 37 mm (1-1/2 inch) pitch over the building width.

5. Connect roof panels to the wall cap through factory-punched holes and corrosion-resistant fasteners.

6. The roof system shall include a gutter and downspout at the low sidewall, eave trim at the high sidewall, and matching rake trim at the building end walls. All gutters and trim shall be galvanized steel pre-painted Arctic White.

7. Provide a design certification signed and sealed by a registered professional engineer.

D. Roof Panel Design:

1. Roof panels shall be supplied in a continuous length from eave line to ridge line and shall be designed to interlock tightly so that no fasteners are required at

intermediate points along the panel side laps.

2. Roof panels shall be 16 inches [406 mm] wide with a smooth surface between the interlocking side ribs. The interlocking ribs shall be a minimum 3 inches [75 mm] high and shall be turned upward.

3. The roof covering shall have no fastener penetrations except at eave lines and ridgelines.

4. Roof panels shall be nominal 20 gage galvanized steel conforming to ASTM A 653. Galvanized coating shall conform to G90 commercial standards. Minimum panel yield strength shall be 50,000 psi.

5. Roof panels shall have a roller or spray applied paint coating with a minimum dry thickness of 1.5 mils. Roof panel coating shall have a flame spread of 0 in accordance with ASTM E84.

6. Finish coat shall be a white siliconized polyester that shall meet the following performance standards after 10 years of continuous exposure to normal atmospheric conditions:

a. Panels shall show no evidence of blistering, peeling, or chipping.

b. Panels shall show no evidence of surface chalking in excess of the No. 4 rating of ASTM D659.

c. Panels, after cleaning, shall not show color change in excess of 7 NBS units when measured in accordance with ASTM D2244.

7. The ceiling shall be insulated with (3-1/2”) [89 mm] thick R11 unfaced fiberglass insulation laid at right angles to the panel ribs. The wall U value shall be a maximum of 0.09 BTU/square foot when calculated in accordance with the Zone Method contained in the ASHRAE Handbook of Fundamentals.

E. Wall Panel Design:

1. Exterior wall panels shall be single continuous length from the base channel to the roofline of the building except where interrupted by wall openings.

2. Wall panels shall be 16” [406 mm] wide with a 3” [75 mm] deep inward turned interlocking side rib. Wall panels shall contain two (19mm by 79) mm 3/4” by 3-1/8” fluted recesses each starting 21/2” [62 mm] from the panel edge. Walls panels shall be fastened internally to the base channel and eave cap of the building with 10 mm electro-galvanized machine bolts placed within the panel

interlock. No wall fasteners shall be exposed on the exterior surfaces of the walls.

3. Wall panels shall be nominal 24 gage galvanized steel conforming to ASTM A-653 with galvanized coating conforming to G90 standards.

4. Minimum yield strength of panel material shall be 40,000 psi.

5. Wall panels shall have a roller or spray applied paint coating with a minimum dry thickness of 1.5 mils. Wall panel coating shall have a flame spread of 0 in accordance with ASTM E84.

6. Finish coat shall be a white siliconized polyester that shall meet the following performance standards after 10 years of continuous exposure to normal atmospheric conditions:

   a. Panels shall show no evidence of blistering, peeling, or chipping.

   b. Panels shall show no evidence of surface chalking in excess of the No. 7 rating of ASTM D659.

7. Panels, after cleaning, shall not show color change in excess of 7 NBS units when tested in accordance with ASTM D-2244.

8. The interior of the metal walls shall be lined with 32” (813 mm) wide nominal 26 gage galvanized steel panels, prepainted Arctic White with 6 mm high by 1”(25 mm) wide flutes on 8”(200 mm) centers.

9. The exterior wall panel void shall be filled with 1/4” (89 mm) 3-1/2” thick R11 unfaced fiberglass insulation. The wall U value shall be 0.16 BTU/square foot when calculated in accordance with the Zone Method contained in the ASHRAE Handbook of Fundamentals.

10. The wall liner systems shall be furnished complete with white base molding and white trim.

F. Doors:

1. All doors shall be 1-3/4”(45 mm) thick flush type.

2. Door panels shall be minimum 20 gage galvanized steel reinforced by laminating to a honeycomb core enclosed with 16 gage end channel.

3. Hinge reinforcements shall be nominal 7 gage. Lock reinforcements shall be nominal 16 gage.

4. Door frames shall be painted with one coat of baked-on primer. All doors shall be pre-assembled in their frames and hardware installed and tested. Field installation of single doors shall not require any frame assembly or hanging.

5. Door hardware shall consist of:

   a. (3) 4-1/2" by 4-1/2" (114 mm by 114 mm) standard weight plain hinges with Satin Stainless finish and non-rising pins.

   b. (3) 11/16" by 5/8" (18 mm wide by 16mm) high extruded aluminum threshold.

   c. 1/4" by ½" (6mm by 13 mm) silicone rubber weather stripping.

   d. Mortise lockset per ANSI A156.13, Series 1000, Grade 1, Function F13, 626 Sating Chrome finish (levers both sides). Lock shall be Schlage. Coordinate through the COTR with SI Locksmith for the master key set.

G. Exhaust Fan shall consist of shutter, fan assembly, wall sleeve, and rear guard. Fan shall have a 115 volt, 1/6 HP direct drive totally enclosed motor rated for continuous duty with thermal overload protection. Guards shall conform to OSHA requirements.

H. Solenoid Operated Louver:

1. Louver shall have O-flanged self-framing design. Louver frame shall be constructed of nominal 14 gage formed aluminum. Louver blades shall be nominal 12 gage extruded aluminum. Finish shall be natural mill finish, unpainted.

2. Louver blades shall be pivoted on ½" (13 mm) diameter aluminum pivot pins through nylon flanged bearings and operated by means of a pull bar operating handle connected to solenoid. All louvers shall be complete with an 18-14 aluminum mesh insect screen.

3. Solenoid operator shall be designed for use with a single panel wall louver. Unit shall be programmed to open the wall louver when the fan motor is activated and shall spring return closed when the fan is deactivated. Solenoid operator shall be equipped with a mounting plate, linkage, and mounting hardware.

I. A/C Motor Operated Louver:

1. Louver shall have O-flanged self-framing design. Louver frame shall be constructed of nominal 14 gage formed aluminum. Louver blades shall be nominal 12 gage extruded aluminum. Finish shall be natural mill finish,

unpainted.

2. Louver blades shall be pivoted on ½" (13 mm) diameter aluminum pivot pins through nylon flanged bearings and operated by means of a pull bar operating handle connected to solenoid. All louvers shall be complete with an 18-14 aluminum mesh insect screen.

3. The motor activator shall provide true spring return operation for reliable fail-safe application and positive closure of dampers. The actuator shall provide 95 degrees of rotation and have a graduated position indicator that shows 0 – 90 degree positions.]

2.13 FIRE ALARM SIGNALS

A. [Alarm and] Supervisory signals shall be sent to the Fire Alarm System to indicate a pump running condition[(alarm)], loss of line power[(supervisory)], phase reversal of line power[(supervisory)], failure to start and trouble condition on the controllers[(supervisory)].

2.14 PRESSURE MAINTENANCE (JOCKEY) PUMPS

A. General: Provide pump with controller to maintain a pressure of __PSI([_]kPa) on the system. Provide electrically driven pump. Pump shutoff pressure shall not exceed [the design working pressure of the system] __PSI ([_ kPa]). Provide approved indicating gate valves of the outside screw and yoke type in the maintenance pump suction and discharge piping. Pump shall start when the pressure drops to ___psi[___]kPa and to stop when the pressure reaches ___psi[___]kPa.

B. Capacity: ___gpm,___psi head[__]lpm, [___]kPa head, [_____]rpm, [_._]HP, [208]volt, [3]phase, ___inch[___]mm suction, ___inch[__]mm discharge connections, similar to[Grundfos Pump Model CR2-60U].

2.15 JOCKEY PUMP MOTOR

A. Squirrel cage induction type, grease lubricated, horizontally mounted, drip-proof with drip cover.

2.16 JOCKEY PUMP CONTROLLER

A. General: Controller shall be wall mounted, factory assembled, wired and tested, and specifically designed for this type of service. The controller shall be U.L. listed and be of the same manufacturer as the main fire pump controller. The control panel shall incorporate a full voltage magnetic starter, fusible disconnect switch, "Hands-off Automatic" selector switch and a pressure switch. The pressure switch shall have a

range of 0 - 2068.4 kPa and have independent high and low settings. The pressure switch shall be directly pipe mounted to a solidly welded bulkhead pipe coupling without any other supporting members and field connections shall be made externally at the controller coupling. The controller shall have a running period timer to prevent too frequent automatic starting of jockey pump motor. The timer shall be set to keep the motor in operation for at least one minute and interwired with the pressure switch.

B. Disconnect/Alarms/Testing: The disconnect switch shall be capable of being padlocked in the "OFF" position with up to 3 padlocks for installation and maintenance safety, and shall also be capable of being padlocked in the "ON" position. Provide a separate audible and visible supervisory signal at the fire alarm panel for each: pump running, loss of power, switched to manual. The jockey pump shut-off pressure shall not exceed 1206.6 kPa. The controller manufacturer, prior to shipment, shall hook-up and test the controller as a completed assembly. This test shall include each function of the controller.

2.17 HOSE MANIFOLD TEST HEADER

A. General: Header shall be constructed and installed in accordance with NFPA 20. Provide flanged inlet connection to hose valve manifold assembly. Provide approved [bronze] [chrome plated] hose gate valves with 2 ½ inch (63.5 mm) [National Standard] male hose threads with matching cap and chain. Locate the assembly 3 feet (.9 m) above grade in the horizontal position for each test header outlet. Assembly hose connections shall be outside of the building. A ball drip valve shall be installed at the lowest point of the piping and discharge to the outside of the building.

B. A detail of the hose valve manifold test header shall be indicated on the contract drawings showing supply arrangement, size of header supply piping, number of hose valves, valve arrangement, and test header location. Where possible, a "straight line manifold" test header which allows the pump to be tested without the use of fire hoses should be provided in lieu of the standard "rosebud" test header. The straight line manifold test header is not a stock item and must be shop fabricated in accordance with the contract drawings.

2.18 NAMEPLATES

A. Fire Pumps: Fire pumps shall be supplied with a factory installed nameplate, containing the following information:

1. Manufacturer, type, and model number

2. Capacity or size.

B. Motor: A nameplate, conforming to NFPA 70, shall be provided on electric motors.

PART 3 - EXECUTION

3.01 FIRE PUMP INSTALLATION

A. Refer to section 211000 for general requirements on the installation of piping, fittings, valves, and other components

B. General: Install fire pumps, [electric drive], [diesel drive], and drive controller per the manufacturer's published installation instructions and NFPA 20.

C. Pumps connected to adjustable-speed drivers must be equipped with a listed relief valve. Where pumps are driven by constant-speed motors and the pump shutoff pressure plus the static suction pressure exceeds the pressure for which the system components are rated 175 psi (1207 kPa), relief valves are required.

D. Concrete Base: Install pump on a concrete base, keyed and doweled to the subfloor, and smooth trowel finished with chamfered edges.

E. Pump Base: Pump base shall be filled with mortar to reduce vibration.

F. Drains: Pipe circulating relief valves, drip basin under pump and ball drips to floor drains with 1 inch (25.4 mm) diameter screwed galvanized pipe. Paint with one coat red enamel.

G. Flushing: Flush all [new] [and] [existing] piping from the point of connection at the underground water supply to the suction flange of the pump. Total quantity of water shall be sufficient to remove all foreign material from the pipe.

H. Demolition: Carefully remove all unwanted materials so as not to damage material which is to remain. Replace existing work damaged by the Contractor's operations with new work of the same construction.

I. Fire Stopping: Fire stop all holes for conduit, piping, or other penetrations which pass through floor slabs, fire-rated walls, partitions with fire-rated doors, vertical service shafts, or any fire-rated assemblies in accordance with Section 078413 Fire Stopping.

3.02 INSTRUCTING OPERATING PERSONNEL

A. Upon completion of the work and at a time designated by the COTR, provide the services of experienced technicians regularly employed by the manufacturer of the pumps, drivers and controllers to instruct Smithsonian operating personnel in the proper operation and maintenance of the equipment.

B. These services shall be for a period of not less than one eight hour working day.

3.03 FIELD INSPECTIONS AND TESTS

A. Inspections: Prior to initial operation, inspect equipment and manufacturer's submittals for conformance with NFPA 20.

B. Preliminary Tests: Perform the following tests on pumps, drivers and other equipment to ensure proper performance, and compliance of the fire pump system with these specifications and NFPA 20. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary test to make necessary adjustments. When tests are completed and corrections made, submit a signed and dated material and test certificate similar to that specified in NFPA 13, with a request for formal inspection and tests.

1. Hydrostatic test on aboveground piping in accordance with NFPA 13 and underground piping in accordance with NFPA 24 in the presence of the Contracting Officer or his designated representative.

2. Visual equipment checks to assure proper compliance with approved shop drawings.

3. Pump start and run to ensure proper operation and to detect pipe, valve and fitting leakage.

4. Test of pump [alarm and] supervisory signals.

5. Additional tests and inspections necessary.

C. Final Inspection and Testing: Advise the COTR when the preliminary tests have been completed and all necessary corrections made, so as to permit final inspection and testing. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the final test. Submit request for testing at least 15 days prior to test date. A final acceptance test will not be scheduled until as-built drawings and operation and maintenance manuals have been received by the COTR.

1. At the final test, a material and test certificate must be provided in accordance with NFPA 13.

2. Up-to-date as-built drawings must be submitted to the COTR at the final test. These drawings shall be undamaged sets of prints of the contract drawings and shop drawings, with changes from the original drawings marked in red.

3. The final test shall be witnessed and supervised by the COTR and the OSHEM fire protection engineer.

4. An experienced technician, regularly employed by the pump installer, shall be present during the final testing. [Where pumps are engine driven, an experienced technician, regularly employed by the engine manufacturer, capable of demonstrating that engine trouble alarms and operating features perform as required shall be present.]

5. Tests shall include no-flow (churn), 100 and 150 percent capacity flows and pressures for compliance with manufacturer's characteristic curves. A full flow waterflow test, utilizing the test header, is required.

6. At this inspection, the Contractor will repeat the required tests as directed. The Contractor shall correct all defects and perform additional tests until the system complies with the contract requirements.

7. The Contractor shall furnish, at the time of the tests, the manufacturer's certified shop test characteristic curves for each pump as well as all appliances, equipment, [water,] [electricity,] instruments, connecting devices and personnel for the tests. In particular, the Contractor shall provide hoses, underwriter playpipes, pitot tube, calibrated gauges (3), volt/amp meter, hand-held tachometer and necessary tools. [The Government shall furnish water for the tests.]

8. Any cost incurred by the Smithsonian for additional tests (due to the failure of the contractor to demonstrate that the system is functioning properly during the final test) shall be borne by the Contractor.

END OF SECTION 213110

SECTION 27 05 00

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Drawings, and Division 1, General Requirements, of the contract govern the work of this section.

1.2 SUMMARY

A. This specification is to be used as a base document in conjunction with all other Contract Division 27 specifications for the installation of a complete communications system. Section includes:

1. Technical Standards
2. Definitions.
3. General Administrative Requirements
4. Submittals.
5. Quality assurance.
6. Warranty
7. Material Delivery, storage, and handling.
8. Substitutions
9. Examination
10. Demolition
11. Installation
12. Field quality control.
13. Project closeout and record documents.

B. Related Specifications

1. Divisions-02 through -49 Sections for Work to be performed to complete Division-27 requirements.

2. Division 27 Specifications:

   a. Section 27 0526 “Grounding and Bonding for Communication Systems” for work associated with grounding and bonding telecommunications systems.
   b. Section 27 1100 “Communications Equipment Room Fittings” for racks, cabinets, cross connects, panels and telecommunications equipment.

c. Section 27 1300 “Communications Backbone Cabling” for work associated with backbone cabling systems.
d. Section 27 1500 “Communications Horizontal Cabling” for work associated with communications cable distribution to Work Area Outlets.

1.3 TECHNICAL STANDARDS

All designs and installations shall be done in accordance with the following codes and standards. The codes and standards are minimum requirements. The most stringent requirement between the codes, standards and the Contract documents shall be followed. The contractor is responsible for the research of all codes, standards, and regulations, including federal, state and local, which are applicable to the project. All work shall comply with the requirements of the latest edition of codes and regulations in use by the local jurisdiction at the time of the design and installation.

NFPA 70 National Electric Code (NEC)

NFPA 75 Protection of Information Technology Equipment

Underwriter's Laboratories (UL): Applicable listing and ratings.

BICSI TDMM “Telecommunications Distribution Methods Manual”

TIA-526-7 Revision A Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

TIA-526-14 Revision C Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant

TIA-568.C.2 Revision C Balanced Twisted-pair Telecommunications Cabling and Components Standards

TIA-568.C.3 Revision C Optical Fiber Cabling Components Standard

TIA-568.C.4 Revision C Broadband Coaxial Cabling and Components Standard

TIA-568.0.D Revision D Generic Telecommunications Cabling for Customer Premises

TIA-568.1.D Revision D Commercial Building Telecommunications Infrastructure Standard

TIA-569 Revision D Telecommunications Pathways and Spaces

TIA-606 Revision B Administration Standard for Telecommunications Infrastructure

TIA-607 Revision B Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises

TIA-758 Revision B Customer-Owned Outside Plant Telecommunications Infrastructure Standard

1.4 DEFINITIONS

A. General: Basic Contract definitions are included in the Division 01-27 Sections and other Contract Documents.

B. The following list of terms used in this Specification shall be defined as follows:

1. "AHJ": Authority Having Jurisdiction
2. "ANSI": American National Standards Institute
3. "Contractor": Telecommunications Installation Company
4. "COR": Contracting Officer's Representative.
5. "COTS": Commercial Off the Shelf
6. "TIA": Telecommunications Industry Association
7. "TS": Telecommunications Space-Telecom Room, Equipment Room, IDF, MDF

1.5 GENERAL ADMINISTRATIVE REQUIREMENTS

A. The installation shall be done in accordance with all codes and regulations of the Authority Having Jurisdiction (AHJ).

B. The contractor shall have the proper licensing and provide all necessary permits and inspections required by the AHJ and the local jurisdictions.

C. The contractor shall provide all necessary parts, tools, equipment, and labor to install a complete and functional structured cable system per the contract documents, specifications, and drawings.

D. The contractor shall have experience in the structured cable plant installation business for at least five (5) continuous years. References for 3 projects of similar size, complexity, and length of performance are required.

E. The contractor shall have BICSI certified technicians performing the installation work or have at least 10 years of installation experience in Smithsonian Institution buildings.

F. Unless waived by Smithsonian's OCIO Network Management Division, the contractor shall be a Certified Partner of the Manufacturer's parts being installed. The proper number or percentage of technicians performing the installation shall have the Manufacturer's certification per the Manufacturer's requirements.

1.6 SUBMITTALS

A. All submittals shall be in accordance with the Contract, Division 01 and 27 requirements.

B. Submit manufacturer's written detailed technical product information and specifications for each type of product proposed for installation. Each submittal shall be marked with the section and paragraph numbers of the corresponding specification. Transmit all submittals to the COR or COR's designee. Written approval shall be received from the COR for the product prior to release of order for the products and equipment. At a minimum, include products listed in the Division-27 Specifications. Include all relevant products that will be installed, whether listed or not in the Specifications.

C. Submit the parts of a system or assembly, which require many parts to make a whole, together.

D. Submit shop drawings per the Contract requirements or if the proposed installation differs from the Contract Documents, the design intent, or as requested by the COR.

E. Allow 15 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.

F. As-built documentation shall fully represent actual installed conditions and shall incorporate revisions made during the course of construction.

G. Provide final test results for all cabling. Provide Manufacturer's warranty for installed cable plant.

1.7 QUALITY ASSURANCE

A. Materials and equipment furnished shall be new, unused and without defects. Furnish only specified products and equipment that have been approved in writing by the COR. The materials installed shall be consistent during the entire project.

B. Provide materials and equipment produced as standard products by a manufacturer regularly engaged in producing the specified materials and equipment.

C. All items including cables, faceplates, patch panels, racks/cabinets, and bonding equipment shall be labeled in accordance with OCIO labeling requirements and ANSI/TIA 606-B labeling standards. All means of labeling/identification shall be visible and clearly identifiable by OCIO personnel. All labels shall be machine generated or engraved. All labels shall be constructed and attached by means to ensure the lifespan of the label to be equal or greater than that of the device being identified.

D. The contractor shall provide a Project Manager for the duration of the project to coordinate the installation and provide the necessary documentation. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this section.

E. Contractor shall comply with all the technical standards and specifications listed in this document and the contract.

1.8 WARRANTY

A. Telecommunications cable system, as specified in this Section, shall carry a minimum 20 year extended system and applications warranty. The extended warranty shall cover parts and labor for the duration of the extended warranty. The extended warranty shall also cover electrical performance of the twisted pair cabling system to the specific category per ANSI/TIA 568-C performance criteria for cabling. Contractor shall warrant installed hardware, under normal use and service, to be free from defects and faulty workmanship during the warranty period.

PART 2 - PRODUCTS

2.1 GENERAL

A. Refer to Division 27 sections for approved products or specifications.

B. All materials and equipment shall be manufactured by a manufacturer that regularly and presently produce the materials and equipment specified for this project. The manufacturer shall have been in business for more than five years. The materials and equipment shall be standard COTS and replacements shall be readily available.

C. The materials provided for the “link” shall meet the required Contract specifications and documents and be either from the same manufacturer or be part of a warrantied system in which two manufacturers’ warranty a system together.

2.2 MATERIAL DELIVERY, STORAGE AND HANDLING

A. Protect equipment and materials during shipping, storage, and handling to prevent damage. Equipment and materials shall be protected against physical damage, dirt, moisture, humidity, and temperature.

B. Store materials in a clean, dry, ventilated space. Do not store equipment and materials outside of manufacturer's specified environmental conditions. Storage outdoors covered by rainproof material is not acceptable.

C. Deliver materials in manufacturer's original, unopened, undamaged packaging with identification labels intact.

D. Do not install damaged equipment and materials. Remove from site and replace with new. Dents and paint damage to racks and cabinets shall be refinished or switched out for new at the discretion of the COR.

E. All risk of damage will remain with the Contractor until project completion and acceptance of the installation by the COR. Before that time, the Contractor is solely responsible for theft, loss, and damage of equipment and materials.

2.3 SUBSTITUTIONS

A. Do not provide substitution material, processes or equipment without written authorization from the COR.

B. Requests for substitutions shall adhere to the general requirements and procedures outlined in Division 01.

C. Where items are noted as "or comparable", a product of equivalent function, design, construction, quality and performance will be considered. Include in the substitution request: catalog cuts, product information, and pertinent test data required to substantiate that the product is in fact equivalent to that specified. Only one substitution will be considered for each product specified.

D. Substitutions shall be equivalent, in the opinion of the COR, to the specified product. The burden of proof of such shall rest with the Contractor. When the COR in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted product, component, article, or material to be equivalent to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the Work, or from any provisions of the Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination of the site conditions is the responsibility of the Contractor. Examine conditions for compliance with requirements of other sections in which related work is specified and determine if conditions for Division 27 installation to proceed are satisfactory. Do not proceed if conditions are unsatisfactory and notify the COR. This includes pathways, conduits, and boxes.

B. Verify conditions are acceptable for product installation in accordance with Contract and manufacturer's requirements. For manufacturer, verify environmental conditions are within the parameters and pathway supports are properly installed.

C. Verify all fire rated walls being penetrated have a properly installed and rated fire stop assembly.

3.2 DEMOLITION

A. Coordinate all utility outages with the COR per Division-01 requirements.

B. All telecommunications cabling which will not be in use and is disconnected from termination devices shall be completely demoed from termination device to termination device.

C. Develop a written project schedule listing the timing of work that will affect occupied areas. Provide the schedule to the COR for verification of acceptability. Work shall not proceed until acceptance is given by the COR.

3.3 INSTALLATION

A. Comply with all applicable codes and standards as listed under the Technical Standards of this Section.

B. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

1. Maintain jobsite file and comply with MSDS for each product delivered to jobsite.

C. Coordinate installation work with the General Contractor to meet the construction schedule. Attend construction meetings as necessary to fulfill this requirement.

D. Protect installed products, surrounding areas, and finish surfaces from damage during construction activities. Provide temporary coverings on surfaces for protection from dust

and construction / installation debris. Outlets, patch panels, fiber connections and housings, and cabinets shall be protected from dust infiltration.

E. Clean the Project site daily. Remove temporary coverings and protection of adjacent work areas. Remove unused products, debris, spills, or other excess materials.

F. Review installed work in conjunction with the General Contractor and develop a punch list for items needing correction. Provide punch list to the COR for review prior to the acceptance walk-thru.

G. TRs need to be finished and turned over to OCIO before the rest of the project's spaces are completed. The date of turnover will be decided by OCIO and Smithsonian Facilities before the project begins and needs to be maintained on the project schedule. At the time of turnover, the TRs need to be complete, dust free, and access controlled. Electrical and HVAC needs to be operational. Spaces around the TR shall also be finished to the level of being dust free. No work is allowed in the TRs and dust mitigation needs to be provided by the General Contractor or Contractor to prevent adjacent construction zone work's dust from entering the TRs once the TR is turned over.

3.4 FIELD QUALITY CONTROL

A. Provide a qualified Field Supervisor who is a BICSI Certified Technician in charge of the Work and is present at the job site during all times Work is being performed or who has 10 years of experience working in conjunction with OCIO on Smithsonian Institution projects. Perform the installation within the restraints of the construction schedule.

B. Coordinate and attend weekly status meetings to review the overall progress and issues to be resolved throughout the course of construction. Prepare and distribute meeting agenda prior to and meeting notes after meetings in a format acceptable to the COR.

C. Scheduling: Prepare an overall construction schedule based on the results of the planning meetings with the COR. Prepare and issue updated schedules whenever there are modifications.

D. Perform weekly reviews, at a minimum, and provide a written report. Keep areas of work accessible and notify the COR of completed work released for review. A final punchlist shall be signed by the COR indicating all reviewed deficiencies have been corrected.

3.5 PROJECT CLOSEOUT AND RECORD DOCUMENTS

A. Provide a completed punch list and the necessary as-built documentation to the COR and a written form of acceptance for signature. Corrections must be completed before the COR will give acceptance.

B. The as-built documentation shall contain as-built drawings showing the layouts, rack elevations, and outlet numbering of all TRs and floors with all changes during the project detailed in the drawings; test results with all outlets showing PASS; and a binder with all materials and equipment manuals.

END OF SECTION 27 0500

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Drawings, and Division 1, General Requirements, govern the work of this section.

1.2 SUMMARY

A. Section includes grounding and bonding requirements for communications installations.

B. Related Sections:

1. Section 260526 “Grounding and Bonding for Electrical Systems: for additional general requirements associated with Division-27 Work.
2. Section 260528 “Pathways for Electrical Systems” for work associated with communications systems.
3. Section 270500 “Common Work Results for Communications: for additional general requirements associated with Division-27 Work.

1.3 TECHNICAL STANDARDS

All designs and installations shall be done in accordance with the following codes and standards. The codes and standards are minimum requirements. The most stringent requirement between the codes, standards, and the Contract documents shall be followed. The contractor is responsible for the research of all codes, standards, and regulations, including federal, state and local, which are applicable to the project. All work shall comply with the requirements of the latest edition of codes and regulations in use by the local jurisdiction at the time of the design and installation.

NFPA 70 National Electric Code (NEC)

NFPA 75 Protection of Information Technology Equipment

TIA-568.C.2 Revision C Balanced Twisted-pair Telecommunications Cabling and Components Standards

TIA-568.C.4 Revision C Broadband Coaxial Cabling and Components Standard

TIA-568.0.D Revision D Generic Telecommunications Cabling for Customer Premises

TIA-568.1.D Revision D Commercial Building Telecommunications Infrastructure Standard

TIA-569 Revision D Telecommunications Pathways and Spaces

TIA-606 Revision B Administration Standard for Telecommunications Infrastructure

TIA-607 Revision B Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises

TIA-758 Revision B Customer-Owned Outside Plant Telecommunications Infrastructure Standard

NECA/BICSI 607-2011 Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

BICSI TDMM Telecommunications Distribution Methods Manual

1.4 DEFINITIONS

A. General: Basic Contract definitions are included in other Division 01 and -27 Sections and other Contract Documents.

B. In addition, the following list of terms used in this Specification shall be defined as follows:

1. “AHJ”: Authority Having Jurisdiction
2. “AWG”: American Wire Gauge.
3. “GE”: Grounding Equalizer
4. “TBB”: Telecommunications Bonding Backbone
5. “TGB”: Telecommunications Grounding Busbar
6. “TMGB”: Telecommunications Main Grounding Busbar

1.5 SYSTEM DESCRIPTION

A. Work under this Section shall include the design and planning of the telecommunications grounding/bonding system, the furnishing of the necessary materials, and the labor and associated services to install a complete working

telecommunications grounding/bonding system per the aforementioned Technical Standards.

B. Telecommunications grounding/bonding systems consist of the following subsystems:

1. Grounding/Bonding Conductors.
2. Grounding/Bonding Busbars.
3. Grounding/Bonding Connectors.
4. Cable identification tags and system labeling.
5. Record documents.

1.6 SUBMITTALS

A. All submittals shall be in accordance with Contract, Division 01, and Division 27 requirements.

B. Product Data: Submit manufacturer's written detailed technical product information and instruction installations for each type of product proposed for installation.

C. Samples: When requested, provide a sample of labels for conductors and busbars.

D. Shop Drawings: Plans providing point-to-point wiring diagrams of proposed pathway routes.

E. As-built drawings to be included in Operation and Maintenance Manuals. As-built drawings shall depict the following: installed pathways layout; location of all connections to the TBB; labeling of each telecom busbar; final IDF and MDF layouts; final wall and rack elevations; and one line riser diagrams for grounding and bonding.

1.7 QUALITY ASSURANCE

A. Work performed shall be according to Project documents and manufacturer's written specifications.

B. Material and equipment shall be new and conform to grade, quality, and standards specified.All items including bonding conductors and busbars shall be labeled in accordance with OCIO labeling requirements and ANSI/TIA 606-B labeling standards. All means of labeling/identification shall be visible and clearly identifiable by OCIO personnel. All labels shall be machine generated or engraved. All labels shall be constructed and attached by means to ensure the lifespan of the label to be equal or greater than that of the device being identified.

C. Installer shall have BICSI trained technicians or shall have 10 or more years' experience doing installations for the Smithsonian Institution.

D. Comply with all the above referenced standards.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Grounding and Bonding Conductors:

1. Provide insulated stranded copper equipment grounding conductors, with the exception of solid copper conductors for sizes 6 mm² (10 AWG) and smaller. Identify all grounding conductors with continuous green insulation color or green with a yellow stripe. For sizes 25 mm² (4 AWG) and larger, identify wire per NEC.
2. Provide bare stranded copper bonding conductors, with the exception of solid bare copper for wire sizes 6 mm² (10 AWG) and smaller.

B. Telecommunication System Ground Busbars:

1. Telecommunications Main Grounding Busbar (TMGB):

a. 6.4 mm (1/4 inch) thick solid copper bar.
b. Minimum 100 mm (4 inches) high and length sized in accordance application requirements and future growth of minimum 510 mm (20 inches) long.
c. Minimum thirty predrilled attachment points for attaching standard sized two-hole grounding lugs.

1) At least 15 lugs with 15.8 mm (5/8 inch) hole centers.
2) At least 3 lugs with 25.4 mm (1 inch) hole centers.

d. The contractor shall use wall-mount stand-off brackets, assembly screws and insulators for at least 50mm (2 inches), with preferably 100 mm (4 inches), standoff from wall.

e. Listed as grounding and bonding equipment.

2. Telecommunications Grounding Busbar (TGB):

a. 6.4 mm (1/4 inch) thick solid copper bar.

b. Minimum 50 mm (2 inches) high and length sized in accordance application requirements and future growth of minimum 300 mm long (12 inches) long.

c. Minimum nine predrilled attachment points (one row) for attaching standard sized two-hole grounding lugs.

1) 6 lugs with 15.8 mm (5/8 inch) hole centers.
2) 3 lugs with 25.4 mm (1 inch) hole centers.

d. The contractor shall use wall-mount stand-off brackets, assembly screws and insulators with at least 50mm (2 inches), but preferably 100 mm (4 inches), standoff from the wall.

e. Listed as grounding and bonding equipment.

C. Equipment Rack and Cabinet Ground Bars:

1. Solid copper ground bars designed for horizontal mounting to framework of open racks or enclosed equipment cabinets:

a. At least a 4.7 mm (3/16 inch) thick by 19.1 mm (3/4 inch) high copper bar.

b. 482 mm (19 inches) EIA/ECA-310-E rack mounting width for mounting on racks or cabinets.

c. Two each 12-24 x 19.1 mm (3/4 inch) screws and flat washers for attachment to rack or cabinet.

d. Listed as grounding and bonding equipment.

D. Irreversible Compression Lugs:

1. Electroplated tinned copper.
2. Two holes spaced on 15.8 mm (5/8 inch) or 25.4 mm (1 inch) centers.
3. Sized to fit the specific size conductor.

E. Antioxidant Joint Compound: Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Exterior Equipment Grounding: Bond exterior metallic components (including masts and cabinets), antennas, raceways, primary telecommunications protector/arresters, secondary surge protection, waveguides, cable shields, and other conductive items directly to Telecommunications Bonding System.

B. Install telecommunications bonding backbone conductor throughout building via telecommunications backbone pathways effectively bonding all interior telecommunications grounding busbars in telecommunications rooms, antenna headend equipment room, telephone operators room, main computer room, VoIP active equipment room, and network operations room to TMGB after testing bond to verify bonding conductor for telecommunications from grounding electrode conductor is installed per NEC. Size telecommunications bonding backbone conductor as specified in TIA-607-B.

1. All connections to the TBB shall be exothermic welds.
2. Label conductor with exact source and destination information.

C. Conduit Systems:

1. Bond ferrous metallic conduit to ground.
2. Bond grounding conductors installed in ferrous metallic conduit at both ends of conduit using grounding bushing with #6 AWG conductor.

D. Boxes, Cabinets, and Enclosures:

1. Bond each pull box, splice box, equipment cabinet, and other enclosures through which conductors pass to ground.

E. Corrosion Inhibitors: Apply corrosion inhibitor for protecting connection between metals used to contact surfaces, when making ground and ground bonding connections.

F. Telecommunications Grounding System:

1. Bond telecommunications grounding systems and equipment through the TMGB using the Electrical Bonding Conductor to facility's electrical grounding electrode at Intersystem Bonding Termination.
2. Provide hardware as required to effectively bond metallic cable shields, communications pathways, cable runway, and equipment chassis to ground.
3. Install bonding conductors without splices using shortest length of conductor possible to maintain clearances required by NEC.

4. Provide paths to ground that are permanent and continuous with a resistance of 1 ohm or less from each raceway, cable tray, and equipment connection to telecommunications grounding busbar.
5. All connections to the TBB shall be exothermic welds.
6. Bonding Jumpers:

    a. Assemble bonding jumpers using insulated ground wire of size and type shown on drawings or use a minimum of 16 mm² (6 AWG) insulated copper wire terminated with compression connectors of proper size for conductors.
    b. Use connector manufacturer's compression tool.
    c. Label bonding jumpers with exact source and destination information.

7. Bonding Jumper Fasteners:

    a. Conduit: Connect bonding jumpers using lugs on grounding bushings or clamp pads on push-type conduit fasteners. Where appropriate, use zinc-plated external tooth lockwashers or Belleville Washers.
    b. Wireway and Cable Tray: Use grounding hardware and methods per the manufacturer's guidelines.
    c. Grounding Busbars: Fasten bonding conductors using two-hole compression lugs.

G. Telecommunications Room Bonding:

1. Telecommunications Grounding Busbars:

    a. Install busbar hardware no less than 950 mm (18 inches) A.F.F.
    b. Where other grounding busbars are located in same room, e.g. electrical panelboard for telecommunications equipment, bond busbars together as indicated on grounding riser diagrams.
    c. Make conductor connections with two-hole compression lugs sized to fit busbar and conductors or exothermic welds.
    d. Attach lugs with stainless steel hardware after preparing bond according to manufacturer recommendations and treating bonding surface on busbar with anti-oxidant to help prevent corrosion.
    e. Label Busbar using Telecommunications Room.

H. Self-Supporting and Cabinet-Mounted Equipment Rack Ground Bars:

1. Install rack-mount horizontal busbar to provide multiple bonding points,
2. At each rack or cabinet containing active equipment or shielded cable terminations:

a. Bond busbar to ground as part of overall telecommunications bonding and grounding system.
b. Provide 16 mm² (6 AWG) bonding jumpers between rack and cabinet ground busbars and overhead cable runway or raised floor stringers, as appropriate.
c. Label cabinet grounding bar by cabinet or rack ID number.

I. Other Communication Room Ground Systems: Ground metallic conduit, pathways, and other metallic equipment located away from equipment racks or cabinets to telecommunications ground busbar using insulated 16 mm² (6 AWG) ground wire bonding jumpers.

J. Communications Cable Grounding:

1. Bond all metallic cable sheaths in multi-pair communications cables together at each splicing or terminating location to provide 100 percent metallic sheath continuity throughout communications distribution system.
2. Install a cable shield bonding connector with a screw stud connection for ground wire, at terminal points. Bond cable shield connector to ground.
3. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or splice case manufacturer's splice case grounding and bonding accessories. When an external ground connection is provided as part of splice closure, connect to an effective ground source and bond all other metallic components and equipment at that location.

K. Communications Cable Tray Systems:

1. Bond metallic structures of cable tray to provide 100 percent electrical continuity throughout cable tray systems.
2. Where metallic cable tray systems are mechanically discontinuous:

a. Install splice plates or grounding hardware provided by cable tray manufacturer between cable tray sections so resistance across a bolted connection is 0.010 ohms or less, as verified by measuring across splice plate connection.
b. Install 16 mm² (6 AWG) bonding jumpers across each cable tray splice or junction where splice plates or manufacturer's grounding hardware cannot be used.

3. Bond cable tray installed in same room as telecommunications grounding busbar to busbar.

L. Communications Raceway Grounding:

1. Conduit: Use insulated 16 mm² (6 AWG) bonding jumpers to bond metallic conduit at both ends and intermediate metallic enclosures to ground.
2. Cable Tray Systems: Ground using manufacturer's recommended guidelines using the manufacturer's grounding hardware.

3.2 FIELD QUALITY CONTROL

A. Perform tests per BICSI's Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.

B. Perform two-point bond test using trained installers qualified to use test equipment.

C. Conduct continuity test to verify that metallic pathways in telecommunications spaces are bonded to TGB or TMGB.

D. Conduct electrical continuity test to verify that TMGB is effectively bonded to grounding electrode conductor.

E. Perform a resistance test to ensure patch panel, rack and cabinet bonding connection resistance measures less than 5 Ohms to TGB or TMGB.

END OF SECTION 27 05 26

SECTION 27 11 00
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Drawings, and Division 1, General Requirements, govern the work of this section.

1.2 SUMMARY

A. Section includes equipment room and telecommunications room fitout.

B. Related Sections:

1. Section 06 1000 “Miscellaneous Rough Carpentry” for plywood backing panels.
2. Section 07 8413 “Penetration Firestopping” for penetrations in fire-resistance-rated walls and horizontal assemblies.
3. Division-26 Sections for materials and installation methods common to the Work associated for Division-27,
4. Section 27 0500 “Common Work Results for Communications” for additional general requirements associated with Division-27 work.
5. Section 27 0526 “Grounding and Bonding for Communications Systems” for work associated with grounding and bonding systems to provide for personnel safety.
6. Section 27 1300 “Communications Backbone Cabling” for work associated with backbone cabling systems.
7. Section 27 1500 “Communications Horizontal Cabling” for work associated with horizontal cable systems.

1.3 TECHNICAL STANDARDS

All designs and installations shall be done in accordance with the following standards. The contractor is responsible for the research of all codes, standards, and regulations, including federal, state and local, which are applicable to the project. All work shall comply with the requirements of the latest edition of codes and regulations in use by the local jurisdiction at the time of the design and installation.

NFPA 70 National Electric Code (NEC)

TIA-568.0 D Revision D Generic Telecommunications Cabling for Customer Premises

TIA-568.1 D Revision D Commercial Building Telecommunications Infrastructure Standard

TIA-569 Revision D Telecommunications Pathways and Spaces

TIA-606 Revision B Administration Standard for Telecommunications Infrastructure

TIA-607 Revision B Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises

TIA-758 Revision B Customer-Owned Outside Plant Telecommunications Infrastructure Standard

BICSI TDMM Telecommunications Distribution Methods Manual

1.4 DEFINITIONS

A. General: Basic Contract definitions are included in other Division 01 and 27 Sections and other Contract Documents.

B. In addition, the following list of terms as used in this Specification shall be defined as follows:

1. "ER": Equipment Room, environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate cross-connect.
2. "IDF": Intermediate Distribution Frame, space on each floor for housing telecommunication equipment, horizontal station cabling, backbone cabling, and horizontal/intermediate cross connects. A synonym is TR.
3. "MDF": Main Distribution Frame, centralized space where telecommunications equipment, including the main core switch, phone system and servers, are usually housed. The main cross connects are contained in this room. A synonym is ER.
4. "TGB": Telecommunications Grounding Busbar, grounding busbar in each IDF and MDF which connects back to building ground and contains the bonding/grounding connections for the room.

5. "TR": Telecom Room, space on each floor for housing telecommunication equipment and a common access point to the horizontal cross-connect and backbone pathways.
6. "UPS": Uninterruptible Power Supply

1.5 SYSTEM DESCRIPTION

A. Work under this Section shall include the planning and coordination of the buildout of the TRs/ IDFs and ER/MDFs. The furnishing of necessary materials, and the labor and associated services required to install a complete working telecommunications cabling system.

TRs shall not be used to support any other building utility nor shall other utilities transit the TRs. IDF/TRs shall house the following functions:

1. Fiber Data backbone cross-connect field.
2. Analog Voice backbone cross-connect field.
3. Data system switches.
4. Horizontal termination field of outlets served from this room.
5. Intermediate cross-connect between the data system equipment and the horizontal termination field.
6. Video backbone (coaxial terminations).
7. Horizontal and backbone cable support pathways.

B. The following functions/equipment occur or are housed in the MDF:

1. Main and intermediate cross-connect point.
2. Core and access network switches.
3. OCIO Servers and Equipment
4. UPS

C. The buildout of IDF/TRs and the MDF shall include the following Work:

1. Plywood on the walls.
2. Grounding/bonding of all equipment.
3. Firestopping of sleeves and core holes.
4. Static-dissipative resilient floor covering.
5. Telecommunication racks (equipment racks, vertical management sections, anchoring, and bracing).
6. Cable, wire and patch cord management.
7. Overhead cable support.
8. Identification tags and labeling.

9. Record Documents.
10. Warranty.

1.6 SUBMITTALS

A. All submittals shall be in accordance with Contract, Division 01, and Divisions 27 requirements.

B. Product Data: Submit manufacturer's written detailed technical product information and instruction installations for each type of product proposed for installation.

1. Provide information on each proposed firestop system with respective material safety data sheets (MSDS) for approval.

C. Sample of typical equipment rack label.

D. Shop Drawings: Include all proposed changes to TR(s) design.

E. Record drawings to be included in Operation and Maintenance Manuals.

1.7 QUALITY ASSURANCE

A. Work performed shall be according to Project documents and manufacturer's written specifications.

Material and equipment shall be new, with each product by the same manufacturer throughout the Project, and conform to grade, quality and standards specified.

B. All Racks and Cabinets shall be labeled in accordance with OCIO labeling requirements and ANSI/TIA 606-B labeling standards. All means of labeling/identification shall be visible and clearly identifiable by OCIO personnel. All labels shall be engraved plastic. All labels shall be constructed and attached by means to ensure the lifespan of the label to be equal or greater than that of the device being identified.

C. Comply with Telecommunications Industry Association (TIA)-569-B Series "Commercial Building Standard for Telecommunications Pathways and Spaces" and the Building Industry Consulting Services International, Inc. (BISCI) "Telecommunications Distribution Methods Manual" (TDMM).

D. Installer shall have BICSI and manufacturer trained technicians or shall have 10 or more years' experience doing installations for the Smithsonian Institution.

PART 2 - PRODUCTS

2.1 EQUIPMENT RACKs

A. 7’ x 19” 2-Post Equipment Rack

1. Rack shall be UL Listed with a load rating of 1,000 lbs.
2. Upright Mounting Channels shall be 150mm (6”) deep.
3. The mounting holes pattern shall be industry standard (ANSI/EIA)-310-D. The mounting holes shall be double sided pre-threaded #12-24.
4. The rack shall come complete with base angles and top angles The assembled rack shall be 7-feet high (overall) by 19-inches mounting width (20-1/4-inches wide overall), and shall contain 45 Numbered Rack Mounting Unit (RMU) mounting spaces.
5. A full package of the manufacturer’s rack screws shall be provided with each rack.

B. 7’ x 19” 4-Post Equipment Rack

1. Rack shall be UL Listed with a load rating of 2,500 lbs.
2. Depth shall be 762mm (30”) or greater.
3. The mounting holes pattern shall be industry standard (ANSI/EIA)-310-D. The mounting holes shall be double sided pre-threaded #12-24 and on back and front rails.
4. The assembled rack shall be 7-feet high (overall) by 19-inches mounting width (20-1/4-inches wide overall), and shall contain 45 Numbered Rack Mounting Unit (RMU) mounting spaces.
5. A full package of the manufacturer’s rack screws shall be provided with each rack.

2.2 VERTICAL CABLE MANAGEMENT FOR FLOOR-STANDING RACK

A. Vertical cable management(VCM) shall be double sided with front and back troughs.

B. VCM shall be 2100 mm (84”) high and at least 150 mm (6”) wide, with at least 150 mm (6”) deep cable storage capacity in back and in front.

C. The cable manager should have fingers for horizontal cable management.

D. The vertical management section shall have matching bolt holes for attachment to the rack.

E. The vertical cable management between two racks shall have an 150mm(6”) wide channel.

2.3 HORIZONTAL MANAGEMENT PANEL

A. Provide a two RMU, 4 inch deep, front only horizontal organizer for usage between 48 Port patch panels. Provide a one RMU 4 inch deep front only horizontal organizer for usage between the fiber panel and patch panel or between 24 Port Patch panels.

2.4 CABLE RUNWAYS

A. Horizontal Cable Runway in the IDF/TR shall be 38.1mm x 9.53mm x 1.65mm (1 1/2" x 3/8" x .065") side stringers. The cross members are 12.7mm x 30mm x 1.65mm (1/2" x 1" x .065") and are welded at 230mm (9") intervals.

1. Shall be UL Classified for suitability as an equipment grounding conductor.
2. All junction and butt splice connections shall be UL Classified.
3. Finish shall be Black.
4. Size cable runway per cable load.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Racks shall be bolted to the floor using all four bolts. The rack shall be installed level. Racks shall connect to ladder rack above using rack to runway brackets.

1. Placement of the rack shall correspond to the design drawings. Any deviation shall be brought to the attention of the COR.
2. The rack shall have a clearance of 900mm (3') in front, back, and on one side.
3. The rack shall have a bonding bar which is bonded to the nearest TGB.
4. Vertical Cable Management shall be installed on each side of the rack. For two racks side by side, The middle vertical cable manager shall be wider than the end managers.
5. Install horizontal management and patch panels to the equipment racks per the manufacturer's written installation instructions and as shown on the Drawings.
6. Furnish one bag of 50 Bonding mounting screws per equipment rack.

B. Install black 12" Ladder Rack at 7' Overhead for Cable Support.

1. Ladder Rack shall be installed per the drawings. The COR should be notified of changes.
2. The ladder rack shall be supported by the racks, wall angle brackets, and ceiling supports.

C. Install black Ladder Rack for vertical cable support at the locations as shown on the Drawings for use to support cables routing vertically from conduits/sleeves to the overhead cable support.

1. Provide parts required to complete the installation (e.g., vertical mounting brackets, bolts, foot kit, etc.).
2. Where cable runway is used, install the runway such that the rungs are facing outward (the greater distance from the rung to the stringer edge is facing inward).

D. Bond all racks and ladder rack to the TGB.

E. All racks shall be labeled as to the identity of the device indicated on the Drawings. The label shall be made of plastic laminate and attached at the center of the front top rail of the rack and shall be visible from eye level. The plastic laminate shall be white with black lettering. If the rack is not identified on the drawing, OCIO NMD shall be notified to provide the proper labeling. All labeling shall be approved by OCIO NMD before it is implemented.

E. Refer to Section 27 0500 “Common Work Results for Communications” for type of and installation requirements for labeling on equipment racks.

3.2 CONSTRUCTION

A. Plywood Backing Panels: Two walls shall be fitted with fire-retardant-treated “AC” grade plywood. Mount the plywood 8-inches above-finished-floor. Plywood shall be mechanically fastened directly into wall studs or concrete block.

1. One instance of the “Fire Rating” stamp on each plywood panel shall be visible at normal eye level when mounted. Obtain written acceptance from the COR prior to painting the plywood.
2. Paint surfaces with a standard paint color that enhances the room lighting.

B. Floors, walls, and ceilings shall be finished to minimize dust.

C. Provide an anti-static or static-dissipative tile floor system.

D. Floor penetrations shall be a minimum of three 4-inch bushed sleeve penetrations extending 3-inches above the finished floor. Core drilling shall be done in accordance with Division-01 Specifications.

1. Sleeves for horizontal pathways shall be 8-feet above the finished floor.

E. Vertical cable runway shall be provided on the wall at the riser floor sleeve and ceiling sleeve penetration(s). See the Drawings for exact placement.

F. Fire Protection: Firestop all conduit and pathway floor/wall penetrations, matching the hourly rating of the construction penetrated, that are for passive telecommunications cable installation.

END OF SECTION 27 11 00

SECTION 27 13 00
COMMU NICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Drawings, and Division 1, General Requirements, govern the work of this section.

1.2 SUMMARY

A. Section includes:

1. Backbone ISP (Inside Plant) twisted pair cabling and fiber optic cabling.
2. Backbone OSP (Outside Plant) twisted pair cabling and fiber optic cabling.

B. Related Sections:

1. Section 260XXX “Common Work Results for Electrical” for additional general requirements associated with Division-27 Work.
2. Section 260536 “Cable Trays for Electrical Systems” for work associated with telecommunications cable tray.
3. Section 270500 “Common Work Results for Communications” for additional general requirements associated with Division-27 Work.
4. Section 27 0528 “Pathways for Communications Systems” for work associated with horizontal cable systems.

1.3 TECHNICAL STANDARDS

All designs and installations shall be done in accordance with the following codes and standards. The codes and standards are minimum requirements. The most stringent requirement between the codes, standards, and the Contract documents shall be followed. The contractor is responsible for the research of all codes, standards, and regulations, including federal, state and local, which are applicable to the project. All work shall comply with the requirements of the latest edition of codes and regulations in use by the local jurisdiction at the time of the design and installation.

NFPA 70 National Electric Code (NEC)

TIA-526-7 Revision A Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

TIA-526-14 Revision C Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant

TIA-568.C.2 Revision C Balanced Twisted-pair Telecommunications Cabling and Components Standards

TIA-568.C.3 Revision C Optical Fiber Cabling Components Standard

TIA-568.C.4 Revision C Broadband Coaxial Cabling and Components Standard

TIA-568.0.D Revision D Generic Telecommunications Cabling for Customer Premises

TIA-568.1.D Revision D Commercial Building Telecommunications Infrastructure Standard

TIA-569 Revision D Telecommunications Pathways and Spaces

TIA-606 Revision B Administration Standard for Telecommunications Infrastructure

TIA-607 Revision B Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises

TIA-758 Revision B Customer-Owned Outside Plant Telecommunications Infrastructure Standard

BICSI TDMM Telecommunications Distribution Methods Manual

1.4 DEFINITIONS

A. General: Basic Contract definitions are included in other Division 01 and 27 Sections and other Contract Documents.

B. The following list of terms used in this Specification shall be defined as follows:

1. “CMP”: Communications Multipurpose Plenum (National Electrical Code [NEC] plenum rating).
2. “CMR”: Communications Multipurpose Riser (NEC riser/non-plenum rating).

3. "ISP": Inside Plant (cabling).
4. "MM": Multimode (fiber type).
5. "OFCP": Optical Fiber Conductive, Plenum, plenum rating
6. "OFNP": Optical Fiber Non-conductive Plenum, plenum rating.
7. "OFNR": Optical Fiber Non-conductive Riser, non-plenum riser rating.
8. "PVC": Polyvinyl Chloride.
9. "SM": Single-mode (fiber type).

1.5 SYSTEM DESCRIPTION

A. Work under this Section shall include the planning and coordination of telecommunications backbone cable system, the furnishing of necessary materials, and the labor and associated services required to install a complete working communications backbone cable system.

B. Telecommunications backbone cabling systems consist of the following subsystems:

1. Backbone ISP twisted pair copper cables and terminations.
2. Backbone ISP & OSP multimode and singlemode fiber optic cables and terminations.
3 Cable management.
4. Cross-connects.
5. Cable identification tags and system labeling.
6. Record documents.
7. Warranty.

1.6 SUBMITTALS

A. All submittals shall be in accordance with Contract, Division 01 and 27 requirements.

B. Product Data: Submit manufacturer's written detailed technical product information and specifications for each type of product proposed for installation.

C. Shop Drawings: One line diagrams of proposed pathway routes. Include cross-connection records and associated cut sheets.

D. As Built Drawings to be included in Operation and Maintenance Manuals. Include copies of all test results. As built drawings shall depict the pathway the cable followed and a one line diagram of all the backbone cables connection points.

E. Warranties: Special warranties specified in this Section.

1.7 QUALITY ASSURANCE

A. Work performed shall be according to Project documents and manufacturer's written specifications.
Material and equipment shall be new, a product of the same manufacturer throughout the Project, and conform to grade, quality, and standards specified.

B. All items including cables and termination equipment shall be labeled in accordance with OCIO labeling requirements and ANSI/TIA 606-B labeling standards. All means of labeling/identification shall be visible and clearly identifiable by OCIO personnel. All labels shall be machine generated or engraved. All labels shall be constructed and attached by means to ensure the lifespan of the label to be equal or greater than that of the device being identified.

C. Installer shall have BICSI and manufacturer trained technicians or shall have 10 or more years' experience doing installations for the Smithsonian Institution.

D. Comply with ANSI/TIA-568-C: Commercial Building Telecommunications Cabling Standard.

1.8 WARRANTY

A. Special Warranty: Telecommunications cabling system, as specified in this Section, shall carry a minimum 20 year extended system and applications warranty. This extended warranty shall cover parts and labor for the duration of the extended warranty. This extended warranty shall also cover electrical performance of the twisted pair cabling system to the specific category per ANSI/TIA/EIA-568-C performance criteria for backbone cabling.

PART 2 - PRODUCTS

2.1 ISP COPPER BACKBONE CABLES

A. General: Cable shall be Category 3 25-Pair UTP CMP cable.

B. Conductors: Conductors shall be 24-AWG (American Wire Gauge) solid copper, shall be 100% FEP insulated.

1. Conductors shall be twisted into pairs. Twisted pairs are formed into 25-pair binder groups (and super binder groups, if required by pair count) and shall be individually color coded to industry standards (ANSI/Insulated Cable Engineers Association [ICEA] Publication S-80-576, and EIA-230).

C. Outer Jacket shall be CMP and independently verified for flammability which shall comply to NEC article 800, NFPA 70, NFPA 262, and UL910.

D. Electrical Performance: Electrical performance of the twisted pairs and overall cable shall comply with ANSI/TIA/EIA-568-C Part 2 requirements for Category 3 UTP cabling.

E. Mechanical Performance: Cable shall comply with ANSI/ICEA S-90-661-2006

F. Manufacturers: Subject to compliance with the requirements, provide the following Manufacturers' or other manufacturers' comparable products:

1. General Cable
2. Superior Essex Inc
3. AMP

2.2 FIBER OPTIC CABLES – INDOOR/OUTDOOR OFCP

A. General: For fiber optic backbone cables between buildings, cable shall be indoor/outdoor interlock armor OFCP tight buffer fiber optic cable. A hybrid multimode/singlemode cable can be installed if necessary.

B. 50/125 µm OM3 multimode fiber strands shall meet or exceed the following performance criteria:

1. Attenuation: 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm wavelengths, maximum.
2. Overfilled Bandwidth: 1500 MHz•km at 850 nm and 500 MHz•km at 1300 nm wavelengths, minimum.
3. Laser Bandwidth: 2,000 MHz•km at 850 nm and 500 MHz•km at 1300 nm wavelengths, minimum.

C. Single-mode fiber strands shall meet or exceed the following performance criteria:

1. Core Diameter: 8.3 µm.
2. Attenuation: 0.5 dB/km at 1310 nm and 0.5 dB/km at 1550 nm wavelengths, maximum.

3. Dispersion: 3.5 ps/nm•km at 1285-1330 nm.

D. Buffering: Each fiber shall be completely covered with a "primary coating" (acrylate material). This shall constitute the "fiber strand".

1. Each fiber strand shall be fully covered with a flame retardant thermoplastic material (PVC material or equivalent thermoplastic). This shall constitute the "buffered strand" (tight buffer type), and shall have a diameter of 0.9 mm.
2. Buffered Strands: Buffered strands shall be individually color coded to meet the requirements of TIA-598-C.

H. Cable Sheath: The cable shall have an internal strength element such as aramid yarn (e.g., Kevlar).

1. Tensile Strength: The cable shall have a 145 lb, minimum, rated load.
2. Pull Strength: The cable shall have the minimum pull strengths:

   a. 12 Fibers or less – 1335 N (300 lbf)
   b. more than 12 Fibers – 2670 N (600 lbf)

2. Outer Jacket: The cable shall have a seamless outer jacket (PVC material or equivalent) applied to and completely covering an interlock aluminum armor sheath and the internal components (fiber strands, strength element, other).
3. Flame Rating: The cable shall be NEC (Article 770) rated as OFCP, and UL listed as such.

I. Manufacturer: Subject to compliance with the requirements, provide the following Manufacturers' or other manufacturers' comparable products:

1. Corning Cable Systems
2. General Cable

2.3 FIBER OPTIC CABLES – ISP cable

A. General: For fiber optic backbone cables between the MDF and IDFs in a single building staying in conditioned space, the cable shall be interlock armor OFNP tight buffer fiber optic cable. A hybrid multimode/singlemode cable can be installed if necessary.

B. 50/125 µm OM3 multimode fiber strands shall meet or exceed the following performance criteria:

1. Attenuation: 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm wavelengths, maximum.
2. Overfilled Bandwidth: 1500 MHz•km at 850 nm and 500 MHz•km at 1300 nm wavelengths, minimum.
3. Laser Bandwidth: 2,000 MHz•km at 850 nm and 500 MHz•km at 1300 nm wavelengths, minimum.

C. Single-mode fiber strands shall meet or exceed the following performance criteria:

1. Core Diameter: 8.3 µm.
2. Attenuation: 0.5 dB/km at 1310 nm and 0.5 dB/km at 1550 nm wavelengths, maximum.
3. Cutoff Wavelength: 1260 nm.
4. Dispersion: 3.5 ps/nm•km at 1285-1330 nm.

D. Buffering: Each fiber shall be completely covered with a "primary coating" (acrylate material). This shall constitute the "fiber strand".

1. Each fiber strand shall be fully covered with a flame retardant thermoplastic material (PVC material or equivalent thermoplastic). This shall constitute the "buffered strand" (tight buffer type), and shall have a diameter of 0.9 mm.
2. Buffered Strands: Buffered strands shall be individually color coded to meet the requirements of TIA-598-C.

H. Cable Sheath: The cable shall have an internal strength element such as aramid yarn (e.g., Kevlar).

1. Tensile Strength: The cable shall have a 145 lb, minimum, rated load.
2. Outer Jacket: The cable shall have a seamless outer jacket (PVC material or equivalent) applied to and completely covering an interlock aluminum armor sheath and the internal components (fiber strands, strength element, other).
3. Flame Rating: The cable shall be NEC (Article 770) rated as OFCP, and UL listed as such.

I. Manufacturer: Subject to compliance with the requirements, provide the following Manufacturers' or other manufacturers' comparable products:

1. Corning Cable Systems
2. General Cable

2.5 TERMINATION EQUIPMENT

A. Twisted Pair Cabling Termination Equipment: The 25-Pair Category 3 UTP CMP cable shall be terminated on a 24 Port Category 3 Modular Patch Panel on each end, using 1-Pair per port.

1. Manufacturer: Subject to compliance with the requirements, provide the following Manufacturers' or other manufacturers' comparable products:

a. Panduit

b. Commscope
c. Legrand
d. Siemon

B. Fiber Optic Patch Panels: Fiber optic cable termination housing shall be a fully assembled rack-mounted fiber optic enclosed housing for providing strain relief, slack storage and organizing the termination of the fiber optic cable strands and provide patch cord management. The patch panel shall include all required installation and mounting components, connector panels and coupling adapters, for an integrated termination and patching facility. Each coupler panel shall consist of 6 Duplex SC couples.

1. Passive fiber optic physical equipment and apparatus used in interconnecting and cross-connecting fiber optic cables shall possess a minimum fire resistant rating of UL-94V-1.
2. The equipment, apparatus, and material for fiber optic equipment and apparatus shall conform to existing Occupational Safety & Health Association (OSHA) Health and Safety Laws. The equipment and apparatus shall have provision for the application of safety labels such as laser identification or warning labels as required by system considerations.

C. Manufacturers: Subject to compliance with the requirements, provide the following Manufacturers' or other manufacturers' comparable products:

1. Corning Cable Systems
2. Panduit
3. Legrand
4. Commscope

2.6 FIBER OPTIC CONNECTORS

A. Multimode Fiber Optic Connectors - SC Type:

1. Materials: Ferrule, ceramic (zirconia or aluminia) with pre-radiused finish/face. Connector housing to be plastic.
2. Connector shall have an integral strain relief feature, including a bend limiting rear boot.
3. Connector Boot Color: Aqua.
4. Connectors shall be installable via either epoxy or anaerobic method.
5. Manufacturer: Subject to compliance with the requirements, provide the following Manufacturers' or other manufacturers' comparable products:

a. Corning Cable Systems

b. Panduit
c. Legrand
d. Commscope

B. Single-mode Fiber Optic Connectors - SC Type:

1. Materials: Ferrule, ceramic (zirconia or alumina) with pre-radiused finish/face. Connector housing shall be plastic.
2. Connector shall have an integral strain relief feature, including a bend limiting rear boot.
3. Connector Boot Color: Blue.
4. Connectors shall be installable via either epoxy or anaerobic method.
5. Manufacturer: Subject to compliance with the requirements, provide the following Manufacturers' or other manufacturers' comparable products:

a. Corning Cable Systems
b. Panduit
c. Legrand
d. Commscope

PART 3 – EXECUTION

3.1 EXAMINATION

A. Pathways: Prior to installation, verify pathways (cable trays, conduits, etc.) exist are complete and ready to accept backbone cables.

B. Telecommunication Rooms (TRs): Prior to installation, verify that ERs and TRs are complete and ready to accept the backbone cables and terminations.

3.2 ROUTING INSTALLATION AND REQUIREMENTS

A. Install copper and fiber optic cables and neatly organize and dress using designated cable routing facilities.

B. Labeling: Each cable shall be labeled within 4" of each end. The cable label shall contain the exact source and destination information consisting of Telecommunications Space ID, rack, patch panel/termination block ID and ports. The label shall wrap around the cable sheath with multiple instances of the ID printed so the ID can be read from different angles. The text on the labels shall be an uppercase, easily readable font without serifs. The label shall be manufactured for the purpose of identifying flexible communications cabling and shall be used only on flexible materials.

a. All fiber optic cabling shall have a warning tape, stating, at a minimum, "Warning:Fiber Optic Cable" at each point of cable pathway that is accessible by the Owner, Owner's personnel, or other Contractor. Fiber housings shall be labeled with destination of each fiber cable and each coupler port shall be labeled with strand number.
b. All copper cabling shall have the termination block labeled with destination of cable and each pair shall be labeled.

C. Fasten to support devices via tie wraps or Velcro-type straps in a "crossed" configuration per cable or cable bundle (up to three cables or innerducts) every 24 inches.

D. When routing horizontally within TRs, utilize the overhead cable support. When routing vertically within TRs, utilize the wall mounted vertical cable runway and fasten using Velcro-type straps.

E. Place and suspend cables in a manner to protect them from physical interference or damage.

3.3 INSTALLATION - TWISTED PAIR CABLING

A. Placement: Protect cable during installation. Place cables with no kinks, twists, or impact damage to the sheath. Replace cable if damaged during installation.

1. Maintain a minimum bend radius of ten times the cable diameter during and after installation.
2. Maintain pulling tension within manufacturer's written limits. When placing cables in conduit place a pull rope along with cables where run in conduit and spare capacity still exists in the conduit. Tie off ends of the pull rope.

B. Routing: Provide a 10 foot, minimum, sheathed cable slack loop at each end of the run. Place the slack in the overhead cable support.

1. Maximum cable length from the "Source" termination to the "Destination" termination shall be 1650 feet.
2. Route cables a minimum of 6 inches away from power sources to reduce interference from electromagnetic interference (EMI).

C. Termination: Terminate twisted pair backbone cables to modular patch panels, terminating each pair to Positions "4" and "5" of each port position.

1. Provide the patch panels as shown on the Drawings. If not shown, install patch panels at the top of the rack.
2. Properly strain relieve cables at termination points per manufacturer's written instructions.

D. Refer to Section 27 0500 "Common Work Results for Communications" for type of and installation requirements for labeling of cables.

3.4 INSTALLATION - FIBER OPTIC CABLING

A. Backbone Cable:

B. Placement: Place and suspend cables in a manner to protect them from physical interference and damage from kinks, twists, or impacts. Replace cable if damaged during installation.

1. Maintain a minimum bend radius of 20 times the cable diameter during installation, and a minimum bend radius of ten times the cable diameter after installation.
2. Maintain pulling tension within manufacturer's written limits. Do not use cable-pulling compounds for indoor installations. Place a pull rope along with cables where run in conduit or innerduct and spare capacity still exists in the pathway. Tie off ends of the pull rope.
3. Maximum tensile load during installation is 220 N (50 lbf).

C. Routing: Maximum cable length from the "Source" termination to the "Destination" termination shall be 928 feet for Multimode OM3 Fiber and 10 kilometers for Singlemode Fiber.

1. Provide a 30 foot, minimum, sheathed cable slack loop at each end of the run. Store slack in slack storage ring mounted on the wall.

D. Termination: Terminate/connectorize fiber strands at both ends using the specified fiber optic connectors appropriate for the mode type of the fiber. Perform terminations in accordance with manufacturer's written instructions. Provide required accessories and consumables for the complete termination of fiber strands.

1. Install the termination panel, including connector panels and adapters in designated equipment rack location as per Drawings. If location not shown, locate at the top.

2. Strain relieve cables at fiber optic termination panels per manufacturer's written instructions.
3. Provide 3 feet of tight buffered fiber (unsheathed) slack at each end of the run within the patch panel/termination enclosure. Store fiber slack in rear of patch panel in the "routing rings" per manufacturer's written instructions.
4. Perform post-installation certification testing as described in Section 27 0800 "Commissioning of Communications."

E. Refer to Section 27 0500 "Common Work Results for Communications" for type of and installation requirements for labeling of fiber optic cables.

3.5 FINAL REVIEW

A. Test fiber for proper attenuation per TIA 568-C

B. Inspect installed products and work in conjunction with the COR. Develop a punchlist for items needing correction.

C. Issue punchlist to the COR for review prior to performing punchlist walk.

D. Repair defects prior to system acceptance.

E. Review corrected punchlist with the COR and obtain the COR's final sign off.

END OF SECTION 27 13 00

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Drawings, and Division 1, General Requirements, govern the work of this section.

1.2 SUMMARY

A. Section includes:

1. Horizontal UTP Station Cable
2. Cable connecting hardware, patch panels, and patch cords.

B. Related Sections:

1. Section 260XXX “Common Work Results for Electrical” for additional general requirements associated with Division-27 Work.
2. Section 260536 “Cable Trays for Electrical Systems” for work associated with telecommunications cable tray.
3. Section 270500 “Common Work Results for Communications” for additional general requirements associated with Division-27 Work.
4. Section 270528 “Pathways for Communications Systems” for work associated with horizontal cable systems.

1.3 TECHNICAL STANDARDS

All designs and installations shall be done in accordance with the following codes and standards. The codes and standards are minimum requirements. The most stringent requirement between the codes, standards, and the Contract documents shall be followed. The contractor is responsible for the research of all codes, standards, and regulations, including federal, state and local, which are applicable to the project design. All work shall comply with the requirements of the latest edition of codes and regulations in use by the local jurisdiction at the time of the design and installation.

NFPA 70 National Electric Code (NEC)

TIA-526-7 Revision A Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

TIA-526-14 Revision C Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant

TIA-568.C.2 Revision C Balanced Twisted-pair Telecommunications Cabling and Components Standards

TIA-568.C.3 Revision C Optical Fiber Cabling Components Standard

TIA-568.C.4 Revision C Broadband Coaxial Cabling and Components Standard

TIA-568.0.D Revision D Generic Telecommunications Cabling for Customer Premises

TIA-568.1.D Revision D Commercial Building Telecommunications Infrastructure Standard

TIA-569 Revision D Telecommunications Pathways and Spaces

TIA-606 Revision B Administration Standard for Telecommunications Infrastructure

TIA-607 Revision B Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises

TIA-758 Revision B Customer-Owned Outside Plant Telecommunications Infrastructure Standard

1.4 DEFINITIONS

A. General: Basic Contract definitions are included in other Division 01 and -27 Sections and other Contract Documents.

B. In addition, the following list of terms as used in this Specification shall be defined as follows:

1. “AHJ”: Authority Having Jurisdiction
2. “AWG”: American Wire Gage.
3. “CAT6A”: Category 6A UTP copper cable.
4. CMP: Communications plenum rated cable.

5. CMR: Communications riser rated cable.
6. "FEP": Fluorinated ethylene propylene, an insulating material for plenum rated cables.
7. "Permanent Link": The portion of the horizontal cabling from station outlet termination to TR termination. This may include a consolidation point in the span. It does not include the patch cords which plug into the equipment on each end.
8. "PVC": Polyvinyl chloride, an insulating material for non-plenum rated cables.
9. "NEC": National Electrical Code.
10. "UTP": Unshielded twisted pair copper cable.
11. "WAO": Work Area Outlet

1.5 SYSTEM DESCRIPTION

A. Work under this Section shall include the planning and coordination of telecommunications cable systems, the furnishing of necessary materials, and the labor and associated services required to install a complete working telecommunications horizontal cabling system.

B. Telecommunications horizontal cabling systems consist of the following subsystems:

1. Horizontal cable, terminations, and outlets.
2. Patch cords and cross-connects.
3. Cable identification tags and system labeling.
4. Record documents.
5. Warranty.

1.6 SUBMITTALS

A. All submittals shall be in accordance with Contract, Division 01, and Division 27 requirements.

B. Product Data: Submit manufacturer's written detailed technical product information and instruction installations for each type of product proposed for installation.

C. Samples: Typical work area outlet (WAO), including the faceplate, faceplate label, connectors/jacks, port labels, cables (12-inches long), and cable label.

D. Shop Drawings: Plans providing point-to-point wiring diagrams of proposed pathway routes. Include cross-connection records and associated cut sheets.

E. As built drawings to be included in Operation and Maintenance Manuals. As built drawings shall depict the following: installed pathways layout(cable tray, conduits, J Hooks); location of all telecom outlets; labeling of each telecom outlet; final IDF and MDF layouts; final wall and rack elevations; and one line riser diagrams for voice/data and grounding.

F. Warranties: Manufacturer's warranty shall be provided for the structured cable system. Warranty shall be for at least 20 years.

1.7 QUALITY ASSURANCE

A. Work performed shall be according to Project documents and manufacturer's written specifications.

B. Material and equipment shall be new, a product of the same manufacturer throughout the Project, and conform to grade, quality, and standards specified.

C. All items including cables, faceplates, and patch panels shall be labeled in accordance with OCIO labeling requirements and ANSI/TIA 606-B labeling standards. All means of labeling/identification shall be visible and clearly identifiable by OCIO personnel. All labels shall be machine generated or engraved. All labels shall be constructed and attached by means to ensure the lifespan of the label to be equal or greater than that of the device being identified.

D. Installer shall have BICSI and manufacturer trained technicians or shall have 10 or more years' experience doing installations for the Smithsonian Institution.Comply with Telecommunications Industry Association (TIA)-569-B Series: Commercial Building Standard for Telecommunications Pathways and Spaces.

1.8 WARRANTY

A. Special Warranty: The telecommunications horizontal cabling system, as specified in this Section, shall receive a specific manufacturer's structured cabling system link/channel and applications warranty, specifying that the installation is free from defects in materials and workmanship. This extended warranty shall cover parts and labor for the duration of the extended warranty and no less than 20 years. This extended warranty shall include coverage of the electrical performance of cabling system to the specific category per American National Standards Institute / Telecommunications Industry Association / Electronic Industries Alliance (ANSI/TIA/EIA)-568-C Series performance criteria for "Permanent Link."

PART 2 -PRODUCTS

2.1 HORIZONTAL CABLE

A. General: Category 6A 100-ohm, 4-Pair, UTP CMP cable.

B. Conductors: Insulated conductors, 22-AWG to 24-AWG solid-copper fully-insulated with a flame retardant thermoplastic material (PVC, or equivalent). Insulated color code shall be per ANSI/TIA 568-C.2 Section 5.3.3.

C. Cable Sheath: The cable shall be unshielded. Outer jacket shall be seamless applied to and completely covering the internal components. Cable shall be imprinted with the manufacturer's name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation), and length marking in feet at regular intervals not to exceed 2 feet.

1. Flame Rating: Per NEC (Article 800) rated as CMP, and Underwriter's Laboratories (UL) listed as CMP.
2. Listed and labeled by an NRTL acceptable to an AHJ as complying with UL 444 and NFPA 70.

D. Cable Diameter: The maximum cable diameter shall be less than 7.5 mm (.295 in).

E. Electrical Performance and Transmission Performance: Meet or exceed ANSI/TIA-568-C Series for CAT6A UTP cabling.

F. Mechanical Performance: Shall comply with ANSI/CEA S-102-732-2009

G. Manufacturers: Subject to compliance with requirements, provide the following Manufacturers' or other manufacturers' comparable products:

1. General Cable
3. Panduit
4. Superior/Essex
5. Approved equals by COR

2.2 MODULAR PATCH CORDS

A. General: Factory-made, four-pair cable terminated with eight position RJ45 modular plug on each end. The patch cords shall not have "snagless boots".

B. Cordage: Insulated conductors, 22-AWG to 26-AWG stranded copper, fully insulated with a flame retardant thermoplastic material (such as PVC, or equivalent). Sheath

shall be unshielded, flame-retardant polyvinyl chloride (PVC) jacketed. Insulated conductor color code shall be per ANSI/TIA 568-C.2 Section 5.8.2 Table 3 Option 1.

1. Flame Rating: NEC CM (or higher) rated and UL listed as CM.

C. Electrical Performance: Comply with ANSI/TIA 568-C Series for CAT6A UTP patch cords requirements (minimum).

D. Mechanical Performance: Shall comply with ANSI/CEA S-102-732-2009

D. Patch Cords shall be colored coded as follows:

1. Yellow: Data Patch Cable.
2. Pink: Analog Voice Patch Cable.
3. Red: Cross-Over Patch Cable.

2.3 PATCH PANEL

A. General: Patch panel shall meet or exceed TIA and ISO Category 6A component performance requirements. Patch panel shall be horizontally oriented for a 19-inch rack-mounted configuration.

B. Patch panels shall be modular panels housing multiple-numbered jack units with 110 termination IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

C. Patch panel shall provide port labeling abilities, icon compatibility, and rear cable management support.

D. Manufacturer: Subject to compliance with requirements, provide the following Manufacturers' or other manufacturers' comparable products:

1. Panduit
2. Legrand
3. Commscope
4. Siemon
5. Approved equals by COR

2.4 WORKSTATION FACEPLATES

A. Faceplate: Faceplate shall include required accessories, such as icons, blank inserts, and labels.

1. Standard Work Area Outlet (WAO): A duplex port, single-gang wall plate. Color to be provided by the architect or match the electrical outlet plates.
2. Refer to Drawings for port quantity per outlet type.

B. Manufacturer: Shall match the provider of the termination equipment.

C. Wall Phone Outlets: Faceplate for wall phone outlets shall come equipped with one Category 6A 8-position modular jack and two mounting studs.

2.5 CONNECTORS / MODULAR JACKS

A. Connectors shall be 8-position 8-conductor RJ45 modular type, Category 6A rated, and shall be intended for the termination of 4-pair UTP cables. The connector shall meet IEC 60603-7-1 thru IEC 60603-7-5 modular interface requirements and ANSI/TIA-570-B marking and mounting requirements.

B. All connectors shall be T568B wired. Modular jack shall be the same manufacturer as the patch panel. The outlet color should be approved by the architect.

C. Manufacturers: Subject to compliance with requirements, provide the following Manufacturers' or other manufacturers' comparable products:

1. Panduit
2. Legrand
3. Commscope
4. Siemon
5. Approved equals by COR

2.6 MISCELLANEOUS COMPONENTS

A. Velcro Cable Ties: Velcro cable ties shall be 3/4-inch wide and the color black.

B. Identification Products: Labels for patch panels, faceplates, and each end of the cable shall comply with TIA 606 and UL 969 for a system of labeling materials.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Pathways: Prior to installation, verify that pathways are complete and ready for cables.

B. Equipment and Telecommunication Rooms: Prior to installation, verify that ERs and TRs are complete and ready for cables. Complete and ready for installation requires the room to be dust free with the proper antistatic flooring installed. The rooms shall be complete with no additional mechanical, electrical, drywall, or plumbing work required.

3.2 INSTALLATION

A. Install products, components, accessories, hardware, etc, according to the manufacturer's written instructions.

B. All cables, faceplates, patch panels, and termination blocks shall be labeled in accordance with OCIO labeling requirements below and ANSI/TIA 606-B labeling standards. All means of labeling/identification shall be visible and clearly identifiable by OCIO personnel. All labels shall be machine generated or engraved. All labels shall be constructed and attached by means to ensure the lifespan of the label to be equal or greater than that of the device being identified.

1. Outlet numbering which shall be shown on the cable, faceplate, patch panel, and termination block shall consist of Telecom Room#-Drop Number-and Port Letter. The Telecom Room # is the Room number where the cables terminate. The drop number is done sequentially throughout the floor e.g. 001, 002, 003,…. The port letter is done using A, B, C, D starting from the top left port on the faceplate then going right on the same line and then going to the next line of port on the faceplate. Thus a quad faceplate being fed to Telecom Room 138 and being the thirty first faceplate would have the ports; TR138-031-A,B,C,D.

C. Horizontal Copper Cable: Copper cables shall be loosely bundled in orderly dressed groups of up to, but not more than, 48 individual cables from the point of entry into the TR to the termination point.

1. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.
2. Maintain maximum cable length of 295-feet from the termination in the TR to the termination at the outlet.
3. Installation: Place cables with no kinks, twists, or damage to the sheathing. Protect cables during installation. Replace cable if sheath is damaged during installation.

a. Maintain a minimum bend radius of six times the cable diameter during and after installation.
b. Maintain pulling tension within manufacturer's written recommendation or 110 N (25 lbf) maximum.
c. Place and suspend cables in a manner to protect them from physical interference or damage.

4. Routing: When routing horizontally within TR, utilize the overhead cable support. When routing vertically within TR, fasten the cable bundles using approved cable ties to the wall-mounted vertical cable support every 24-inches on center.

   a. Route cables a minimum of 6-inches away from power sources to reduce interference from electromagnetic interference (EMI). When routing cables in the space outside of the TR, cables should be laid randomly in the pathway. This will help mitigate “Alien Crosstalk.”
   b. When routing cables in areas without primary horizontal pathways, install cables onto secondary pathways or approved support devices, such as Category 6A approved J hooks.
   c. Route cables at 90 degree angles, allowing for bending radius along corridors for ease of access. Do not route through an adjacent space if a corridor borders at least one wall of the room.
   d. Provide a minimum 7-foot sheathed cable slack loop at each end of the run in the TR and 1-foot of slack left in the work area after termination. In the TR, place the slack in the overhead cable support. At the workstation, store the slack using J hooks in the ceiling space before the conduit stub for the device.
   e. At the equipment bay in the TR where wall-mounted racks are used, route the horizontal cables down the hinged side of the equipment rack.

5. Termination: Per the manufacturer’s written instructions and ANSI/TIA-568-C standard installation practices, strain relieve cables at termination points, and terminate pairs on the specified connecting hardware.

   a. The maximum pair untwist at the termination point shall be 13 mm (.5 in).
   b. All connectors shall be terminated T568B modular jack pin/pair assignment.

6. Labeling: Each cable shall be labeled within 4” of each end. The cable label shall contain the Faceplate Outlet ID of the cable as shown on the faceplate. The label shall wrap around the cable sheath with multiple instances of the ID printed so the ID can be read from different angles. The text on the labels shall be an uppercase, easily readable font without serifs. The label shall be manufactured

for the purpose of identifying flexible communications cabling and shall be used only on flexible materials.

D. Patch Panels and Horizontal Management Panels: Install the discrete patch panels and horizontal management panels in the configuration as shown on the Elevation Drawings.

1. Installation: Patch Panels shall be mounted to the rails using screws in all four corners of the Patch Panel. Horizontal Management Panels shall be placed between each Patch Panel. Spaces shall not be left between Patch Panels and Horizontal Management Panels.

2. Termination: Per the manufacturer's written instructions and ANSI/TIA-568-C standard installation practices, strain relieve cables at termination points, and terminate pairs on the specified connecting hardware.

a. The maximum pair untwist at the termination point shall be 13 mm (.5 in).
b. All connectors shall be terminated T568B modular jack pin/pair assignment.

3. Labeling: All Patch Panels shall have 2 types of labeling: the identification of the actual patch panel and the identification of the ports on the patch panel.

a. All patch panels shall be labeled as to the identity of the patch panel. The identification shall be derived based on Telecom Room, the rack in which it is mounted and a sequential letter, e.g. TR01-A-PP03, where TR01 is the Telecom Room, A is the rack, and PP03 indicates this is the third patch panel in the rack.

b. All ports on the patch panel shall be labeled with the Outlet ID # and port per Section 3.2.B.1.

E. Outlet Faceplates: Install faceplates plumb, square, and at the same level as adjacent device faceplates. The hole cutout of the drywall shall not be visible on any sides of the faceplate. For surface raceway, color shall match electrical device and/or coverplate. All ports on the faceplate shall be labeled with the Outlet ID# and port per Section 3.2.B.1. The machine generated label shall be installed behind the faceplate's plastic label window to ensure it is permanent and does not fall off the faceplate.

F. Outlet Modular Connectors: In accordance with manufacturer's written instructions and ANSI/TIA-568-C standard installation practices, terminate pairs on the specified modular connector.

G. Wall Mounted Telephones: Install telephone to height noted on the Drawings and per the manufacturer's written instructions and in compliance with codes.

H. Wireless LAN Access Point Enclosures: Refer to Drawings for enclosure cabling service and installation requirements. If the outlet for the WAP is installed in a plenum space, use plenum rated surface mount boxes. Wireless LAN Access Points shall be labeled separately from the standard room outlet labeling. All Wireless LAN Access Points shall be grouped together on the patch panel and be labeled W-001, W-002, through W-00N with N being the total number of Access Points.

I. Refer to Section 27 0500 "Common Work Results for Communications" for type of and installation requirements for labeling of cable and outlet labels.

3.3 FINAL REVIEW

A. The contractor shall test all cables for Category 6A compliance using a Level III tester per TIA 568-C. Soft copies and if asked for hard copies of the test results shall be provided to OCIO to review as the testing proceeds. No Pass*, a Pass within the error level of the tester, or Fail test results will be accepted.

B. Review installed products and work in conjunction with the COR. Develop a Punchlist for items needing correction.

C. Issue punchlist to the COR for review prior to performing punchlist walk.

D. Repair defects prior to system acceptance.

E. Provide final as-built documentation per the contract including numbered drawings, Final test results, and manufacturer's warranty.

F. Review installed products and work in conjunction with the COR for sign-off.

END OF SECTION 27 15 00

SECTION 283111 – ADDRESSABLE FIRE ALARM SYSTEMS

Download Word document.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provision of Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this Section.

B. Related Sections:

1. General and Special conditions
2. Division 1: Submittals
3. Division 7: Firestopping
4. Division 8: Door Release and unlocking
5. Division 9: Painting
6. Division 14: Elevators
7. Division 21: Sprinkler System, Fire Pumps
8. Division 23: Air Handling Systems
9. Division 26: Basic Electrical Requirements

1.2 SUMMARY

A. Scope: The contract drawings are conceptual. This work includes designing and **[providing a new, complete,] [modifying the existing]** addressable fire alarm system as described herein and on the contract drawings for **<Building Name>**. **[The existing system is a [Siemens XLS.] [<other FA system.>]]** The system shall include all wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, dual channel, alarm and supervisory signals, initiating devices, alarm notification appliances, interfaced equipment, and all other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described.

B. Existing Equipment: Existing or temporary fire alarm equipment shall be maintained operational until the new equipment has been tested and accepted by the Smithsonian Institution Authority Having Jurisdiction. As new equipment is installed, it shall be labeled "NOT IN SERVICE" until the new equipment is accepted. Once the new system is accepted by the Smithsonian, the labels on the new equipment shall be removed and the existing equipment shall be labeled "NOT IN SERVICE" until removed from the building. Just prior to demolition and construction activities (dust producing activities), dust covers shall be installed over smoke detectors and the duct detector(s) for the air handling unit serving the area on a daily/per shift basis. Duct detector sampling tubes and interior housing shall be cleaned prior to removal of detector dust cover. The dust covers are to be removed at the end of every workday/shift. An in-line filter shall be installed for each air-sampling unit to prevent dust infiltration if it is not possible to shut down the unit in question during construction. This filter shall be maintained and replaced by the Contractor for the duration of construction. Air sampling piping shall be cleaned at the end of the construction contract.

C. **[Provide a single reset button in the command center that upon activation will reset the existing fire alarm system, any temporary fire alarm system, and the new fire alarm control units simultaneously. Provide all necessary relay modules and programming necessary to implement this requirement. Provide written procedure for the SI command center operators. Procedure shall address implementation of reset button if alarm, supervisory, or trouble conditions exist on any of the panels. Remote panels shall be installed such that OPS control room personnel can interact with the system without leaving the command center.]**

D. Equipment Removal: After acceptance of the new system by the Smithsonian, all existing equipment not connected to the new system shall be removed and all damaged surfaces shall be restored to finishes similar to surrounding walls/ceiling/floor. Detectors shall remain covered during removal and while in storage. Operational equipment which was removed shall be carefully packaged, labeled, and turned over to the SI at the discretion of the COTR. **[The following equipment shall be returned to the COTR upon removal:**

1. **List of equipment desired by Life Safety Group.]**

2. Other equipment, such as conduit and electrical boxes, shall be removed from the site and disposed of by the Contractor.

E. Repair/Service Replacement Parts: Repair services and replacement parts for the system shall be furnished under this contract after the date of final acceptance of work by the Smithsonian Institution. On-site service during the warranty period shall be provided within 24 hours after notification. All repairs shall be completed within 48 hours after notification.

1.3 ALLOWANCES

Unless allowances are included, delete this article.

A. **[List Allowances, if included as part of the contract. Confirm with OPDC Cost Estimating]**

1.4 UNIT PRICES

A. **[List Unit Prices, if included as part of the contract. Confirm with OPDC Cost Estimating]**

1.5 RELATED SECTIONS

A. General and Special conditions

B. See Division 01 Section SUBMITTALS

C. [See Division 01 Section SUSTAINABLE DESIGN REQUIREMENTS]

D. See Division 07 Section FIRESTOPPING

E. See Division 08 Section DOOR RELEASE AND UNLOCKING

F. See Division 09 Section PAINTING

G. See Division 14 Section ELEVATORS

H. See Division 21 Sections SPRINKLER SYSTEMS, FIRE PUMPS, CLEAN AGENT FIRE EXTINGUISHING SYSTEMS

I. See Division 23 Section AIR HANDLING SYSTEMS

J. See Division 26 BASIC ELECTRICAL REQUIREMENTS

K. **[See Division 27 Section EMERGENCY COMMUNICATIONS SYSTEMS]**

1.6 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. Designer: Person or persons responsible for the development of fire alarm or signaling system plans and specifications.

C. EoR: Engineer of Record

D. FACU: Fire Alarm Control Unit

E. Fire Alarm Contractor: Any company with the qualified experience and personnel as laid out in Section 1.9 to complete fire alarm system installation work.

F. FM: FM Global (Factory Mutual)

G. FPE: Fire Protection Engineer

H. Furnish: To supply the stated equipment or materials

I. Install: To set in position and connect or adjust for use

J. Installer: The person or persons working on the wiring, conduit, devices, and panels associated with the fire alarm system.

K. NAC: Notification Appliance Circuit

L. NFPA: National Fire Protection Association

M. NICET: National Institute for Certification in Engineering Technologies

N. OSHEM: Office of Safety Health and Environmental Management

O. Provide: To furnish and install the stated equipment or materials

P. Quality Control Personnel: The person or persons responsible inspection for and quality control activities associated with the wiring, conduit, devices, and panels of the fire alarm system.

Q. SLC: Signaling Line Circuit

R. Technician: The qualified person in charge of fire alarm system programming.

S. UL: Underwriters Laboratories

1.7 SYSTEM DESCRIPTION

A. The System shall be a complete, supervised, noncoded, addressable multiplex fire alarm system with voice/strobe evacuation, dual channel intelligent analog alarm initiation,

[conventional smoke detection initiation,] and complying with all aspects of the applicable documents listed herein.

1.8 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 72, all contract documents, and the requirements of the Smithsonian Design Standards.

B. The system shall be classified as a proprietary protective signaling system.

C. Control features:

1. The system fire alarm control unit shall be tied to the Smithsonian Institution central monitoring system, which is manufactured by Keltron Corporation. The Keltron system uses the existing SI network to communicate fire alarm conditions. A compatible fire alarm system, the appropriate Keltron LS Net transceiver and associated network connections shall be installed. The Keltron programming will be performed by SI staff. The compatible list of fire alarm panels can be obtained from Keltron Corporation.

2. The Keltron power supply can be 24V or 120V. EoR to detail in drawings the desired configuration. 24VDC from the FACU shall not be used to power the Keltron panels.

3. Priority of Signals: Priority levels of pre-recorded automated voice messages including the Fire message, Emergency Communications messages, and test/drill messages are defined in paragraph 1.18. Alarm events are queued in the order received and do not affect existing alarm conditions. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

4. **[The system fire alarm control unit shall be tied to a remote panel and a graphic annunciator in the locations identified on the drawings.]**

5. Any intelligent analog smoke detector or conventional smoke detector zone shall include a selectable alarm confirmation capability. Alarm conditions on these devices are processed through a confirmation period of 45 seconds. Over the next 300 seconds, a signal justification period is initiated where any subsequent alarms are reported immediately.

6. A subprogram shall be provided to allow environmental compensating for smoke detector sensitivity. Each smoke detector shall be programmed with this capability.

7. The system shall provide a field-test function where one person can test the complete system or a specified area at the fire alarm control unit while maintaining full operational function of other areas not under test. Alarms, troubles, device types, and the initiation device addresses shall be logged to historical memory.

8. [Provide a manual pull station attached to the fire alarm control unit that activates the general alarm. Resetting the manual pull station (and all other activated alarms) will cause the general alarm to cease operating. OSHEM shall approve the final sequence of operation.]

9. Bypass Function: Provide program capability via switches or buttons in a locked portion of the fire alarm control unit to bypass the notification appliance circuits, air handler shutdown, smoke control operation, elevator recall, fire door release, horizontal/vertical fire curtain release, and door unlocking features. Operation of these switches or buttons shall indicate this action as a supervisory signal on the FACU display:

    a. [Visual notification appliances]

    b. [Audible notification appliances]

    c. [Air handling unit shutdown]

    d. [Smoke dampers]

    e. [Door hold opens]

    f. [Fire doors/shutters]

    g. [Horizontal fire doors]

    h. [Pre-action system release. A bypass shall be provided for each system.]

    i. [Clean agent system release. A bypass shall be provided for each system.]

    j. [Exhibit audio/visual shutdown]

    k. [Elevator recall/shunt functions. A bypass shall be provided for each machine room.]

l. [Stair pressurization fans]

m. [Smoke control systems. A bypass shall be provided for each system.]

Operation of these switches or buttons shall indicate this action as a supervisory signal on the FACU display.]

10. History Logging - recirculating last 500 events, minimum. History shall be downloadable by classification for selective event reports.

D. Supervision

1. **[Class B initiating device circuits. Retain if existing conventional system. If connecting to existing system, match existing wiring scheme (e.g., Class A, B)]**

2. Class B signaling line circuits for each floor.

3. Class X signaling line circuits for panel-to-panel communication and audio network(s).

4. Class B notification appliance circuits.

5. Provide electrical supervision of the primary power (AC) supply, emergency power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control unit.

6. Provide electrical supervision of the circuits leading to interfacing modules for the monitoring of contact type initiation devices, the control of electrical devices, fire pump controllers, load control relays (controlling elevators and HVAC equipment), and each independent smoke detection, kitchen, and gaseous fire suppression systems.

7. **[Connections to Public Address/Emergency Communications Systems shall meet NFPA 72 criteria for circuit monitoring.]**

E. Spare capacity:

1. All installed signaling line circuits and notification appliance circuits shall have 20 percent spare capacity.

2. All amplifiers shall have 20 percent spare capacity.

3. Battery size shall be a minimum of 125 percent of the calculated requirement.

F. Alarm Functions: Fire alarm system functions and operations shall be as indicated below. A fire alarm sequence of operation shall be provided in the shop drawings. Operation of an alarm initiating device shall cause the functions indicated on the matrix to occur as described below:

1. Sound General Evacuation Alarm: This function shall cause all strobe lights to activate and speakers in the building to sound a temporal three tone for three cycles followed by the voice message:

   "May I have your attention please! May I have your attention please! A fire has been reported in the building. Please walk to the nearest exit and leave the building. Do not use the elevators."

2. This is repeated until the control unit is reset. After the digital message has ended, or if the digitally prerecorded message shall fail for any reason, the alarm signal shall revert to a temporal three tone, which will continue until manually silenced.

3. It shall also be possible to preempt the temporal three signal or prerecorded voice evacuation message and sound a live message from the microphone at the Fire alarm Master CPU location on a floor-by-floor basis. All floors not selected for a manual message shall continue to receive the pre-recorded message or temporal three signal. Paging selector switches shall be provided for this purpose.

4. **[Initiate Pre-signal Alarm: This function shall cause an audible and visual alarm and indication to be provided at the FACU. Activation of an initiation device will be annunciated at the FACU only, without activation of the General Evacuation Alarm.]**

5. Release Held-Open Fire Doors: This function shall cause **[all] [select]** fire doors in the building that are held open by electrical hold-open/release mechanisms to be released and allowed to close. This action shall occur upon activation of the master pull station (evacuation) only.

6. Unlock Time Delay Hardware on Exit Doors: This function shall cause a signal to be sent to all exit doors provided with electrically operated locks to become unlocked and free for egress. **[Provide [a separate blue manual pull station within the OPS Control Room that provides this function in addition to activation from the main FACU.] [a selector switch for deactivation of the time delay hardware on the exit doors.]]**

7. Shutdown Supply Fan Served: This function shall cause the air handling system supply fan on the affected system to shut down.

8. Close Smoke Damper: This function shall cause smoke dampers installed in HVAC systems to shut down.

9. **[Initiate Smoke Management Sequence of Operation: The [building HVAC system] [Smoke Removal System] is arranged to exhaust smoke from a fire area. The sequence of operation is described in Division 23. The fire alarm system shall provide all such interfaces/control points as required to properly activate smoke management systems. Only the first fire alarm system-initiating device to go into alarm condition will activate the smoke control functions. Any subsequent devices will have no effect on the smoke control mode. The exact quantities and locations of all such interface points shall be coordinated with the automatic control systems supplier.]**

10. **[Carbon Monoxide Local Alarm: This function shall initiate local temporal 4 alarm in the zone where carbon monoxide is detected and send notification to the fire alarm control unit.]**

11. **[Initiate Stairwell Pressurization: This function shall initiate the stairwell pressurization systems in each building stairwell. Each stairwell has a separate pressurization system that will be independently activated. The full extent and requirements of this system are described under Division 23. The fire alarm system shall provide all such interfaces/control points as required to properly activate this smoke management system.]**

12. Initiate Elevator Recall: This function shall cause a signal to be sent to the elevator controller recalling the elevator to the preselected floor, or if the activated initiation device is on the preselected floor, the elevator will be recalled to the preselected secondary floor. Recall shall be initiated for all elevators served by a common shaft, elevator machine room, or elevator lobby.

13. Shutdown Power to Elevator Equipment: This function shall cause a signal to be sent to a shunt trip switch in the power circuit serving the elevator to cause elevator shutdown. This shall be typical for all elevators served by a common shaft, elevator machine room or elevator lobby.

14. Activate Fire Suppression System Served: This function shall cause a signal to be sent to an interface device to operate a solenoid and activate a fire suppression system.

15. Shutdown Exhibit Hall Audio/Visual Equipment: This function shall cause a signal to be sent to a circuit shunt trip causing audio/visual equipment to shut down.

16. Illuminate LED on Device in Alarm: This function shall cause an LED, integral to a device, to illuminate, flash, or change color when in alarm condition, indicating that the device is in alarm. For contact devices, such as sprinkler valve tamper switches, the LED shall be built into the intelligent system interface module monitoring the device.

17. Activate audio/visual signals and display address on the FACU: This function shall illuminate an alarm indicating LED, sound an audible alarm, and display a device address at the FACU when the system is in an alarm condition. **[Signals shall also be transmitted to a computer control display system.]**

18. **[Transmit Event to remote monitoring point: This function shall cause the event to be transmitted to the remote monitoring point at the Smithsonian Institution SIPPS Control Center. The message sent shall include the building of origin and the identical message displayed on the fire alarm control unit LCD display board.]**

19. **[Activate Audio/Visual Signals and Address Display on Remote Panel or Graphic Annunciator Panel: This function shall cause the event to be transmitted to a remote panel, whose location is shown on the drawings. The message sent shall be the same message displayed on the FACU LCD display board.]**

20. Signal Confirmation: This function shall cause the fire alarm control unit to reset the activated device and wait for a second alarm activation. Alarm conditions are processed through a confirmation period of 45 seconds. Over the next 300 seconds, a signal justification period is initiated where any subsequent alarms are reported immediately.

G. Trouble Functions: Provide the following actions and indications at the FACU upon a single break, open condition, or ground fault on all supervised circuits which may prevent the required operation of the system:

1. Annunciate at the FACU: A yellow visual signal, audible alarm, and alphanumeric LCD display of type of trouble, and device, module, or circuit address.

2. Send a signal to the existing remote monitoring point. This message shall include the building of origin as well as all information indicated to be displayed on the FACU.

3. Send a signal to the remote panel shown on the drawings. This message shall include the building of origin as well as all information indicated to be displayed on the FACU. The message sent shall be the same message displayed on the FACU LCD display board.

H. Each independent fire detection, kitchen, and fire suppression system shall be monitored for supervisory conditions. Each monitored condition shall be provided with a separate address.

I. Fire alarm signal initiation shall be by one or more of the following devices:

1. Manual pull station
2. Heat detector
3. Smoke detector
4. Projected beam detector
5. Aspiration smoke detector Alarm
6. Automatic sprinkler system water flow switch or pressure switch.
7. Combustible gas detection system
8. Conventional initiation device zone (for legacy systems)
9. Flame detector
10. Releasing control panel Alarm
11. **[Fire pump running]**

J. Supervisory signal initiation shall be by one or more of the following devices or actions:

1. Operation of a fire-protection system valve tamper switch.
2. **[Operation of the building fire pump or pump running signal]** and/or any associated fire pump system troubles/ supervisory signals.
3. Duct smoke detector associated with air handling unit or smoke damper.
4. Laser scanner aspiration smoke detector alert and action
5. Operation of any non-fire system as designated on the Matrix.
6. Generator running
7. Generator fault
8. **[Fire pump fault]**

9. Bypass Functions
10. **[Live page emergency alert]**
11. **[Emergency voice notification message]**
12. Strobe power supply panel trouble conditions
13. Carbon monoxide detector
14. Any sub-system such as releasing panel trouble contacts.
15. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
16. **[Critical failure of emergency communications system hardware]**
17. **[General failure of emergency communications system hardware]**
18. Abnormal position of any switch at the FACU or annunciator.

K. System trouble signal initiation shall be by one or more of the following devices or actions:

1. Loss of primary power at the FACU or remote panel(s).
2. Ground or a single break in FACU internal circuits.
3. Abnormal A/C voltage at the FACU.
4. A break in standby battery circuitry.
5. Open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
6. Failure of battery charging.
7. Amplifier failure

1.9 SUBMITTALS

A. General: Refer to Division 01 Section "SUBMITTALS" for basic information relating to submittal requirements. Partial submittals will not be acceptable and will be returned without review. Complete submittals shall include drawings, product data, calculations, and qualifications. Before any work is commenced, the submittal shall be approved by

the Office of Safety, Health and Environmental Management (OSHEM). Any work performed by the contractor prior to their approval will be at the contractor's own risk. If such work is contrary to applicable codes and contract documents, the contractor shall bear all costs including, but not limited to, demolition, reconstruction, and all costs and expenses associated with revising the fire alarm system to meet all applicable codes and contract document requirements. All working drawings shall be a minimum 24 in by 36 in. Electronic submittals in PDF based format are also acceptable.

B. System Description: Submit a detailed description of the control unit as it shall operate for this specific installation. General system descriptions from the catalog cuts and copies of the Systems Design Operation portion of this specification will not be acceptable. All equipment shall be compatible and listed/approved for operation with one another. Any accessory panel shall be compatible with the fire alarm unit(s).

C. **[As part of the shop drawing package provide a written description of each pre-recorded voice message including the tone (number of cycles and when the tone is played), the duration of the message, and whether it is a male or female voice.]**

D. Comply and provide documents associated with the recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.

E. Equipment: Include annotated catalog data showing manufacturer's name, model, voltage, and catalog numbers for all equipment and components of the following:

1. Fire alarm control unit (FACU) (e.g., interface modules, covers, console rack, video display unit, amplifier panels)
2. Releasing Panels
3. Strobe power extender panels
4. Storage batteries
5. Battery charger
6. Cabinet
7. Manual pull station
8. Addressable interface devices
9. Terminal cabinets/assemblies
10. Addressable relays and interface modules

11. Graphic annunciator panel
12. Annunciation devices (e.g., speakers, strobes, bells)
13. Fire detector (e.g., smoke, heat, flame, video)
14. Air aspirating smoke detection system
15. Strobe, speaker, and speaker/strobe notification appliances
16. Amplifiers (primary and back-up)
17. Tone generators
18. Digitalized voice generators
19. Firefighter telephones
20. Waterflow switch
21. Tamper switch
22. Electromagnetic door holder
23. Remote fire alarm control unit
24. Fire alarm cabling
25. Boxes
26. Terminal strips
27. Wire nuts
28. Relays
29. Transient voltage surge suppressors
30. Conduit
31. Support

F. Shop Drawings: Provide three sets of working drawings not smaller than 24 inches by 36 inches (609 mm by 914 mm) and an electronic file. Shop drawings shall be prepared on a Computer Aided Drafting (CAD) System. As a minimum, the shop drawing submittal shall include all items required by NFPA 72 Section 7.4, and the following:

1. Interior wiring diagram for FACU.

2. Point to point wiring diagrams on floor plans at a scale of not less than 1/8" = 1'-0" (1:100), showing all field devices (indicating and initiating devices, relays, switches, etc.), field interconnections, the routing of conduit and circuits between devices, electrical boxes, terminal cabinets, risers, and the FACU. All device circuit numbers and addresses shall be indicated. The device circuit number and addresses on the point-to-point wiring diagram shall be in logical/sequential order (e.g., L1D1, L1D2).

3. **[Plans showing all approved t-tapping locations. The plans shall also indicate each area of the building that has been tapped off the main circuit. Provide zone-type boundaries or hatching to delineate these areas.]**

4. **[Wiring diagrams for each approved t-tapped location in the project area.]**

5. Field wiring color code scheme: The following wire jackets shall be used for fire alarm cabling.

    a. XNET/Class X Network Circuit: White

    b. DACNET/Audio Risers: Blue

    c. Phone Riser/Circuit: Yellow

    d. Master Sync: Red with White Stripe

    e. VESDAnet: Black

    f. 24VDC Power, Door Holds, etc.: White with Red Stripe

    g. Strobe: Red with Blue Stripe

    h. Speaker: Blue with Red Stripe

    i. SLC: Red

    j. IDC: Green

    k. Control Circuit: Orange

    l. [Additions to existing systems and circuity shall match existing cabling.]

6. Wire nut color code scheme shall be provided in the wiring schedule for each wire size/type.

7. Locations for all ceiling mounted equipment shall be coordinated with lighting fixtures, air outlets, ductwork, and other fixtures. Shop drawings shall include reflective ceiling plans that show at a minimum lights and HVAC diffusers. All detectors shall be centered and aligned with ceiling tiles and/or other ceiling mounted devices.

8. Complete riser diagrams indicating the wiring sequence of all devices and their connections to the control equipment. Provide a color code schedule for the wiring.

9. **[Detailed drawings of the remote graphic annunciator.]**

10. Detailed drawings of the control units. Each control unit shall be provided with a diagram demonstrating hardware and wiring terminations of that panel specific to the project. Generic wiring diagrams will not be accepted.

11. Wiring diagrams of all load control relays. Each device shall be provided with a diagram demonstrating writing terminations of that device, specific to the project. Installation responsibilities of specific parts of the detail (if applicable), shall be shown.

12. Detailed sequence of operations and matrix.

13. Utilize NFPA 170 standard symbols.

14. **[Proposed device coverage maps for each aspirating smoke detection unit. Maps shall denote the coverage of each pipe on the unit and the location of the central detector. Maps shall be in 11”x17” format and installed in a frame at the detector. If any graphic type of software is provided, the area served by the detector shall be hatched on the floor plan indicating the pipe(s) in question.]**

G. As-Built (Record) Working Drawings: On a daily basis the contractor's superintendent shall record as-built conditions on a set of Shop Drawings maintained at the job site. Two sets of Shop Drawings reflecting as-built conditions shall be available prior to and for use during the final acceptance test. Two weeks after the acceptance test and before final acceptance of the work, furnish four complete sets of as-built drawings. The drawings shall be prepared on uniform sized sheets not less than 24 inches by 36 inches (609 mm by 914 mm). The drawings shall include:

1. As-built locations of all devices and equipment. Point to point wiring diagrams on floor plans at a scale of not less than 1/8” = 1’-0” (1:100), showing all field devices (indicating and initiating devices, relays, switches, etc.), field interconnections, the routing of conduit and circuits between devices, electrical boxes, terminal cabinets, risers, and the FACU. All device circuit numbers and addresses shall be

indicated. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points. Device addresses shall be listed next to each device.

2. Conduit pathways shall be shown. T-taps and other circuit deviations shall be shown.

3. Riser diagram

4. All deviations from the project drawings and approved shop drawings. Deviations shall be noted by clouds or other means.

5. Record Drawing Software: Provide three (3) USB drives containing CAD based drawings in DWG and PDF format of all as-built drawings and schematics. All as-built submittals shall also be digitally transmitted to the COTR.

6. Record Programming: Provide one (1) USB drive containing the final programming for the FACU.

7. Device Addresses: Prior to fire system installation, provide for approval a complete list of device addresses with corresponding commands, controls, and sequence of operation.

8. LCD Display Messages: The fire alarm control unit shall display messages in the following format: Device type, Floor, Room/Location. All messages for tamper and waterflow switches shall also display the zone and valve location. System programming and device descriptions shall be provided to OSHEM with as-built drawings prior to final acceptance. Any changes required to the programming/descriptions shall be completed before final acceptance.

9. LCD messaging shall be standardized using the following rules and abbreviations:

    a. Abbreviations:

        1) AMPS-24 – Power Supply

        2) DD – Duct Detector

        3) FFT – Firefighter Telephone

        4) FS – Flow Switch

        5) FSD – Fire/Smoke Damper (usually followed by a number)

6) HD – Heat Detector

7) MON – Monitor Module

8) MS – Manual Station

9) NAP – Notification Appliance Power Supply

10) RLY – Relay Module

11) SD – Smoke Detector

12) TS – Tamper Switch

b. Examples:

1) Standard Device: (Device Type) (Floor Level) (Location Description including room number)

Example: SD L1 GALLERY 203 BY STAIR 2

2) Air Handler: (Device Type) (Floor Level) (Air Handler Number) (Room Number where AHU is present)

Example: DD LL AHU10 SUPPLY PM10

3) Fire/Smoke Dampers: (Device Type) (Floor Level) (Location) (Damper Number) (Air Handler number, if possible) (Room Number where AHU is present)

Example: DD LL 3103 FSD-OA-1-8 AHU10 PM10

4) Fire Sprinkler Valve: (Device Type) (Floor Level) (System Number) (Location/Area covered by sprinkler system) (Location of valve if possible)

Example: FS L2 2-1 G203 VLV IN STAIR 1

5) Relays and Monitors: (Device Type) (Floor Level) (Location Description) (Function of Relay/Monitor)

Example: RLY L1 EL10 EMR 110A SHUNT TRIP

H. Qualification Data: For Designer, Installer, and Technician as outlined in Section 1.6.

I. Strobe and Voice Evacuation Circuit Labels: Prior to fire system installation, provide for approval a complete list of area descriptions for strobe and voice evacuation circuits to be labeled on the fire alarm control unit(s).

J. Descriptions on Graphic Annunciators: Prior to fire system installation, provide descriptive labels for graphic annunciator labeling which will include sprinkler zones, sprinkler valve locations, fire walls, stairwells, and elevators.

K. Service Manuals and Equipment Descriptions: Thirty days prior to the final acceptance test and after the preliminary testing has been completed submit the following:

1. Furnish four (4) bound copies of complete service manuals to include: device and board specifications, operation, installation, and maintenance manual; manufacturers installation instructions for all aspects of the installation; Test Mode Operating Instructions; manufacturer's wiring specifications for the system; training manual.

2. Maintenance checklists for equipment.

3. As-built circuit diagrams, complete with color-code scheme, and device descriptions.

4. Complete parts list by make model number and manufacturer.

5. List of smoke detector addresses and corresponding sensitivity readings.

6. Copies of approved submittal materials.

7. Operating instructions shall be framed and mounted at the FACU.

L. Calculations:

1. Battery capacity calculations: The battery calculations shall be detailed to show device quantity, standby current, alarm current and total current to justify proposed battery size. Ampere-hour requirements for each system component and each panel component shall be submitted with the calculations.

2. Supervisory power requirements for all equipment.

3. Alarm power requirements for all equipment.

4. Power supply rating justification showing power requirements for each of the system power supplies.

5. Justification showing power requirements of the system amplifiers. Amplifiers shall be sized for a minimum of 1 watt per connected speaker in common areas and 0.5 watt per speaker in all other locations.

6. Voltage-drop calculations for NAC wiring runs demonstrating worst-case condition. Show capability of 25 or 70.7 vrms circuits for wire runs.

7. Provide complete battery calculations for both the alarm and supervisory power requirements. Ampere-hour requirements for each system component shall be submitted with the calculations.

8. Updated battery calculations shall be provided prior to Acceptance Testing to account for as-built conditions.

9. **[Provide detailed specific airflow balancing calculations for each of the air sampling smoke detectors. Calculations shall be submitted with detailed drawings that indicate all sampling points, calculation nodes, and relevant information to allow complete review of the calculations against the detailed design drawings.]**

M. FACU Wire Chart: Prepare a system wire chart. Chart every wire showing the wire number, color, size, type of circuit, designation, origination point and termination point. The chart shall be typewritten with minimum 12-point lettering on paper that is 8.5 inches by 11 inches. The format of the wire chart shall be as shown on the contract drawings. Provide one copy of the wire chart in a sealed plastic envelope (or laminated copy) inside the fire alarm control unit.

N. Terminal Cabinet Wire Chart: Prepare a wire chart of the wires in each terminal cabinet. Chart every wire showing the wire number, color, size, type of circuit, designation, origination point and termination point. The chart shall be typewritten with minimum 12-point lettering. The format of the wire chart shall be as shown on the contract drawings. The chart shall be protected with a clear laminate and mounted in each cabinet so that it does not interfere with the wiring or terminals.

O. Work Schedule: All work shall be coordinated with facility operations. Museum operations may require limited access to areas, arranging for museum security personnel to accompany contractors in non-public areas, and working during off-hours. Prior to initial work, meet with museum staff to establish a work schedule. A work schedule shall be submitted for approval prior to initial work.

P. Certificate of Compliance: Within two weeks after passing the acceptance test, submit a certificate of code and contract compliance to the COTR in accordance with NFPA 72.

Q. **[Software: Furnish programming software as well as any special components including software keys needed to program the panels and appliances. Provide license for the system software and factory support until expiration of the final warranty at which time the manufacturer will allow SI to renew the license for an undetermined amount of time. License shall be provided at the time of commissioning.]**

1.10 QUALITY ASSURANCE

A. General Qualifications:

1. A submittal shall be provided, prior to installation taking place, specifying personnel for each of the roles outlined below.

B. Manufacturer Qualifications

1. Testing Services or Laboratories: Construct all fire alarm and fire detection equipment in accordance with the latest edition of the following publications from Underwriters Laboratories (UL) and Factory Mutual Engineering Corporation (FM):

a. UL Fire Protection Equipment Directory

b. UL Electrical Construction Materials Directory

c. UL 38 – Standard for Manual Signaling Boxes for Fire Alarm Systems

d. UL 228 – Door Closers-Holders, With or Without Integral Smoke Detectors

e. UL 268 - Smoke Detectors for Fire Alarm Systems

f. UL 268A - Smoke Detectors for Duct Application

g. UL 464 - Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

h. UL 497A – Standard for Secondary Protectors for Communications Circuit

i. UL 521 - Heat Detectors for Fire Protective Signaling Systems

j. UL 864 - Standard for Control Units and Accessories for Fire Alarm Systems

k. UL 1283 – Standard for Electromagnetic Interference Filters

l. UL 1449 - Standard for Surge Protective Devices

m. UL 1480 - Speakers for Fire Alarm and Signaling Systems, Including Accessories

n. UL 1971 – Standard for Signaling Devices for the Hearing Impaired

o. FM Approval Guide

p. Codes and Standards, Latest Edition

q. International Building Code

r. NFPA 70, National Electrical Code

s. NFPA 72, National Fire Alarm and Signaling Code

t. NFPA 101, Life Safety Code

u. Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).

v. ASME/ANSI A 17.1, Safety Code for Elevators and Escalators

C. Qualifications of Installer:

1. Installation shall be accomplished by a fire alarm contractor with a minimum of five years' experience in the installation of fire alarm system of comparable size and capacity.

2. Contractor shall have an office, which has been in existence for at least 3 years, within a 121-kilometer (75 mile) radius of the project site.

3. The Installer foremen or team leaders shall be at minimum NICET Level II in fire alarm systems and shall be onsite when any work on the fire alarm system is performed. Work shall not be performed on the fire alarm system if one of these individuals is not present and overseeing work. [Key personnel shall be present on the Contractor's daily log.]

4. **[Quality Control Personnel shall be at minimum NICET Level III in fire alarm systems and shall visit the site weekly to inspect the work installed, including conduit, wiring, devices, and panels. This person or persons shall not be the Installer or the Technician.]**

5. The Technician shall be at minimum NICET Level III in fire alarm systems and shall supervise installation, adjustments, and tests of the system. If a Technician is on

site daily whenever work is performed, they can qualify as the Installer as well. The Technician shall be an employee of the fire alarm contractor.

6. The certifications of the Installer, Technician, and Quality Control Personnel shall be part of the submittals and shall be approved by OSHEM prior to the start of their work. If the Installer or Technician is changed at any point during the project, the credentials of the replacement shall be submitted and approved prior to the start of their work. Certifications for corporate personnel or personnel who will not be on-site for installation of the project will not be accepted.

D. Qualifications of Distributor/ Service Organization/ Designer:

1. Design Personnel certified by NICET as Fire Alarm Level III or IV or a registered fire protection engineer. The manufacturer's equipment distributor shall show evidence of certification by the manufacturer in the technical support of the system installed under this contract.

2. The distributor shall show evidence of certification of at least one employee by the NICET at Level III or IV in the Fire Alarm Systems subfield of Fire Protection Engineering Technology. If such a certified individual is not employed, adequate documentation shall be provided to show comparable training and experience of an existing employee. At a minimum, comparable training and experience shall consist of ten years of progressive experience in the installation and design of fire alarm systems of comparable size and complexity to that specified herein.

3. In lieu of an employee with NICET Level III or IV certification, the distributor shall show evidence of at least one employee with a minimum of ten years of progressive experience in the design of fire alarm systems. In addition, the distributor shall show evidence of technical support in the design, installation, and testing of the systems from a manufacturer-affiliated company, which shall show evidence of certification of at least one employee by the NICET at level III or IV in the Fire Alarm Systems subfield of Fire Protection Engineering Technology.

4. The contractor shall furnish evidence that the fire alarm equipment supplier has an experienced and effective service organization, which carries a stock of repair parts for the system being furnished. Should the Contractor fail to comply with the service requirements of this section, the Smithsonian will then have the option to make the necessary repairs and back-charge contractor without any loss of warranty as provided by the contract documents.

5. The control equipment manufacturer shall provide an employee certified in the inspection, testing and maintenance of the panel and/or equipment being

installed, to assist in the final connections to the panel. This individual shall also assist with pre-testing and acceptance testing.

E. Qualifications of Instructor:

1. Instructor: Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing and maintenance of the system provided. The instructor shall train the Smithsonian employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm system. Qualifications shall be provided to OSHEM for review prior to any training taking place.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.11 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.12 PROJECT CONDITIONS

A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by The Smithsonian Institution or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify COTR no fewer than 48 hours in advance of proposed interruption of fire alarm service.

2. Do not proceed with interruption of fire alarm service without The Smithsonian Institution's written permission.

3. No system shall be out of service during non-business hours unless a fire watch is established.

4. **[At no time shall the work area not be protected by either the temporary fire alarm system or the building fire alarm system.]**

5. When working on the fire alarm system, the Contractor shall be present in the control room or at the main fire alarm control unit for the duration of the work and be aware of any abnormal conditions resulting from their work. If their work causes any abnormal conditions (alarm, supervisory, or trouble signals), the Contractor shall be present to acknowledge them and clear them by the end of the work shift. Issues that would incapacitate the majority or all of the system shall be brought to the attention of the COTR and OSHEM and rectified immediately. If other abnormal conditions are received (not the result of the Contractor's work), the Contractor will discontinue work as needed by SI/OPS to resolve the condition.

6. COTR shall be notified in advance if disruption is required in areas open to the public. The affected area shall be closed to the public during service disruption. Work shall be done during closed-hours, or Smithsonian Institution shall give permission to close the public areas during open hours.

7. All contractor(s) working on the fire alarm system (or subsystem) shall check the system(s) status before and after each shift to ensure no faults are present in the area of work. Any existing alarm, trouble, or supervisory signals shall be recorded at the beginning and end of each shift. Photographs of the panel troubles shall be provided to the COTR and OSHEM before and after each shift. Any troubles in either the area of work or the remainder of the facility determined to be at the fault of the Contractor shall be rectified at no additional cost to the SI within 24 hours of the issue being discovered. Issues determined to be critical by the COTR or OSHEM shall be rectified immediately.

8. If a temporary fire alarm panel is present, photographs of the panel troubles shall be provided to the COTR and OSHEM daily. Any troubles shall be rectified within 24 hours of the issue being discovered.

1.13 TEMPORARY FIRE PROTECTION

A. MC cable may be utilized for temporary fire alarm systems. All temporary MC cable shall be removed prior to project close-out.

B. **[A Listed and Approved temporary wireless fire alarm system shall be provided. The system shall be monitored by the building fire alarm system.]**

1.14 COORDINATION

A. Coordinate device layout with reflected ceiling plan and all ceiling–mounted equipment, including diffusers, lights, security cameras, fire alarm devices, exit signs, and other devices.

B. Coordinate major equipment and aspiration smoke detection piping layouts with other trades to avoid obstructions and excessive changes in direction for piping.

1.15 WARRANTY

A. The contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the final acceptance of this work by the Smithsonian and after the receipt of as-built drawings and schematics of all equipment.

B. **[A full system warranty fire alarm test shall be provided by the installer one month prior to warranty expiration. All interfaced systems (e.g., smoke management systems, lighting systems), shall be tested. All deficiencies found shall be corrected for the warranty to be considered complete. If the warranty is phased, then the testing shall also be phased. The warranty period shall not start when the panel is powered on but rather when the project or phase has been completed.]**

1.16 SERVICE AGREEMENT

A. **[List requirements, if part of the contract. Confirm with OPDC Cost Estimating].**

1.17 EXTRA MATERIALS

A. Spare parts shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, stamping, or tagging.

B. Furnish the following spare parts. Quantity shall be two percent of the installed number of devices, but not less than the quantities listed:

1. Smoke Detectors of each type installed: 5

2. Heat detectors: 2

3. Manual pull stations: 2

4. Audio/visual devices of each type installed: 5
5. Addressable monitor modules: 5
6. Addressable relay modules: 10
7. Duct detector housing: 1
8. Air aspirating smoke detector of each type installed: 1
9. Air aspirating smoke detector filters: 2 of each type installed
10. Air aspirating capillary tubing: 1 spool
11. Air aspirating sample ports: 5 of each type installed
12. Electromagnetic door holder: 2
13. Keys for all fire alarm cabinets: 5
14. Wrenches or special tools required to gain access to all lockable equipment: 5 of each type required

1.18 EMERGENCY COMMUNICATIONS MESSAGING AND PRIORITY LEVELS

A. Messaging shall be provided in a female voice. Voice shall be fully recorded in lieu of being computer generated. The SI reserves the right to reject recordings that are not perceived as intelligible.

B. Unless noted otherwise, latching messaging shall repeat indefinitely until reset at the fire alarm control unit. The following momentary messages shall be broadcast only once: All Clear, Emergency Drill, Test Message, Test Complete, Drill Complete.

C. Messaging shall be preceded and followed by a minimum of two cycles of the tone indicated in the table below.

D. Messaging shall be provided with the following tones and priorities as defined in the table below. All pre-recorded messages shall be stored within the fire alarm control unit.

Message #	Prior-ity	Scenario	Message Type	Pre-tone	Message

2	1	Active Shooter/Hostile Person (exterior)	Lock-down	3 sec 900 Hz	May I have your attention please! An armed threat has been identified outside the building. Please lock all doors, take cover and wait for instructions from security personnel or police officers.
3	2	Active Shooter/Hostile Person (interior)	Evacuate	Temporal (3 rounds)	May I have your attention please! An armed threat has been identified inside the building. Please evacuate the building as quickly and safely as possible. This is not a drill.
1	3	Fire	Evacuate	Temporal (3 rounds)	May I have your attention please! May I have your attention please! A fire has been reported in the building. Please walk to the nearest exit and leave the building. Do not use the elevators.
4	4	Bomb Threat	Evacuate	Temporal (3 rounds)	May I have your attention please! An emergency situation is in progress, all personnel should proceed to the nearest exit immediately and follow the instructions of security personnel.
6	4	Evacuation – General	Evacuate	Temporal (3 rounds)	May I have your attention please! This is a general evacuation request. For your own safety, please proceed to the nearest exit and follow the instructions of security personnel.
5	5	Safe Haven – General	Safe Haven	3 sec 900 Hz	May I have your attention please! There has been an incident outside the building that requires special attention. Please remain in the building until advised by museum staff or emergency personnel.

12	5	Extreme Wind Warning (115 mph or greater)	Seek Shelter	3 sec 900 Hz	May I have your attention please! The National Weather Service has issued an extreme wind warning for our area. All staff and visitors are advised to stay inside the building and away from windows until further notice.
8	5	Tornado Warning	Seek Shelter	3 sec 900 Hz	May I have your attention please! The National Weather Service has issued a Tornado Warning for our area. All staff and visitors should stay inside the building and move away from windows and doors until the warning is over. Please follow directions of security personnel and Smithsonian staff.
7	5	Severe Thunderstorm	Seek Shelter	3 sec 900 Hz	May I have your attention please! The National Weather Service has issued a Severe Thunderstorm Warning for this area. All staff and visitors are advised to stay inside the building until further notice.
11	6	High Wind Warning (Over 40 mph)	Warning	3 sec 900 Hz	May I have your attention please! The National Weather Service has issued a High Wind Warning for our area. Please use caution when exiting the building.
15	9	All Clear	All Clear	3 sec 900 Hz	May I have your attention please! The emergency has been cleared, the building is all clear. Please resume your normal activities. Thank you for your patience and cooperation.

16	10	Emergency Drill	Drill	3 sec 900 Hz	May I have your attention please! This is a drill. This is a drill. The following message is not an actual emergency. This is only a drill.
13	10	Test Message	TEST	3 sec 900 Hz	May I have your attention please! The following is a test of the emergency notification system. This is not an emergency. This is only a test.
14	10	Test Complete	TEST	3 sec 900 Hz	May I have your attention please! This concludes the test of the emergency notification system, thank you for your patience and cooperation.
17	10	Drill Completed	Drill	3 sec 900 Hz	May I have your attention please! The emergency drill has been completed. Thank you for your patience and cooperation. Please continue normal activities.

PART 2 - PRODUCTS

2.1 GENERAL

A. All components provided shall be listed for use with the selected system.

B. With the exception of the air aspirating smoke detection control panels, all fire alarm equipment (including releasing panels) shall be from a single manufacturer.

C. Only appliances that comply with the manufacturer's installation instructions shall be permitted.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements and compatibility to Smithsonian monitoring system, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. FACU, cabinets, and peripheral devices:
    a. Notifier
    b. FireLite
    c. Siemens
    d. Approved equal. (Shall be approved by OSHEM prior to submitting shop drawings)
2. Wire and Cable:
    a. As per Division 26 this specification.
3. Conduit:
    a. As per Division 26 this specification
4. Boxes, supports, terminal blocks, and appurtenances:
    a. As per Division 26 this specification.

2.3 FIRE ALARM CONTROL UNIT (FACU)

A. The control unit shall be a UL. Listed Fire Alarm Control Unit **[with multiplex signaling service and dual channel voice evacuation].** All components shall be provided by one manufacturer. **[The FACU shall be capable of interfacing with any emergency voice notification system installed as part of this project including the ability to initiate audible fire alarm and emergency notification messages through the paging system.]** As the central control unit for the entire system, the control unit shall provide power, supervision, control, and logic, utilizing solid state, modular components, internally mounted and arranged for easy access. Each control unit shall be suitable for operation on a 120-volt, 60 hertz, normal building power supply.

B. Cabinet: Install control unit components in cabinets large enough to accommodate all components and to allow ample gutter space for interconnection of all panels as well as all field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall say Fire Alarm Control Unit and shall not be less than 1 inch high. If multiple panels are provided, additional identification shall be provided on each nameplate to distinguish the panels. Provide prominent rigid plastic or metal identification plates for all lamps, circuits, meters, fuses, and switches. The cabinet shall be provided in sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

C. **[Compatibility: All control units and devices shall be multiple-generation backwards compatible without the use of redundant head-end equipment and control panels.]**

D. **[Devices: Shall be addressable/programmable via rotary or dip switches, unless the device in question interfaces with a monitor module or control relay. Use simple to install and maintain decade-type (numbered 0 to X) address switches by using a standard screwdriver to rotate two dials on the device to set the address.]**

E. Control/Display Modules: Provide power and control modules in the FACU to perform all functions described in this specification.

1. Provide communication between the FACU and remote circuit interface panels, annunciators, and displays.

2. Non-volatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition.

3. Visual indication of alarm, supervisory or trouble initiation on the fire alarm control unit shall be by liquid crystal display or similar means with a minimum of 80 characters of which at least 32 are field changeable.

4. LED display for "ALARM", "AUDIBLE SILENCED", "SUPERVISORY", "TROUBLE", and "POWER ON".

5. Switches or buttons for "ALARM ACKNOWLEDGE", "AUDIBLE SILENCE", "SUPERVISORY ACKNOWLEDGE", "TROUBLE ACKNOWLEDGE", and "RESET."

6. **[Programmable buttons or switches to perform custom functions such as drill, disable, bypass automatic control commands or other special functions as required by design.]**

7. Programmable panel mounted relays to be software programmed to perform control functions required for system operation.

8. Notification appliance circuits as required to supervise and operate all connected notification appliances. Operation of NACs shall be fully integrated with the FACU. Switches shall be used to activate or deactivate speaker and strobe circuits. Using multi-colored LEDs, a clear indication shall be provided showing which circuits are active and to which strobe and audio channel. A live voice message shall override the automatic output through use of a microphone input at the control unit. The system shall be capable of operating all strobes and speakers at the same time. The digitalized voice message shall consist of a non-volatile (EPROM) microprocessor-based input to the amplifiers. The microprocessor shall actively

interrogate all circuitry, field wiring and digital coding necessary for the immediate and accurate rebroadcasting of the stored voice data into the appropriate amplifier input. Loss of operating power, supervisory power or any other malfunction, which could render the digitalized voice module inoperative, shall automatically cause the slow whoop tone to take over all functions assigned to the failed unit.

9. **[System shall be compatible with the building emergency communications or mass notification system equipment. Said equipment shall report its status to the FACU. Reported items shall include, but are not limited to, the following:**

10. Status of notification circuits and ancillary equipment

11. **Trouble signals**

12. **Network status]**

13. **[Voice systems shall meet intelligibility requirements of NFPA 72 [and this specification document].]**

14. Locate diodes and relays, if any, on screw terminals in the FACU and/or strobe booster panels.

15. Additional Requirements: The FACU shall have the following additional features:

    a. System shall be UL 864 listed.

    b. Back-up amplifier.

    c. Field programmable.

    d. Control unit shall have minimum 25% capacity for addition of future signaling line circuits and notification appliance circuits. Each installed circuit shall have 20% spare capacity. **[When circuit isolation is implemented, spare capacities shall apply to each subloop on an SLC circuit.]**

    e. [When adding to existing circuits, a new circuit/card/panel shall be added if less than 10% spare capacity remains.]

    f. Communication with auxiliary devices, including waterflow switches, valve supervisory switches, door controls, etc. using appropriate interface modules as indicated on the riser diagram and interface schematics.

g. [The FACU shall be listed for releasing service and shall be listed for connection to a Central Station Signaling System service.]

h. The FACU shall have drift compensation technology and shall be UL listed as a calibrated smoke test instrument.

i. Device history shall be stored at the FACU. At a minimum, the following information for each sensor shall be maintained: device history, sensitivity levels, alarm verification status, drift compensation data.

j. The FACU shall provide a minimum 500-event history log.

k. All key switches and panel buttons shall be programmed in accordance with the using agency's specific requirements.

l. The computer monitoring station and software provided shall be compatible and compliant with SI network standards. It shall be upgraded prior to project closeout if the original computer provided is no longer compliant with SI's network standards at the time of contract completion.

2.4 FIRE DETECTORS

A. Photoelectric light scattering type smoke detectors shall be provided as follows:

1. The detector shall be suitable for two-wire 24VDC operation and two-way communications on the intelligent analog signaling circuit. Smoke detectors shall be UL listed for use with the FACU and environmental conditions.

2. Detectors shall be self-compensating for ambient temperature and humidity.

3. Detector bases shall be installed on an industry standard, 4 inch (101 mm) square or octagonal electrical outlet box. Bases shall be universal for ionization, heat, and photoelectric (light scattering type) detectors.

4. Detectors shall be twist-lock type on to the base with self-wiping contacts.

5. Screw clamp terminals shall be provided for all conductor terminations.

6. **[The detector shall be addressed, tested, and programmed prior to installation. The detector readout shall yield a discreet electrical value for status tracking and logging for determining maintenance and cleaning requirements. The control unit shall provide a sensitivity readout from the detector without removal from the base.]**

7. Provide self-restoring type detectors that do not require any readjustment after actuation to restore them to normal operation.

8. All components shall be rust and corrosion resistant. Vibration shall have no effect on the detector's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or air born materials. The screen shall not inhibit the movement of smoke particles into the chamber.

9. The detector shall display a differentiating indicating LED when in the alarm state when the system is operating from normal or standby power.

10. **[Where selective localized control of electrical devices is required for interfaced equipment operation, furnish and install a base with software programmed addressable relay integral to the base.]**

B. Photoelectric - Beam Type:

1. Detectors shall be UL listed for use with the fire alarm control unit and environmental conditions.

2. Detectors with active receivers are required.

3. Field programmable sensitivity settings of 20%, 35%, and 60% beam obscuration.

4. Latching alarm LED is built into the cover of the receiver or transmitter.

5. Compensation circuit for environmental variations.

C. Duct Detectors:

1. Duct smoke detectors shall meet the requirements for photoelectric light scattering type detectors. With the addition that duct detectors are UL 268A listed for installation in air duct sampling housings for the detection of smoke in HVAC system ducts.

2. Provide remote indication where the detector is obstructed or not visible from the floor level. Location of remote indicators shall be approved by OSHEM.

3. Provide a remote test station where the detector is more than six feet above floor level. An operating key switch shall initiate an alarm test. Location of key switches shall be approved by OSHEM and shall be accessible from the floor level. Key switches shall be provided no more than 8 feet above finished floor.

4. Weatherproof Enclosure: NEMA 250, Type 4X; NRTL Listed for use with the supplied detector for smoke detection in HVAC system ducts.

5. Sampling Tubes: Design and dimensions as recommend by the manufacturer for the specific duct size, air velocity, and installation conditions where installed.

6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

D. Heat Detectors:

1. Detectors shall be Listed or Approved for use with the FACU and environment conditions.

2. Detectors shall be addressed, tested and programmed prior to installation.

3. Detectors shall display a steady LED when in the alarm state when the system is operating from normal or standby power.

4. Detectors shall be equipped with screw terminals for each conductor.

5. Detectors shall be hermetically sealed and of the automatically resetting type which will operate when ambient air temperature reaches detector setting regardless of rate of temperature rise.

6. Detector operation shall not be subject to thermal lag.

7. Heat detectors in hoistways and elevator machine rooms shall be intelligent, low temperature (135ºF-140ºF), rate-compensating detectors.

2.5 AIR SAMPLING SMOKE DETECTOR

A. General:

1. Air Sampling Scanner detector shall be laser based using a piping system and a fan to transport the particles of combustion to the detector.

2. There shall be two levels of alarm from each zone covered by the detector and one trouble condition from each detector.

3. The air being sampled shall pass through a filter to reduce the amount of dust before entering the detection chamber.

4. Detector shall have the capability to connect to a network providing all data to the fire alarm control unit. The air-sampling detector shall be connected to the building fire alarm system using interface modules, one for each level of alarm and one for common trouble.

5. All pipe airflow balancing calculations shall be performed using listed calculation software. Each pipe or sector shall be calculated.

6. Graphics for the supervisory and alarm addresses at each pipe shall be a hatched area noting the area of coverage, and an icon at the location of the detector unit.

7. Provide one copy of a drawing showing the location of the zone pipes and the area of the building it covers in a flexible, oil-resistant protective binder and mount adjacent to each control unit that the pipe network serves. Provide drawing on a minimum 11x17 paper.

B. Detector Layout

1. Sampling port locations on drawings show design intent only. Contractor shall provide a design based on all required calculations necessary to support the design, including but not limited to hole balance, maximum transport time, hole sensitivity, sample and end cap hole diameters, and overall piping network.

2. Each air sampling pipe run shall monitor smoke conditions within the respective run and shall send the appropriate signal to the smoke detection control panel. This information shall be provided as part of the fire alarm shop drawing package.

3. Provide test port at the end of the trunk line. Extend trunk line to wall, turn down wall and install test port 4.5 feet above finished floor. Place test port at end of each sampling pipe (trunk line) to balance system.

    a. A test port provides the function of a sealed accessory and is only opened when required for testing. It is not a sampling port drilled into the end of the pipe.

4. Return exhaust to protected space.

5. Sampling holes shall be drilled into the pipe once pipe network has been installed. Contractor shall perform calculations required to determine the diameter of each sampling hole. This note is typical for all sampling ports in the air aspirating smoke detection system.

C. Detector:

1. The Detector, Filter, Aspirator and Relay Outputs shall be housed in a mounting box and shall be arranged in such a way that air is drawn from the fire risk and a sample passed through the Dual Stage Filter and Detector by the Aspirator.

2. The Detector shall contain self-monitoring for filter contamination.

3. The Detector shall have an obscuration sensitivity range of 0.005 – 20% obs/m.

4. The Detector shall have four independent field programmable smoke alarm thresholds per pipe (sector) and a programmable scan time delay.

   a. The laser based aspirating detection system shall have four (4) alarm thresholds per pipe (sector). The four alarm levels may be used as follows:

      1) Alarm Level 1 (Alert)
      Activate a visual and audible supervisory alarm.

      2) Alarm Level 2 (Action)
      Activate a visual and audible supervisory alarm.

      3) Alarm Level 3 (Fire 1)
      Activate General Building Fire Alarm

      4) Alarm Level 4 (Fire 2)
      Activate General Building Fire Alarm

   b. [Collections and Other Sensitive Areas (list spaces): Initial Detection Alarm Settings shall be as listed. All other detection system settings shall be approved by OSHEM.

      1) Alarm Level 1 (Alert) 0.05% Obs/m

      2) Alarm Level 2 (Action) 0.10% Obs/m

      3) Alarm Level 3 (Fire 1) 0.15% Obs/m

      4) **Alarm Level 4 (Fire 2) 0.20% Obs/m]**

   c. All Areas **[Other than Listed Above]**: Initial Detection Alarm Settings shall be as listed. All other detection system settings shall be approved by OSHEM.

      1) Alarm Level 1 (Alert) 0.50% Obs/m

      2) Alarm Level 2 (Action) 1.00% Obs/m

      3) Alarm Level 3 (Fire 1) 1.50% Obs/m

      4) Alarm Level 4 (Fire 2) 2.00% Obs/m]

5. Each pipe shall have its alarm thresholds set by a Sector Factor. The Sector Factor range shall be between 0.5 and 2.0 (where 2.0 doubles the normal alarm threshold settings).

6. The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Twenty-four hour standby battery backup is required followed by 15 minutes in an alarm condition.

7. The Detector shall also incorporate facilities to transmit the following faults:

    a. Detector

    b. Air flow

    c. Filter

    d. System

    e. Zone

    f. Network

    g. Power

8. Urgent and Minor faults. Minor faults shall be considered as servicing or maintenance signals. Urgent faults indicate the unit may not be able to detect smoke.

9. The detector shall have a flow sensor for each pipe (sector) inlet. Both Minor and Urgent flow faults can be reported.

10. The detection unit shall be capable of allowing for multiple sampling pipe runs up to 200m in total, (4 pipe runs per detector) with a transport time of less than 120 seconds or as appropriate codes dictate. Single zone, single pipe detectors may be used, subject to the listed limitations of the detector. Each pipe on multiple-zone detectors shall be addressable.

11. The Assembly shall contain relays for alarm and fault conditions. The relays shall be software programmable to the required functions. The relays shall be rated at two amps at 30 VDC. Remote relays shall be offered as an option and either configured to replicate those on the detector or programmed differently.

12. The assembly shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each

even shall be recorded. Each detector (zone) shall be capable of storing up to 10,000 events.

D. Displays:

1. A Display module shall be provided within each detector.

2. Each Display shall provide the following features at a minimum:

   a. A bar graph display.

   b. Four independent high intensity alarm indicators, Alert, Action, Fire 1 and Fire2, corresponding to the four alarm thresholds of the indicated sector.

   c. Alarm threshold indicators for Alert, Action, and Fire 1.

   d. LED indication that the First Alarm Sector is established.

   e. Detector fault and airflow fault indicators.

   f. Faults originating in the particular zone (Zone Fault) shall be distinguished from those produced by the overall smoke detection system and from those resulting from network wiring errors (Network Fault). LED indicators shall be provided for each fault category.

   g. Minor and urgent fault LED indicators.

E. Piping Network:

1. The sampling pipe shall be smooth bore with an internal diameter between 5/8 – 1 inch (15-25mm). Normally, pipe with an outside diameter of 1” (25mm) and internal diameter of 7/8 inch (21mm) should be used.

2. The pipe material shall be CPVC and shall meet UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics. Flexible tubing shall not be used.

F. Sampling Holes

1. Sampling holes of 5/64 inch (2mm) or otherwise appropriately sized holes shall not be separated by more than the maximum distance allowable for conventional point detectors as specified in the local code or standard. Intervals may vary according to calculations. Sampling hole layouts shall be indicated on the plans.

2. Consideration shall be given to the manufacturer's recommendations and standards in relation to the number of Sampling Points and the distance of the Sampling Points from the ceiling or roof structure and forced ventilation systems.

2.6 [LINE-TYPE FIXED TEMPERATURE DETECTORS

A. Provide **[thermostatic][or][thermistor]** line-type heat detection cable **[with weather-resistant outer covering]** where indicated. Cable shall be nominally rated for a temperature of **[68][88][138]** degrees C **[155][190][280]** degrees F and shall operate on fixed temperature principle only.]

2.7 MANUAL PULL STATIONS

A. Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

B. Provide double action addressable manual stations where shown on the drawings, to be flush or surface mounted as required. Manual stations shall be addressable.

C. **[Provide single action intelligent manual stations in public areas of the building with plastic protection cover with integral local audible alarm (9 volt) to be flush or surface mounted as required. Manual stations shall be addressable.]**

D. Stations shall be equipped with terminal strip and pressure-style screw terminals for the connection of field wiring. Stations that require the replacement of any portion of the device after activation are not permitted. Stations shall be finished in red with molded raised lettering operating instructions of contrasting color. The use of a key or wrench shall be required to reset the station.

E. [Manual release and abort switches shall be a contrasting color from building fire alarm manual pull stations. Signage shall clearly identify the function of the stations.]

2.8 [ISOLATION MODULES

A. **Provide isolation modules to subdivide each signaling line circuit [into groups of not more than [20 addressable devices][_____]][each floor][in accordance with NFPA 72] between adjacent isolation modules.]**

B. Isolation modules shall provide short circuit isolation for signaling line circuit wiring.

C. Power and communications shall be supplied by the SLC and shall report faults to the FACU.

D. After the wiring fault is repaired, the fault isolation modules shall test the lines and automatically restore the connection.

2.9 NOTIFICATION APPLIANCES

A. Speakers and strobes shall be 24VDC (strobes) or 70 VAC (speakers) and shall be equipped with terminal strip and pressure-style screw terminals for the connection of field wiring. Devices shall be mounted to 4 inch (101 mm) square outlet boxes.

B. Speakers: Provide fire alarm speakers conforming to UL 464.

1. **[Speakers shall be provided with at least the following four tap settings: 2-watt, 1-watt, 1/2-watt, and 1/4-watt.]**

2. The audible signal shall have two alternate and distinct audible patterns; horn tone and recorded voice message; each field switchable for peak output levels of 100db or 106db measured at 3048mm (10 feet). When multiple tones are activated simultaneously, the tones shall be prioritized to avoid interference.

3. System shall meet intelligibility requirements of NFPA 72 **[and this specification document.]**

4. Where the design has determined that high-challenge acoustic areas are present, high-fidelity speakers are to be provided to achieve audibility and intelligibility in the subject areas.

5. **[If determined to be needed, design team to specify specific makes/model options in this section.]**

C. Strobe lights

1. Provide with **[red] [white]** finish plate and with the word **["FIRE"] [“ALERT”]** horizontally printed for ceiling mounting.

2. Xenon strobe with a minimum repetition rate of 1 Hz, not exceeding 3 Hz and a maximum duty cycle of 40% with pulse duration of 0.2 seconds.

3. Visual alarm signals shall be furnished with minimum light intensity of 75 candelas and meet the requirements of ADA and UL 1971. In large rooms with ceilings over 10 feet, 110 candela models shall be provided. Any device up to 110 cd shall have adjustable candela ratings.

4. Provide strobe light visual alarm signals that operate on 24 VDC.

5. Synchronization shall be provided as required in NFPA 72. All strobe lights within view of one another shall be synchronized.

D. Audio-Visual Combination Assemblies shall be provided where strobes and speakers are identified at the same locations.

2.10 [TEXTUAL DISPLAY SIGNS

A. Textual display signs shall be **[LED][LCD flat panel][LED scrolling]** and shall not exceed 400 mm long by 150 mm high by 75 mm deep 16 inches long by 6 inches high by 3 inches deep with a height necessary to meet the requirements of NFPA 72. The text display shall spell out the word "EVACUATE" or "ANNOUNCEMENT" **[and the remainder of the emergency instructions]** as appropriate. The design of text display shall be such that it cannot be read when not illuminated.

B. **[LCD or LED scrolling text displays shall meet the following requirements at a minimum:**

1. **Two lines of information for high priority messaging.**

2. **Minimum of 20 characters per line (40 total) displayed.**

3. **Text shall be no less than height requirements and color/contrast requirements of NFPA 72.**

4. **32K character memory.**

5. **Display shall be wall or ceiling mounted.**

6. **Mounting brackets for a convenient wall/cubicle mount.**

7. **[During non-emergency periods, display date and time.]**

8. **The system shall interface with the textual display sign control panel to activate the proper message.]]**

2.11 AMPLIFIERS, PREAMPLIFIERS, TONE GENERATORS

A. General: Amplifiers, preamplifiers, tone generators, digitalized voice drives and all other hardware necessary for a complete, operational dual channel voice/alarm signaling service conforming to NFPA 72 shall be housed in a remote fire alarm control unit,

terminal cabinet, or in the fire alarm control unit. Each amplifier shall have two channels: one to broadcast a message and the other for paging.

B. Construction: Amplifiers shall utilize solid-state components and shall be provided with output protection devices sufficient to protect the amplifier against any transient voltage up to ten times the highest rated voltage in the system.

C. Inputs: Each system shall be equipped with separate inputs from the tone generator, digitalized voice driver and panel mounted microphone. Microphone inputs shall be of the low impedance, balanced line type. Both microphone and tone generator input shall be operational on any amplifier.

D. Tone Generator: The tone generator shall be of the modular, plug-in type with securely attached labels to identify the component as a tone generator and to identify the specific tone it produces. The tone generator shall be capable of producing multiple tones and be constantly repeated until interrupted by the digitalized voice message, the microphone input, or the alarm silence mode as specified. Tones shall be approved by OSHEM before panel programming. The tone generator shall be single channel with an automatic backup generator per channel such that failure of the primary tone generator causes the backup generator to automatically take over the functions of the failed unit and causes transfer of the common trouble relay.

E. Protection Circuits: Each amplifier shall be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component shall cause automatic transfer to a designated backup amplifier, illumination of a visual "amplifier trouble" indicator on the control unit, appropriate logging of the condition and other actions for trouble conditions as specified.

2.12 **[ELECTROMAGNETIC DOOR HOLDERS**

A. **Where indicated on the drawings, provide magnetic fire door hold open devices. The electromagnetic holding devices shall be designed to operate on [24 VDC] [120 VAC], and require not more than 3 watts of power to develop 1.72 bar (25 psi) of holding force.**

B. **The initiation of nearby smoke detectors shall cause the release of the electromagnetic door-holding device permitting the door to be closed by the door closer. The door hold open devices shall release, allowing the doors to close upon receiving a signal from either: local smoke detectors, Listed and labeled for the application.**

C. **The initiating smoke detectors shall be located within 1.5 m (5 ft) of the door hold open device as required by NFPA 72.**

D. **The device shall be UL Listed based on UL 228 tests.**

E. **[Each electromagnetic door holder shall be provided with means of manual release from a position at the door.]**

F. **Door hold open devices shall fail open, such that the door closes upon loss of power, or the holding device shall have a secondary power source.**

G. **Where magnet extenders are installed, only types compatible with the magnet are permitted.**

H. **Doors fitted with release mechanisms shall be provided with appropriate signage, e.g., 'Automatic Fire Door – Keep Clear.']**

2.13 **[REMOTE PANELS**

A. **Provide remote panels in the locations shown on the plans.**

B. **Remote panels shall meet the requirements listed under Section 2.02 of this specification. Lettering on the nameplate shall say Remote Fire Alarm Control Unit.]**

2.14 **[GRAPHIC ANNUNCIATORS**

A. **Annunciator Panel: Provide a graphic annunciator that indicates the building floor plan, including locations of stairs and elevators, control valve locations, and fire walls. The boundaries for Indicating device circuits, HVAC zones, and sprinkler zones shall be clearly marked on the floor plan. Annunciator shall include a north arrow and a "you are here" indicator. The graphic annunciator shall be a minimum size of 3 feet by 3 feet (914 mm x 914 mm).**

B. **[LCD display: Provide an LCD in the graphic annunciator panel. The LCD shall display the same message displayed on the fire alarm control unit.]**

C. **Indicating Lights: Provide the graphic annunciator with individual LED indicating lights for each type of alarm and supervisory device. Provide an amber LED for indicating a system trouble condition and a separate blue LED for indicating a supervisory condition. Provide a green LED to indicate presence of power and a red LED to indicate an alarm condition. The actuation of any alarm signal shall cause the illumination of a boundary LED, a floor LED, and a device LED. System supervisory or trouble shall cause the illumination of the trouble or supervisory LED. In addition to all of these LED indicators, provide emergency power indicating LED. Provide a push button LED test**

switch. The test switch shall not require key operation. Annunciator LEDs shall only be extinguished by operation of the system reset switch on the FACU.

D. **Material: Construct the graphic annunciator faceplate of smoked Plexiglas. The LEDs shall be backlit. All control equipment and wiring shall be housed in a surface mounted back box. The exposed portions of the back box shall be bronze plated with knockouts.**

E. **Programming: Where programming for the operation of the proper LEDs is accomplished by a separate software program than the software for the fire alarm control unit, the software program shall not require reprogramming after loss of power. The software shall be reprogrammable in the field.]**

2.15 REMOTE MONITORING SYSTEM

A. All equipment device wiring shall be provided for remote monitoring.

B. FACU shall be compatible with existing monitoring system.

C. Communication between FACU and remote monitoring station shall be via **[ethernet] [digital dialer] [radio].**

D. **[Equipment shall be compatible with the existing SI Keltron network.]**

2.16 POWER SUPPLIES

A. Primary power for the FACU shall be 120VAC service obtained from the emergency power panel board. Red colored breaker locks shall be provided for all fire alarm circuit breakers.

B. Secondary power for the FACU shall be provided by sealed gelled electrolyte batteries. Batteries shall be housed in the control cabinet or a separate cabinet with adequate cell separation to prevent accidental discharge.

C. Battery Capacity: Battery supply shall be calculated to operate its load in a supervisory mode for **[24][48]** hours with no primary power applied, and after that time, operate its alarm mode for **[5][15]** minutes. (In addition, an alarm reserve correction of 1.3 shall be included.)

D. Battery Charger: Secondary power battery chargers shall be obtained from the emergency power panel board. Provide battery-charging circuitry for each standby battery bank in the system low voltage power supply or as a separate circuit. The charger shall be automatic in design, adjusting the charge rate to the condition of the batteries. Battery charge rate and terminal voltage shall be read using the fire alarm control unit

LCD display in the service mode, indicating directly in volts and amps. Charger shall be housed in the main fire alarm control unit or the battery cabinet.

E. Fast tab battery terminals are not permitted for batteries larger than 12 ampere-hours.

2.17 SURGE PROTECTIVE DEVICES

A. Surge protective devices shall be provided to suppress all voltage transients which might damage fire alarm control unit components. Systems having circuits located outdoors, communications equipment shall be protected against surges induced on any signaling line circuit. Cables and conductors that serve as communications links shall have surge protection circuits installed at each end. The surge protective device shall wire in series to the power supply of the protected equipment with screw terminations. Line voltage surge arrestor shall be installed directly adjacent to the power panel where the FMCU breaker is located.

B. Surge protective devices for nominal 120 VAC shall be UL 1449 listed with a maximum 500-volt suppression level and have a maximum response time of 5 nanoseconds. The surge protective device shall also meet IEEE C62.41.1 and IEEE C62.41.2 category B tests for surge capacity. The surge protective device shall feature multi-stage construction and be provided with a long-life indicator lamp (either light emitting diode or neon) which extinguishes upon failure of protected components. Any unit fusing shall be externally accessible.

C. Surge protective devices for nominal 24 VAC, fire alarm telephone dialer, or ethernet connection shall be UL 497B listed, meet IEEE C62.41.1 and have a maximum response time of 1-nanosecond. The surge protective device shall feature multi-stage construction and be self-resetting. The surge protective device shall be a base and plug style. The base assembly shall have screw terminals for fire alarm wiring. The base assembly shall accept "plug-in" surge protective module.

D. All surge protective devices (SPD) shall be the standard product of a single manufacturer and be equal or better than the following:

1. For 120 VAC nominal line voltage: UL 1449 and UL 1283 listed, series connected 120 VAC, 20A rated, surge protective device in a NEMA 4x enclosure. Minimum 50,000-amp surge current rating with EMI/RFI filtering and a dry contact circuit for remote monitoring of surge protection status.

2. For 24-volt nominal line voltage: UL 497B listed, series connected low voltage, 24-volt, 5A rated, loop circuit protector, base and replaceable module.

3. For alarm telephone dialers: UL 497A listed, series connected, 130-volt, 150 mA rated with self-resetting fuse, dialer circuit protector with modular plug and play. SECTION 28 31 76 Page 50.

4. For IP-DACTS: UL 497B listed, series connected, 6.4-volt, 1.5A rated with 20 kA/pair surge current, data network protector with modular plug and play.

2.18 EQUIPMENT LOAD RELAYS

A. Relays for the control of air handler contactors and elevator recall circuits shall be rated for use with circuits up to 240VAC at 7A inductive. Relays shall be of the sealed pluggable type, and terminations shall be made to pressure-type screw terminals.

B. Wiring powering equipment load relays shall be supervised.

2.19 INTERFACE/CONTROL MODULES

A. Furnish intelligent analog signaling circuit interface modules for the monitoring of contact type initiation devices, the control of electrical devices, fire pump controllers, load control relays (controlling elevators and HVAC equipment), and each independent smoke detection, kitchen, and gaseous fire suppression systems. The modules shall be capable of monitoring three separate functions: alarm, trouble, and supervisory conditions.

B. **[The module shall be addressed, tested, and programmed prior to installation using a UL listed programmer/tester.]**

C. The module shall display a steady or contrasting intermittent LED for each circuit, in both normal and standby power conditions, when in the alarm state or during control circuit is activation. The LED shall flash during system address polling.

2.20 [FIREFIGHTER TELEPHONE COMMUNICATIONS SYSTEM

A. **Provide a firefighter telephone communication system with complete, common talk, closed circuits. The system shall include, but not be limited to, a master control station mounted in the fire alarm control unit, a power supply and standby battery system, and remote telephone stations.**

B. **Provide a master control station that shall provide all power, supervision and control for all wiring, components, and circuits. The act of lifting any remote telephone handset from its cradle shall cause both a visual and audible signal to annunciate at the master control station. Removing the handset at the master control station and**

depressing a button at the remote telephone handset shall cause the automatic silencing of the audible signal.

C. **Communication between the master control station handset and any/or all remote handsets shall require the depressing of a push-to-talk switch located on any/all remote handsets. During the time that the master control handset is removed from its cradle, it shall be possible to communicate between five remote handsets and the master control station.**

D. **Handsets shall be able to monitor any conversation in progress and join the conversation by pressing the push-to-talk button. It shall not be possible to communicate between two or more remote handsets with the master control station handset in its cradle. The master control station handset shall be red in color and equipped with a 5-foot (1524 mm) long strain-relieved coiled cord. All wiring connections shall be made to terminal strips.**

E. **The master control station shall monitor all wire and connections for any opens, shorts or grounds that would render the system inoperable or unintelligible. The master control station shall be equipped with a silencing switch and ring-back feature such that any audible trouble signal can be silenced and will be so indicated by the lighting of an amber LED. Once any trouble condition has been corrected, the amber LED will be extinguished, and the silence switch will sound again until the switch is restored to its original position.**

F. **The master control station shall be equipped with a separate, LED annunciated switch for each telephone circuit. In addition, LEDs shall provide for the annunciation of operating and supervisory power. The loss of operating or supervisory power shall cause an audible and visual indication at the master control station and shall cause the fire alarm trouble signal to sound on the FACU.**

G. **All switches, LEDs and controls shall be fully labeled.**

H. **Provide surface or flush mounted remote telephone stations as indicated on the drawings. Each station shall be equipped with a hinged door that is magnetically locked. Each handset shall be permanently wired in place with a coiled cord. Each handset shall be red high-impact cycolac and shall be equipped with a push-to talk switch which, when operated, will signal the master control station and a switch-equipped, storage cradle.**

I. **Provide cabinet to contain a minimum of five (5) handsets.]**

2.21 MICROPHONE AND SELECTOR SWITCH

A. Provide handheld microphone and adjacent selector switch schedule in the same cabinet enclosure. The selector switch schedule shall contain a minimum of **[number (30)]** buttons for selecting a speaker circuit or group of speaker circuits for either annunciating pre-recorded messages or manual live page messages. Refer to the contract drawings for additional information on the selector switch schedule. One button shall be provided to incorporate all speaker circuits within the building for an: “all-call" function.

B. Other than Test, Drill, and All Clear pre-recorded messages, the selector switch buttons shall be latching. The latching messages shall broadcast the pre-recorded messages until the button manually unlatched.

2.22 **[TEMPORARY ADDRESSABLE WIRELESS FIRE ALARM SYSTEMS**

A. **Fire Alarm Control Unit Connectivity**

1. **Wireless devices used as components of a temporary fire alarm system shall be capable of connection to a compatible intelligent Fire Alarm Control Unit (FACU) via a Signaling Line Circuit (SLC) via a gateway. The gateway shall provide the link to one mesh network of wireless devices. Multiple gateways can be supported on the same intelligent FACU, limited to four wireless mesh networks in the same radio space. All intelligent sensing functions supported for wired devices shall be supported by comparable wireless devices. Additionally, the Unit shall allow wired devices to be identified with unique type codes which all the system to display wireless trouble identifications such as low battery, jamming, and tamper.**

2. **At a minimum, an alarm signal from the wireless control panel shall be transmitted to the building fire alarm control unit located in the OPS control room.**

3. **Reliability of the wireless communication for the wireless system shall incorporate an advanced mesh technology which incorporates UL 864 Class A approved supervised, redundant communication. All devices in the mesh network shall be capable of acting as repeaters for other devices in the same network. The wireless system shall also have a suite of tools that can be installed on a portable PC and used to assist in qualifying the site, installing the system, and verifying the proper operation of the system.**

4. **The wireless system shall be approved or Listed by the following agencies, as appropriate for each device:**

a. **UL**

b. **FM**

c. **FCC**

B. **Addressable Devices – Wireless**

1. **The system shall be capable of supporting intelligent addressable wireless detectors and monitor modules with similar appearance and capabilities as wired addressable intelligent devices.**

2. **Intelligent wireless devices shall utilize a gateway device to communicate with the intelligent fire alarm control panel, such that the wireless devices report to the panel using the established SLC protocol.**

3. **Wireless devices shall be capable of co-existing on the same panel with wired devices and shall be capable of participating in common control-by-event programming sequences.**

4. **Wireless devices (excepting the gateway) shall operate on batteries recommended by the manufacturer, and shall be UL tested and Listed for 2 years of operation on one set of batteries.**

5. **The gateway shall be connected to the panel SLC loop and shall be capable of being powered by the SLC loop as well. Alternatively, the gateway shall be capable of connection to the SLC loop only for communication with the FACU, and power may be supplied via a separate 24VD input.**

6. **Programmable and automatic sensing options supported by the intelligent FACU shall also be supported for equivalent wireless devices. This includes but is not limited to: ability to set the sensitivity at the FACU, ability to adjust sensitivity based on the time, ability to automatically compensate for dust accumulation and other slow environmental changes, ability to annunciate two dirty detector states, and the ability to participate in cooperative sensing decisions with other wired or wireless detectors that are connected to the same panel.**

7. **Wireless devices shall be connected to a compatible intelligent fire alarm system, and shall be supported by the system as wireless devices. Trouble conditions that are unique to wireless devices shall be reported at the head end, such as: Low Battery, Jamming, and Tamper.**

8. **Intelligent wireless devices shall use a UL approved Class A mesh communication protocol to provide redundant supervised wireless communication links.**

9. **A wireless mesh shall be comprised of up to four gateways each with forty-nine wireless devices per gateway (for a total of 196 wireless devices).**

10. **Multiple wireless gateway systems may be connected to the same FACU.**

11. **The system shall allow for up to four wireless gateways in the same radio space.**

12. **Device status indicators (LEDs) on wireless devices shall not be required to match indications of wired devices, in particular for active indications where a steady-on LED would reduce the battery life of the device.**

13. **Wireless detectors shall have dedicated bases with magnetic tamper mechanisms that initiate a trouble when the device is removed from the base. The tamper trouble condition shall latch at the panel until the detector is restored to the normal installed position and the trouble has been reset.**

14. **Available wireless devices shall include:**

    a. **Intelligent wireless smoke detector (photoelectric technology)**

    b. **Intelligent wireless fixed temperature heat detector, 135 degrees**

    c. **Wireless monitor module**

    d. **Wireless gateway**

15. **Unprogrammed wireless devices shall be capable of being used to perform a site survey to assist in determining the viability of a site for a wireless application. Tests shall include point to point connectivity, and a background RF survey. A program that supports qualification of potential wireless applications, configuration and installation, and diagnostics shall be available. This program shall be installed on a Windows PC, and shall be capable of communicating with wireless devices by use of a USB adapter that plugs into the computer.**

16. **Provide laminated drawings adjacent to each wireless panel showing all connected appliance locations.**

17. **Notification Appliances**

    a. **Horn/Strobe notification appliances shall be provided as part of the temporary fire alarm system.**

18. **System panels shall be carefully dismantled and returned to the COTR after final acceptance testing.]**

2.23 CABLE FASTENERS

A. Wire nuts shall be rated to the same temperature as the cabling in question.

B. Wire nuts shall be provided at the size appropriate for the cabling in question.

C. Terminal blocks shall be provided at the size appropriate for the cabling in question.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment, materials, installation, workmanship, examination, inspection, and testing shall be in accordance with Division 26 of the project specifications and NFPA 72, except as modified herein.

3.2 PRIMARY POWER

A. Make the service connection for the FACU at the emergency distribution panel where shown. Provide a separate NEMA **[1] [4X]** "General Purpose Enclosure" for the circuit breaker. The circuit breaker enclosure shall be painted red, marked "FACU", and provided with a lockable handle or cover.

3.3 SYSTEM FIELD WIRING AND CONDUIT

A. Wiring within Cabinets and Junction Boxes: Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box or cabinet.

B. Conductor Type and Size: Wire size shall be sufficient to prevent dropping voltage below specified minimum levels. Wire type and sizing of conductors shall also be in accordance with the manufacturer's wiring specifications. Conflicts with the manufacturer's requirements shall be brought to the attention of OSHEM during the shop drawing phase, prior to product approval. Minimum wire size and type shall be as follows, unless manufacturer's requirements conflict. Conflicts shall be brought to the attention of the COTR and OSHEM:

1. Signaling Line Circuits: 16AWG, Type FPLR/FPLP, solid copper

2. Notification Appliance Circuits: 14AWG, Type FPLR/FPLP, solid copper, twisted pair
3. 120VAC Circuits: 12AWG, Type THHN, solid copper
4. Interfaced Circuits: 16AWG, Type FPLR/FPLP, solid copper
5. VESDAnet: 16AWG, Type FPLR/FPLP, shielded, stranded
6. Speaker Circuits: 16 AWG, Type FPLR/FPLP, solid copper, twisted pair
7. Firefighter Telephone Circuits: 18 AWG, Type FPLR/FPLP, 2-hr rated, shielded, solid copper, twisted pair
8. Battery Cable: 14AWG, solid copper

C. Connectors:

1. Twist-type wire nuts are permitted at junction boxes 4" square or smaller. No more than two wires are permitted to be connected in this manner.
2. Stab-lock or similar connectors are not permitted.
3. Terminal blocks shall be utilized at terminal cabinets.

D. Terminal Cabinets: Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Cabinet size shall be appropriate for the size of the wiring to be connected. All terminals shall be permanently labeled with circuit type, circuit number, and area served. Terminal strips shall be appropriately sized to accommodate the cables being connected.

E. **[Circuit Isolation:**

1. **Before applying the following requirements, NFPA 72, 2019 Edition (or later) Section 23.6.1 must be applied. Do not utilize Section 23.1.6.4 unless directed or approved by the OSHEM FPE.**
2. **T-tapping shall only be permitted at a terminal cabinet specific to this purpose, at locations coordinated with and approved by the OSHEM FPE. T-tapping that takes place outside of this arrangement is not permitted.**
3. **T-tapping directives apply where any FACU has more than 50 devices of any kind on any single SLC:**

a. Where the SLC in question has up to 50 devices, provide a terminal strip in a UL enclosure at the beginning of the circuit before the first device.

b. Where the SLC in question has more than 50 and less than 100 devices, the circuit shall have a single T-tap, splitting the devices into two circuits, with a maximum of 50 devices on each side of the T-tap.

c. Where the SLC in question has more than 100 and less than 150 devices, the circuit shall have multiple T-taps, splitting the devices into three circuits, with a maximum of 50 devices on each branch of the T-tap.

d. Where the SLC in question has more than 150 and less than 200 devices, the circuit shall have multiple T-taps, splitting the devices into four circuits, with a maximum of 50 devices on each branch of the T-tap.

e. Where the SLC in question has more than 200 devices, provide a second SLC split the number of devices evenly between SLC's and follow items b, c, and d above as appropriate.]

F. Conductor Numbering: All conductors installed in the system shall be numbered at every junction point and device. Use a numbered shrink-wrap label designed specifically for this purpose. Wire numbers shall be the same as those designated on the as-built drawings. Mark each terminal in accordance with the wiring chart and diagrams of the system.

G. Conductor Color Coding: Color coded conductors shall be consistent for each type of circuit. **[When renovating or adding to an existing system, color-coding shall match the existing system.]** Wire color coding schedule shall follow the requirements specified in Section 1.9 of this specification.

H. Junction Boxes: Any junction/gang box used in a circuit shall sole be dedicated to that circuit. A common junction/gang box is not permitted for routing multiple circuits. 6 inches of slack cable shall be provided in all pull-through boxes without devices.

I. Signaling Line and Notification Appliance Circuits

1. Signaling Line, notification appliance, and power circuits shall each be in separate conduit. Circuits accessory to (e.g. controls wiring), or not associated with the fire alarm system shall be run in separate conduit until the point of termination to the fire alarm system.

2. Strobes are to be connected to circuits separate from speakers. This includes strobes and speakers that are mounted as a unit.

3. Provisions for tying in signaling line and notification appliance circuits directly to the FACU mother board (board containing CPU) shall not be used. Initiation and indicating circuits shall be tied to a separate electronic board before connection to the motherboard.

J. Circuit Loading:

1. Spare capacity shall be in accordance with Section 1.07 of this specification.

2. Circuits operating at 24 VDC shall not operate at less than 21.6volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10% of nominal voltage.

K. Spare Circuits: Provide one spare signaling line and notification appliance circuit for each terminal box placed at each floor on each riser. Spare capacity shall also be provided in the FACU for these circuits. FACU control boards shall be provided to permit two spare initiation circuits and two spare indicating circuits. Spare circuits are not to include those provided on the motherboard.

L. Conduit:

1. All conductors shall be in grounded metal conduit. Conduit shall be Rigid metal or EMT. Flexible metal conduit not exceeding six-foot lengths shall be permitted from junction box to initiating device. On flexible metal conduit, use only insulated throat connectors.

2. Run conduit or tubing concealed unless specifically shown otherwise on the drawings.

3. Minimum conduit size shall be 3/4-inch.

4. Steel compression-type fittings shall be used. Set-screw type fittings are not permitted.

5. All sharp edges, including excess all-thread rod, shall be removed from the interior of junction boxes before wire is pulled.

6. Provide insulated throat connectors or plastic bushings on all conduit.

M. Labeling: Label all addressable input/output fire alarm cover plates and appliances (including smoke detectors, manual pull stations, addressable modules, and notification appliances) with their address utilizing a label machine. Addresses on SLC or NAC devices/appliances shall include panel number, circuit number, and appliance number.

Associated end of line shall also be identified as such. Each SLC field device address shall match the fire alarm display address.

N. Circuits to Interfaced Equipment:

1. Circuits to smoke management systems, fan shutdown systems, door locking systems, A/V shutdown, fire door release, firefighter telephones in elevator cabs, etc. shall terminate in terminal cabinets within 914mm (3 feet) of the controllers for those systems. The completion of those circuits from the terminal cabinets to the appropriate system shall be provided under the appropriate division specification.

2. Devices shall have a separate raceway up until the point of termination at the fire alarm system. Wiring other than fire alarm cabling shall not be permitted in any fire alarm conduit.

O. Load Control Relays:

1. Where required by NFPA 101, relays shall be located within three feet of the device controlled.

2. Wiring between the fire alarm addressable module and the equipment load relay shall be supervised.

3.4 ACCESS PANELS

A. All devices shall be easily accessible for testing, repairs, and maintenance. Provide access panel of sufficient size where devices and junction boxes are concealed to allow access. The Contractor shall provide documentation showing accessibility.

B. The minimum access size shall be 12” x 12”. Larger panels may be required at the discretion of the OSHEM FPE if access is deemed insufficient for maintenance staff.

3.5 FIRESTOPPING

A. Seal all holes caused by penetrating conduit, piping, or other penetrations that pass through floors, walls, or ceilings. Firestop penetrations through floor slabs, fire-rated walls, shafts, or any fire-rated assembly in accordance with Division 07 Section Penetration Firestopping.

3.6 MARKING

A. All metal surfaces shall be painted. Metal conduit in finished areas shall be painted the color to match adjacent surfaces. Junction boxes in unfinished areas shall be painted full gloss enamel red. Painting shall be in accordance with Section 09 Painting.

B. 2-inch wide red bands shall be applied every 10 feet when not using red-colored conduit. Tape shall not be used for banding purposes.

C. Prior to acceptance testing, label all addressable input/output fire alarm cover plates and appliances (including detectors, manual pull stations, addressable modules, and notification appliances) with their address utilizing a labeling machine. Handwritten labels are not acceptable. Addresses on SLC or NAC appliances shall include panel number, circuit number, and appliance number. Associated end of line appliances shall also be identified as such. Each SLC field appliance address shall match the fire alarm display address. Relays and monitors shall be labeled with their associated function or the equipment they control.

D. All circuits entering and leaving a terminal cabinet or panel shall be marked with their designations. Where the circuits then travel to another panel or terminal cabinet, those locations and designations shall also be marked in the terminal cabinet.

E. All duct smoke detectors shall be labeled with the designation of the air handling unit it serves and that unit's location.

F. Monitor modules associated with sprinkler **[and fire pump]** equipment shall be labeled with the corresponding system number or valve designation.

G. Laminated device coverage maps shall be provided adjacent to each aspirating smoke detection unit. Maps shall mark the coverage area of each pipe on the detection unit. Maps shall be sized at 11"x17" minimum.

H. Air Aspirating Smoke Detectors shall be labeled with settings adjacent to the panel on a laminated panel. Information present must include, at a minimum:

1. Transport time (for each pipe)
2. Aspiration speed
3. Sensitivity levels for each supervisory/alarm threshold
4. Power feed circuit number

3.7 DEVICE INSTALLATION

A. FACU: Locate the FACU where indicated on the drawings. Surface mount the enclosure with the LCD display located between 5 feet and 6 feet (1829 mm) above the finished floor or center the cabinet at 5.5 feet, whichever is lower.

B. Amplifiers: Install a backup amplifier in each fire alarm zone where one or more amplifiers are present.

C. Manual Pull Stations: Mount the manual pull stations so that their operating handles are 4 feet (1219 mm) above the finished floor.

D. Strobes: Wall mount strobes shall be a minimum of 80 inches (2032 mm) above the finished floor or 6 inches (152 mm) below the ceiling, whichever is lower. The bottom of the strobe lens shall be above the 80-inch level.

E. Speakers: **[Speakers should typically be set on the 1/2 watt tap. Speakers in areas with ceilings above 3048 mm (10 feet) shall be set on the 1-watt tap.] [Speakers shall be tapped in accordance with the Contract Documents.]**

F. Smoke Detectors:

1. In raised floor spaces and high-velocity plenum areas, the smoke detectors shall be installed to protect 225 sq. ft per detector.

2. Detectors shall be installed in elevator machine rooms and elevator hoistways.

3. Install smoke detectors a minimum of 3 feet (914 mm) away from supply air vents.

4. New smoke detectors shall be installed with dust covers. The dust covers shall be removed just prior to acceptance testing.

5. The indicating LED on the smoke detector shall be visible from the floor. Where ceiling conditions prevent viewing of the LED from the floor, a remote indicating lamp shall be installed. Lamp shall be installed not more than 6 feet above finished floor.

G. Air Aspirating Smoke Detectors

1. Detector Assembly:

a. The Detector Assembly shall be surface mounted to a wall using brackets for easy removal/replacement of detector.

b. Piping in the vicinity of the detector shall be clear of all other utilities and installed in such a way as to facilitate easy removal/replacement of the detector.

c. Pipe immediately above the Detector shall be separated by fittings such that pipe does not need to be bent forced to remove it from the detector.

d. Pipe immediately above the Detector shall be easily separable via unions for cleaning close to the Detector.

e. Conduit shall enter/leave the Detector Assembly via the bottom only.

2. Piping Network:

a. Install piping straight and true. All changes in direction shall be by way of fittings. Bending of pipe to avoid structure and other utilities places stress on the fittings and is not permitted.

b. All joints in the sampling pipe shall be airtight and made by using solvent cement, except at entry to the detector. Solvent shall differ in color from the piping. Clear solvent is not permitted.

c. The pipe shall be identified with labels reading: “Aspirating Smoke Detector Pipe – Do not Paint or Disturb” (or similar wording) along its entire length at regular intervals not exceeding the manufacturers’ recommendation or that of local codes and standards. Factory stamped labeling is not acceptable and manufacturer adhesive labels are required. Labels shall be installed every 20 feet. Labels shall be present at risers, changes in direction, and either side of sight obstructions greater than 4 feet in width.

d. All pipes should be supported at not less than 5-foot (1.5m) centers.

e. The far end of each trunk or branch pipe shall be fitted with an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.

f. In addition to the balancing hole listed above, a sealed benchmark test point shall be provided for each branch pipe.

g. [Where construction will be phased, or where the detector must be activated prior to project closeout, in-line filters shall be provided upstream of the detector. Upkeep of the detectors and filters is the responsibility of the Contractor until project closeout. Filters shall be regularly inspected and replaced by the Contractor.]

h. Piping shall be vacuumed in accordance with the manufacturer's requirements prior to final connection to the detector unit.

3. Sampling Points:

a. Each sampling point shall be identified in accordance with Codes or Standards.

4. Testing:

a. OSHEM shall inspect and approve sampling hole sizing after installation.

b. Contractor shall complete the Manufacturer's commissioning guide for the detector in question during their pre-testing, and it shall be provided to OSHEM at final acceptance. Values and functions shall be verified during final acceptance.

c. Final acceptance shall be in accordance with NFPA 72 and the Manufacturer's requirements.

H. Duct Detectors:

1. Installation of duct detector sampling tubes shall be verified by OSHEM prior to final acceptance.

2. Sampling holes shall be oriented facing into the airflow, or as manufacturer's requirements specify.

3. Duct detector sampling tubes shall be verified by OSHEM for proper orientation and airflow. Airflow shall be tested per manufacturer's instructions and shall be confirmed with a magnehelic/manometer (airflow/pressure) meter to ensure air is passing over/through the detector chamber. Testing shall be completed while the air handling units are active at their normal settings.

4. Duct detector sampling tube length and installation shall be in accordance with manufacturer's requirements.

a. Where possible and where access would be available to the endcap, sampling tubes shall be installed extending out the opposite side of the duct.

I. Heat Detectors for Elevator Rooms and Shafts: Heat detectors, provided to meet ANSI A17.1 requirements for elevator power disconnect, shall be located within 2 feet of each sprinkler head.

J. Graphic Annunciator: Surface mount the panel, with the top of the annunciator panel 6 feet (1800 mm) above the finished floor or center the panel at 5.5 feet, whichever is lower.

K. **[Firefighter Telephones: Locate wall mounted in each stair at each floor landing, in each elevator lobby and in each elevator cab 4 feet above the finished floor.]**

L. Audio-Visual Equipment Shunt Switches:

1. Smoke detectors are to be installed in enclosed AV booths/rooms. Activation of the smoke detector shall shut down power to the A/V equipment. Self-contained units (not tied to the FACU) with a local alarm are permitted.

2. Activation of the general fire alarm shall shutdown all AV equipment. A circuit is required from the FACU to relays to the central A/V control circuits to shunt power.

M. Door Hold-Open/Release Devices:

1. Relays shall be mounted within three feet of the device controlled.

2. **[Smoke detectors with integral relays shall control the door hold-open devices.]**

N. Load Control Relays: Relays for elevator shunt and HVAC control shall be mounted in a NEMA style enclosure, painted red, and appropriately labeled for the device being controlled.

O. **[Elevator Cab Fire Alarms: Elevator cab speakers, strobes, and firefighters telephones shall be turned over to the elevator contractor whose work is described in Division 14. Coordinate provision for traveling cables and other installation accessories for connection of these devices.]**

3.8 INSPECTION & TESTING

A. Test Equipment: The Contractor shall supply personnel, communication devices, and all equipment necessary for performance of the final test.

B. Provide no less than 48-hours notice for the inspections and testing below. Notice for final acceptance shall be in accordance with the Final Acceptance section.

C. Conduit Rough-In Inspections:

1. Prior to installation of any wire on a circuit, and/or prior to ceiling close-in, Contractor shall provide conduit plans for review. OSHEM shall inspect and approve conduit layout and installation.

2. Installation shall be in accordance with NFPA 70, NFPA 72, Division 26 of this specification, and Section 283111.

3. If deviations from the approved shop drawings are present, red-line plans shall be available for review at the time of inspection.

4. Contractor shall correct all deficiencies before wire installation commences. OSHEM shall verify all deficiencies.

D. Wiring Tests:

1. Test equipment used for the test shall have been calibrated within one year of the test date.

2. Continuity Tests: Continuity of both wires on a circuit as well as the shield (if present) shall be demonstrated.

3. Megger Tests: After all wiring has been installed, and prior to making any connections to panels or devices, all wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors shall be tested to a minimum of 550 Mega-Ohms. The tests shall be witnessed by OSHEM, SI Life Safety Group, and the Contracting Officer. Test results recorded for use at the final acceptance test. Results recorded shall be values between positive/negative, positive/ground, negative/ground, positive/shield, negative/shield, and shield/ground.

4. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer, OSHEM and the SI Life Safety Group. Test results shall be recorded for use at the final acceptance test.

5. Verify the absence of unwanted voltages between circuit conductors and ground.

6. If partial circuit testing conducted, Contractor shall keep a written record of testing make it available to OSHEM for tracking purposes.

7. Contractor shall correct all deficiencies before device installation commences. OSHEM shall verify all deficiencies.

E. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits are functioning properly. After preliminary testing is complete, provide a letter to the COTR certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly, including proper device message descriptions and proper placement of graphic icons in fire alarm systems with graphic notification equipment. The letter shall also state that all panel functions were tested and operated properly. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

F. Final Acceptance Test: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 14 calendar days prior to the test date. A final acceptance test will not be scheduled until megger test results, the loop resistance test results, preliminary testing letter, and the submittals required in Part 1 are provided to the Contracting Officer. Test the system in accordance with the procedures outlined in the NFPA 72 and as follows:

1. Verify that the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.

2. Complete operational tests under emergency generator power.

3. Complete operational tests under battery power and as described above under battery power. Test the battery charger.

4. Test each initiating and indicating device and circuit for proper operation and response. Disconnect the confirmation feature for smoke detectors during tests to minimize the amount of smoke or test gas needed to activate the detector.

5. Test the airflow through all duct detectors to ensure flow is within the Manufacturer's requirements.

6. Commission all Air Aspirating Smoke Detectors in accordance with Manufacturer's requirements.

7. Test the system for all specified functions in accordance with the contract drawings and specifications and the manufacturers operating and maintenance manual.

8. Verify the audibility **[and intelligibility]** results that were recorded on the as-built drawings as part of the preliminary testing above.

9. Visually inspect all wiring at all panels and terminal cabinets. Up to 5% of all devices shall be disconnected and wiring visually inspected during the acceptance

test. More devices may be inspected at the discretion of the OSHEM FPE if deficiencies are observed. A minimum of 2 devices per circuit shall be inspected.

10. Verify that all software control and data files have been entered or programmed in the FACU.

11. Verify that shop drawings reflecting as-built conditions are accurate.

12. Measure the current in circuits to assure that there is the calculated spare capacity for the circuits. Current should not exceed 80% of the capacity of the circuit.

13. Measure voltage readings for circuits to assure that voltage drop does not exceed manufacturer's requirements. Voltage drop shall not exceed manufacturer's requirements for the devices in question.

14. Measure the voltage drop at the most remote appliance on each notification appliance circuit. Voltage drop shall not exceed manufacturer's requirements for the devices in question.

15. All faults and trouble signals associated with the completed work shall be cleared from the panel.

16. All deficiencies shall be corrected by the Contractor.

G. **[Conduct Intelligibility Testing**

a. Test intelligibility in identified Acoustically Distinguishable Spaces (ADS) in accordance with NFPA 72. Commercially available test equipment shall be provided by the installing contractor. The mean value of at least three readings shall be used to compute the intelligibility score at each test location. Each ADS shall be tested in at least one location.

b. The following areas are not required to meet a minimum intelligibility score:

1) Mechanical/Electrical/Plumbing Rooms

2) Private Bathrooms

3) Elevator Cars

4) Individual Offices

5) Closets

6) **Rooms identified during design where intelligibility cannot be reasonably predicted**

c. **Ensure that the minimum required Common Intelligibility Scale (CIS) value of 0.7 (Speech Transmission Index (STI) 0.5) is obtained in normally occupied areas such as galleries, lobbies, offices, conference rooms, etc. Measurements should be taken near the head level applicable for the space under normal conditions (e.g., standing, sitting, as appropriate).**

d. **Areas of the building identified during design and provided with hard wall and ceiling surfaces (such as metal, concrete, terrazzo, or glass) that are found to cause excessive sound reflections may be permitted to have a CIS score less than the minimum required value if approved by OSHEM. Building occupants in these areas must be able to determine that a voice signal is being broadcast by walking no more than 33 feet to find a location with at least the minimum required CIS score.**

e. **Areas of the building identified during design where occupants are not normally expected to be present are permitted to have a CIS score less than the minimum required value if personnel can determine that a voice signal is being broadcast by walking no more than 50 feet to a location with at least the minimum required CIS score.**

f. **Occasionally, large, cavernous-type open areas are present in SI buildings. In such buildings, hard wall/ceiling surfaces and building geometry may cause excessive sound reflections. Areas identified during design are permitted to have locations with a CIS value lower than the normal, minimum required CIS value when the following conditions are met:**

1) **The CIS value is not less than 0.6 (STI 0.4) at any location within the cavernous area.**

2) **Occupants in the cavernous area must walk no more than 98 feet to find another location having at least the normal, minimum required CIS value.**

3) **Occupants located in the cavernous area can adequately understand the message content in the voice signal being broadcast. Whether the voice message is adequately understood shall be determined by OSHEM.**

4) **Justification for the deviation from the normal, minimum CIS criteria shall be provided to and approved by OSHEM. The justification shall**

address all factors relevant to the request and deviation from the normal, minimum CIS criteria, including but not limited to: the operational requirements that restrict the installation of acoustical wall and ceiling treatments; the potential use of special speaker technologies such as directional speakers or stacked speaker systems; and the availability of physically larger or higher-fidelity speakers even though such speakers might not be Listed for fire alarm use.]

3.9 TRAINING

A. Training sessions shall cover all aspects of system performance, including system architecture, signaling line circuit configurations, sensor and other initiating device types, locations, and addresses, fire alarm control unit function key operation, and other functions as designated by the COTR.

B. Required Instruction Time: Provide 24 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer to account for the nature of shift work of SI employees. One training session shall be videotaped by the contractor. Video shall be delivered to the COTR.

C. Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the FACU. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory and trouble. The instructions shall be approved by OSHEM.

D. **[Provide comprehensive system training in the care, adjustment, maintenance, programming, troubleshooting, and operation of the fire alarm system. This training shall be provided locally by the manufacturer or their representative. If this training cannot be performed locally and requires travel, the Contractor shall include all expenses associated with the travel to include transportation, lodging, meals, and expenses as well as the factory training described above for 2 SI Life Safety Group staff. If there is any recertification required during the warranty period, the Contractor shall be responsible for any cost associated with it. This session shall be separate and distinct from the above-described sessions.]**

E. All training sessions shall be conducted following final system certification and acceptance. Three additional training sessions shall be provided for all security personnel on all shifts six months after final system certification.

F. All training sessions shall be conducted by an authorized fire alarm system distributor representative, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. Manufacturer Factory Certifications for training personnel shall be provided to OSHEM for review prior to scheduling of training.

3.10 KEYS

A. Keys and locks for all equipment shall be identical. All panels and terminal cabinets provided shall be keyed the same. Air aspirating smoke detection control panels shall be keyed the same. Provide not less than five keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

3.11 ON-SITE DOCUMENTATION

A. Provide a document box in the same room as the main FACU. The box shall be red in color and shall be capable of holding a full set of as-built plans. Both electronic and hard-copy plans shall be provided.

END OF SECTION 283111

This specification is the result of a comprehensive review of the Smithsonian soil and tree conditions across the 13 primary Smithsonian gardens in Washington, D.C. Designed and installed over generations, the assessment conveyed an increasing trend of custom soil mixing throughout the past 40 years leading to a higher level of variability in the planting soil textures. This was a departure from the first 120 years of museum development when there was a more consistent use of imported unscreened silt loam and loam within the gardens.

Analysis of the soil and associated plant health has revealed that the imported loam-based soils from the first 120 years have provided more long term stability, consistency and resilience than the custom mixed soils. Trees were living longer, showing less signs of stress and requiring less irrigation in the imported loam-based soils whereas the custom mixed soils have led to higher nutrient leaching, lower soil organic matter levels (due to decomposition of the compost mix component) and more plant stress over time.

In addition to increased plant benefits associated with returning to a naturally occurring loam-based soil approach, it provides a vital consistency and uniform soil condition across the museum sites to help standardize soil sourcing, maintenance and remediation following construction activities.

While it may seem more straightforward to use unscreened imported soils, there are a few critical aspects regarding the correct installation of these soil types that are outlined in the attached specification. Due to its resilient structure, loam textures – sandy clay loam, loam, and sandy loam, common in neighboring Piedmont soils of northern Virginia, is the specified base soil type. Pretested and approved suppliers have been identified for ease of use.

These soils are not to be screened unless used as the lesser component of a specific bioretention or high-use lawn soil. When used as the dominant component in a soil, protecting naturally occurring clumps (or peds) helps create the vital void space in planting soils for roots, air and water movement. It is critical that the soil is not screened, transported or installed when wet or over-compacted during installation. While straightforward, this needs to be repeatedly conveyed to the contractor and factored into the project schedule and installation plans.

Finally, while reuse of existing soils is encouraged, this is not addressed in this specification. Reuse of planting soils requires additional storage planning on-site or at a separate location, and assessment and coordination throughout the construction documents that would be determined on a case by case basis.

Thank you for your role in building healthy soils for the next generations of Smithsonian Gardens plants and visitors. Happy reading!

Smithsonian Institution Planting Soils Specification TEMPLATE

Disclaimer and Responsibility of the User:

How to Use this Template:

1. These instructions are intended to guide you, the specification writer (the specifier), through the process of editing this document into a Planting Soil specification. Be sure to delete these instructions (i.e. all the text in **blue** displayed in this specification) before issuing the specifications.

2. This specification is designed to be used in conjunction with standard Division 01 specifications, which cover project general conditions and project wide contract elements. THIS IS NOT A STAND-ALONE SPECIFICATION and should not be used as a contract for the modification, purchase of and installation of planting soil. Important issues of project ownership, liability, insurance, contract language, project controls, Instructions to bidders, change orders and review and approval of the work are normally in the Division 01 specifications.

3. This specification is broken into three sections:
    a. **Division 1 General Requirements**
        i. Includes an overview of contractor requirements including Scheduling, Testing, Submittals, Mockups and site conditions, among other items.
    b. **Division 2 Products**
        i. Includes a definition for each product
        ii. It is critical that the terms in this section match what is on the Construction Documents (ex. On drawings, installed planting soil is labeled “Planting Soil”, not “Soil Mix” or another unreferenced term)
    c. **Division 3 Execution**
        i. Includes step by step process for installation of planting soils.

4. **Related specification sections:** This specification requires an additional specification section to describe several important related parts of the planting process.
    a. **Site Protection:** This specification assumes that there is a separate specification section and construction drawings and details for tree and soil protection.
    b. **Planting:** This specification assumes that there is a separate specification section and construction drawings for installation of plants.
    c. **Irrigation:** This specification assumes that there is a separate specification section for irrigation and construction drawings associated with the project planting.

5. Before issuing the document, be sure to remove all “**Note to specifier**” incorporated into this document in **blue** text after you have read them and responded to the recommendations

6. This specification is designed for planting soils specific within the Washington, D.C. region and is not recommended for use outside of the region.

SECTION 32 9100

PLANTING SOILS

PART 1 – GENERAL

1.1 SUMMARY

A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soils and /or the modification of existing site soil for use as Planting Soils, complete as shown on the drawings and as specified herein.

B. The scope of work in this section includes, but is not limited to, the following:

1. Locate, purchase, deliver and install the components that make up the Planting Soils:
   a. Base Soil
   b. Coarse Sand
   c. Compost
   d. **Lightweight Aggregate**
   e. **No. 8 Pea Gravel**
   f. **No. 57 Stone**

2. Prepare, deliver and install the Soil Mixes:
   a. **Planting Soil**
   b. **Lawn Soil**
   c. **High-Use Lawn Soil**
   d. **Biofiltration Soil (Bioswales, Bioretention, Raingardens)**
   e. **Lightweight Extensive Soil**

3. Testing and analysis for specification conformance, prior to placement of soils.

4. Finish Grading of Planting Soil area surfaces.

5. Clean up and disposal of all excess and surplus material.

1.2 CONTRACT DOCUMENTS

A. Shall consist of specifications, general conditions, and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.3 RELATED DOCUMENTS AND REFERENCES

A. Related Documents:

1. Drawings and general provisions of contract, including general and supplementary conditions and Division I specifications, apply to work of this section.

2. Related Specification Section **(insert any associated sections that reference soil)**
   a. **Section 01 5639 – Site Protection**
   b. **Section 00 0000 – Site Clearing**
   c. **Section 00 0000 – Earth Moving**
   d. **Section 00 0000 – Planting Irrigation**
   e. **Section 00 0000 – Turf and Grasses**

f. **Section 00 0000 – Exterior Plants**
g. **Section 00 0000 – Storm Utility Drainage Piping**

B. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the Specification to the extent required by the references thereto. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail.

1. ASTM: American Society of Testing Materials cited section numbers.
2. U.S. Department of Agriculture, Natural Resources Conservation Service, 2003. National Soil Survey Handbook, title 430-VI. Available Online.
3. US Composting Council www.compostingcouncil.org and the Digital Resource Center https://www.compostingcouncil.org/page/DigitalResourceCenter, including "Compost and its Benefits".
4. Methods of Soil Analysis, as published by the Soil Science Society of America (http://www.soils.org/).

1.4 PERMITS AND REGULATIONS

A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the SMITHSONIAN Contracting Officer's Technical Representative (COTR) in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.

B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.

C. In case of conflict among any referenced standards or codes or among any referenced standards and codes and the specifications, the more restrictive standard shall apply, or the SMITHSONIAN COTR shall determine which shall govern.

1.5 PROTECTION OF WORK, PROPERTY AND PERSON

A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to the Contractor's actions. Reference Specification **Section 01 5639 – Site Protection** for the specific requirements governing this work.

1.6 CHANGES IN WORK

A. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.7 CORRECTION OF WORK

A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the SMITHSONIAN COTR, at the soonest possible time that can be coordinated with other work and seasonal weather demands but not more than 180 (one hundred and eighty) days after notification.

1.8 DEFINITIONS

A. Acceptance, Acceptable, or Accepted: Formal approval by the SMITHSONIAN COTR in writing.

B. Aesthetic Acceptance of Grades: Formal approval by the SMITHSONIAN COTR in writing of the aesthetic correctness of the contours. Aesthetic acceptance does not address whether an area drains properly, whether the areas are at the correct elevations, or whether it has been compacted properly.

C. Base Soil: naturally produced and harvested soil from the A, B and C horizons and that the soil as further defined in this specification.

D. Compacted soil: soil where the density of soil is greater than the maximum allowable resistance to penetrometer (measured in psi) as defined later in this specification.

E. Compaction: The process by which a force is applied to the soil to achieve a desired soil density as defined in this specification.

F. Compost: well decomposed stable organic material as defined by the US Composting Council and further defined in this specification.

G. Drainage: The rate at which soil water moves through the soil transitioning the soil from saturated condition to field capacity. Most often expressed as saturated hydraulic conductivity (Ksat; units are inches per hour).

H. End of Warranty Acceptance: The date when the SMITHSONIAN COTR accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation (if applicable) work run concurrent with each other, and further defined in this specification.

I. Final Acceptance: The date at the end of Planting Soils installation where the SMITHSONIAN COTR accepts that all work in these sections is complete and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project, and further defined in this specification.

J. Fine grading: The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes other suitable devices, and further defined in this specification, and further defined in this specification.

K. Finished grade: surface or elevation of Planting Soils after final grading and 12 months of settlement of the soil, and further defined in this specification.

L. Minor disturbance: Minor grading as part of agricultural work that only adjusts the A horizon soil.

M. Ped: a clump or clod of soil held together by a combination of clay, organic matter, and fungal hyphae, retaining the original structure of the harvested soil.

N. Scarify: Loosening and roughening the surface of soil and sub soil prior to adding additional soil on top, and further defined in this specification.

O. Smithsonian Contracting Officer's Technical Representative (COTR): The person or entity, appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Smithsonian COTR may appoint other persons to review and approve any aspects of the work.

P. Soil Horizons: distinct layers of the soil profile distinguished by differences in such features as color, texture, organic matter content, and other characteristics as defined in the USDA National Soil Survey Handbook

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242.

Q. Soil Mix: Specialized soil types produced as a result of the combination of Base Soil with soil components (such as Coarse Sand, Compost, or **Lightweight Aggregate**) as defined in ***Part 2 – Section 2.4.A***.

R. Soil Tilling: Loosening the surface of the soil to the depths specified with acceptable mechanical equipment as further defined in this specification.

S. Soil Organic Matter: natural occurring organic matter that is a stable part of the soil matrix. Compost is not considered soil organic matter.

T. Subgrade: surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, or the top elevation of required drainage layers above structure before placing planting soil.

U. Weeds: Any plant that is not on the planting plan.

1.9 LONG LEAD ITEM

A. The Contractor shall be advised that the sourcing, testing, procurement and installation of Planting Soil is a CRITICAL PATH item, requiring timely attention to meet the requirements of the Documents. Having been informed that all aspects of planting soil, the Contractor shall consider this to be A LONG LEAD TIME ITEM. Contractor's failure to heed this notice shall not be a reason for substitution of unacceptable material(s). The SMITHSONIAN COTR will not accept materials that do not meet requirements.

1.10 SUBMITTALS

A. See the contract General Conditions for policy and procedures related to submittals.

B. Planting Soils Installation Plan: Submit, a minimum of twelve (12) weeks prior to the anticipated date of the start of soil installation, a Planting Soils Installation Plan that includes a written narrative of soil procurement, testing, mixing, delivery, storage and handling; mock up preparation, locations and installation process.

The plan shall include the projected timeline for soil work and describe all equipment to be used to mix, deliver, spread, grade and compact the soil. Particular attention should be paid to contingency plans and/or schedule modification options due to the impact of weather on soil moisture, delivery, storage, and handling.

C. Base Soil Source:

1. Submit source information of Base Soil including:
   a. Soil supplier name
   b. Name of contact
   c. Mailing address
   d. Physical address of soil harvesting site or soil stock pile
   e. Phone number

D. Submit all product submittals twelve (12) weeks prior to the start of the soil work.

E. Soil Mix components' Product Data and Samples: For each type of manufactured product, submit data and certificates that the product meets the specification requirements, signed by the product manufacturer, and complying with the following:

1. Submit manufacturers or supplier's product data and literature, and certified analysis for standard products and bulk materials, complying with testing requirements and referenced standards and specific requested testing.

2. Submit soil analytical test results as described in ***Section 1.10.F.2*** below.

F. Soil Testing for Base Soil, **Planting Soil**, **Lawn Soil**, **High-Use Lawn Soil**, **Biofiltration Soil** and **Lightweight Extensive Soil**.

1. Submit soil test analysis report for each sample of Base Soil and the Soil Mixes from an approved soil-testing laboratory and where indicated in Part 2 of the specification as follows:
   a. Submit Base Soil for testing at least twelve (12) weeks before scheduled installation of the Soil Mix.
   b. Submit Soil Mix tests no more than two (2) weeks after the approval of the Base Soil, Compost, Coarse Sand, and **Lightweight Aggregate**. Do not send any Soil Mix to the testing laboratory for testing until the Base Soil, Compost, Coarse Sand, and **Lightweight Aggregate** have been approved.
   c. If tests fail to meet the specifications, obtain other sources of material, retest and resubmit until accepted by the SMITHSONIAN COTR.
   d. No soil components shall be used until certified test reports by an approved Testing Agency have been approved by the SMITHSONIAN COTR.
   e. No Soil Mix shall be used until certified test reports by an approved testing laboratory have been received and approved by the SMITHSONIAN COTR.
   f. If, at any time during the project, the Base Soil, soil components or Soil Mixes requires adjustment to meet the specifications and/or performance criteria, the Contractor shall submit the adjusted soil components and/or mixes for testing as specified herein.
   g. All soil testing will be at the expense of the Contractor.
   h. Failure to complete tests as specified will result in rejection of test results
2. For each type of test required, select and use the same testing laboratory throughout the work from the provided list below. Notify the SMITHSONIAN COTR of any change in laboratory and do not proceed until the SMITHSONIAN COTR has provided pre-approval of the change.
   a. Laboratory shall be an independent, certified laboratory with experience and capability to conduct the testing indicated and that specializes in the types of tests to be performed. Tests shall be made in strict compliance with the standards of the Association of Official Analytical Chemists and ASTM.
   b. The following table lists testing parameters, approved soil testing facilities, and specific laboratory testing packages that will provide required data. Testing agencies not listed below shall be approved by the SMITHSONIAN COTR.

Soil Test Requirements, Parameters, Approved Laboratories and Analytical Packages			
Soil Component	Test Parameter	Approved Labs	Laboratory Analytical Suite
Soil Compaction Curve	ASTM D698 - 12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort	Terracon 4545 42nd St., NW, Suite 307 Washington, DC 20016 Phone: (202) 375 7900 Or approved equal	
Soil Gradation (Particle Size	Sieve Analysis (ASTM D6913M - 17 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis) Sieve Nos. 4, 10, 18, 35, 60, 140, 270, Silt and Clay (pan)	Turf and Soil Diagnostics 613 E 1st St Linwood, KS 66052 Phone: 913-723-3700 Or approved equivalent	Particle Size Analysis

Soil Test Requirements, Parameters, Approved Laboratories and Analytical Packages			
Soil Nutrient and Chemical Tests (Select 1 lab for testing for the duration of the project)	Soil Organic Matter Soil pH (active pH) Cation Exchange Capacity Electrical Conductivity (EC) Total Nitrogen (Kjeldahl N) Nitrate-N Available Phosphorus Potassium Magnesium Calcium	Ward Laboratories 4007 Cherry Ave, Kearney, NE 68847 Phone: (800) 887-7645	S-4 + Ammonium-N, Total N, Exchangeable Aluminum, Wet Aggregate Stability
		Waypoint Analytical Laboratories 7621 Whitepine Rd	S3M + Nitrate-Nitrogen, Ammonium-
	Sodium Manganese Zinc Lead Boron Ammonium-N	Richmond, VA 23237 Phone: 804.743.9401	Nitrogen, Electrical Conductivity (EC), and Exch. Aluminum (Waypoint does not offer Total-N)
		Or approved equivalent	
Compost Testing (Select 1 lab for testing for the duration of the project)	pH Boron Calcium Copper Iron Magnesium Manganese Total nitrogen Ammonium-nitrogen Nitrate-nitrogen Organic-nitrogen C:N Ratio Phosphorus Potassium Sulfur Zinc Soluble salts Moisture Dry matter Wet Density	Woods End Laboratory 290 Belgrade Road Mt. Vernon ME 04352 Phone: 207-293-2457	Premium Analysis
		Ward Laboratories 4007 Cherry Ave, Kearney, NE 68847 Phone: (800) 887-7645	Manure & Compost Complete
		Or approved equivalent	
Soil Biological Tests (Both labs required)	PLFA (phospholipid-fatty acid) test Mycorrhizal spore counts Mycorrhizal root colonization	Ward Laboratories 4007 Cherry Ave, Kearney, NE 68847 MIDI Labs 125 Sandy Drive Newark, DE 19713	PLFA Wet Aggregate Stability
		Mycoroots 1970 NW Lance Way, Corvallis, OR 97330	Mycorrhizal spore count Mycorrhizal root colonization

G. Soil Samples for Base Soil, **Planting Soil**, **Lawn Soil**, **High-Use Lawn Soil**, **Biofiltration Soil** and **Lightweight Extensive Soil**:

Submit samples of each product, concurrently with the submission of the laboratory test reports to the SMITHSONIAN COTR for approval. Samples shall be submitted in two-gallon bags and labeled to indicate product, characteristics, and locations in the work. Samples arriving without labels will be rejected. Samples will be reviewed for consistency with specification requirements as can be reasonably ascertained and with certified data.

1. Submit samples a minimum of twelve (12) weeks prior to the anticipated date of the start of soil installation.

2. Samples of Base Soil and the Soil Mixes shall be submitted at the same time as the required soil testing analysis of that material, per ***Section 1.10.F.2*** above. Analysis data and Samples that don't arrive together, thereby verifying the sample matches the data, will be rejected.

H. Subgrade Infiltration and Density testing reports:

1. See requirements for testing in ***Section 1.15B*** below.

1.11 SOIL INSTALLATION MOCKUP

A. Prior to installation of Planting Soils, construct at the site a mockup of each Soil Mix required and configuration using the means and methods and equipment proposed by the Contractor to complete the work. Installation of the mockup shall be in the presence of the SMITHSONIAN COTR. The purpose of the mockup is to test the methods of installation, finish grading and compaction of the soil and to serve as a benchmark for completed soil compaction. The mockup shall be as follows:

1. Mockup of the following Soil Mix to be provided:
   a. **Planting Soil**
   b. **Lawn Soil**
   c. **High-Use Lawn Soil**
   d. **Biofiltration Soil**
   e. **Lightweight Extensive Soil**

2. The mockup area may remain as part of the installed work at the end of the project if protected from further compaction, contamination, or other disturbance.
   a. Locate mock-up on site in a proposed planting area easily referenced by workers performing soil installation and finish grading operations.

3. Where soil mockups are intended to remain in place, complete subgrade soil infiltration and density testing per the requirements outlined in ***Section 1.15B*** below, before construction of the soil mockup.

4. Following acceptance of the soil submittals, in areas that can be protected from disturbance and further compaction, install mockups of each Soil Mix, configuration and soil modification, 3-meter X 6 meter (10-foot X 20-foot) X the full depth of the deepest installation, using the requirements of these specifications. Compaction methods, including the type of compaction equipment and number of passes required to achieve the required compaction shall be evaluated and results measured.

5. Compaction in the mockup soil shall be examined and tested as described below:
   a. Soil density and moisture shall be tested using a nuclear soil density gauge (nuclear densometer) if required by the SMITHSONAIN COTR. Soil density (measured as the percent derived from the dry density divided by the maximum dry density) shall be tested to confirm

that soil installation methods will achieve specified soil conditions (density and moisture). Results of nuclear soil density testing shall be used to compare to other soil density and compaction testing methods that are specified in this section.

b. Cone penetrometer (see ***Part 1.14.G*** below). A cone penetrometer will be used to test for compacted layers or changes in soil density within an installed soil profile. A minimum of four readings from each Soil Mix shall be taken at the specified depths of the soil profile. Readings from the cone penetrometer will be compared to results of the nuclear soil density gauge to provide a relative basis of soil compaction measurements.

c. Cone penetrometer must only be used in dry to moist soils (described as the Acceptable Condition in ***Section 1.16.A***). The Penetrometer cannot be used in excessively dry or very moist or wet soils. Refer to the section noted above for requirements concerning soil moisture levels.

d. In the event that the nuclear soil density gauge or the cone penetrometer readings exceed the specified densities, reconstruct the mockup, adjusting the soil compaction method achieve the desired results.

e. Conduct visual observations of soil structure. Record changes in soil particle configuration, such as platy (soil forms plate-like structure), massive (soil appears to have no form, with no observable soil pores), or granular (soil has distinct peds, or soil particles that are friable and break easily).

f. Where the modification requires ripping, tilling or fracturing soils that are over compacted, start the procedure in a new location so that the process is working on soil that is similar to the density of the expected soil.

6. Contractor shall submit a report of the final methods of soil installation to the SMITHSONIAN COTR. This shall include all penetrometer, nuclear densometer, and soil moisture readings that were catalogued during the mockup process.

7. Provide a protective 1.2-meter-high (4-foot) fence around each mockup to keep all work and equipment from entering the surface of the mockup area.

1.12 OBSERVATION OF THE WORK

A. The SMITHSONIAN COTR may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.

1. Should the SMITHSONIAN COTR determine the need for nuclear densometer testing, he/she may request use of the Contractor’s nuclear densometer (by a qualified professional) or cone penetrometer at any time to check soil compaction and moisture.

B. The SMITHSONIAN COTR shall be informed of the progress of the work, so the work may be observed at the following key times in the construction process. The SMITHSONIAN COTR shall be afforded sufficient time to schedule visit to the site. Each required review may require multiple visits to reflect the phasing of work. Failure of the SMITHSONIAN COTR to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.

1. SOIL MOCKUP REVIEW: At the time of construction of all soil mockups.

2. SUBGRADE REVIEW: Observe each area of soil installation including planter drainage and waterproofing work prior to the installation of any the Planting Soils.

3. COMPLETION of PLANTING SOILS INSTALLATION: Upon completion of all soil modification and installation of the Planting Soils.

4. COMPLETION OF FINE GRADING AND SURFACE SOIL MODIFICATIONS REVIEW: Upon

completion of all surface soil modifications and fine grading but prior to the installation of shrubs, ground covers, or lawns.

1.13 PRE-CONSTRUCTION MEETING

A. Schedule a pre-construction meeting with the SMITHSONIAN COTR at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.

1.14 QUALITY ASSURANCE

A. Installer Qualifications: The installer shall be a firm having at least ten(10) years of experience of a scope similar to that required for the work, including the preparation, mixing and installation of soil mixes to support planting. The installer shall be experienced with the installation of plants and soil in on-grade and over-structure conditions.

1. The bidders list for work under this section shall be approved by the SMITHSONIAN COTR.

2. Installer Field Supervision: When any planting soil work is in progress, installer shall maintain, on site, an experienced full-time supervisor who can communicate in English with the SMITHSONIAN COTR.

3. Installer's Field Supervisor shall have a minimum of five (5) years' experience as a field supervisor installing soil in on-grade and over-structure conditions, shall be trained and proficient in the use of field surveying equipment to establish grades and can communicate in English with the SMITHSONIAN COTR.

4. The installer's crew shall be experienced in the installation of planting soil, plantings, and interpretation of planting plans, and soil installation plans.

5. Submit references of past projects and employee training certifications that support that the Contractors meet all of the above installer qualifications and applicable licensures.

B. Soil Supplier Qualifications: The soil supplier shall be a firm having at least five (5) years of experience of a scope similar to that required for the work, including the preparation, mixing and delivery of soil to support planting, including experience with the installation of plants and soil in Washington, D.C. ***It is the intent of this specification to use unscreened naturally formed loam soils sourced from the Piedmont region in Virginia and local parts of Maryland (generally west of I-95). These soils typically have characteristics (soil clay content, structural stability, and native organic matter content) that favor stable aggregate structure formation, drainage, and compaction resistance.*** The soil supplier shall be located in the area where these soils are found.

C. Installer and Soil Supplier Bidders List: The bidders list for work under this section shall be approved by the SMITHSONIAN COTR prior to the start of the bidding process. Submit bidders list for approval.

1. Pre-approved soil supplier:
   a. JK Enterprise Landscape Supply
      15900 Lee Highway
      Culpepper, VA 20121
      P: 703-926-1967

   b. Luck Ecosystems
      PO Box 29682
      Richmond, VA 23242
      P: 877-904-5825

   c. Or approved equal

2. Pre-approved compost supplier:
   a. Leafgro
      Multiple bulk distributors available

   b. WeCare Denali
      7800 Kabik Ct.
      Woodbine, MD 21797
      P: 410-795-7666

D. Soil testing laboratory qualifications: an independent, certified and accredited testing laboratory, with the experience and capability to conduct the testing indicated and that specializes in USDA agricultural soil testing, planting soil, and the types of tests to be performed. Geotechnical engineering testing labs shall not be used for chemical analyses.

E. Base Soil source inspection: The SMITHSONIAN COTR may inspect the Base Soil source stock piles as part of the approval process. The Soil Supplier shall accompany the SMITHSONIAN COTR.

   If multiple sites or options are to be considered, arrange the inspection trip such that all optional locations can be inspected in one day. The SMITHSONIAN COTR may remove samples of the material as a record of the inspection and independent testing as needed.

F. All delivered and installed Planting Soils shall conform to the approved submittals sample color, ped sizes and distribution, texture and approved test analysis.

   1. The SMITHSONIAN COTR may request samples of the delivered or installed soil be tested for analysis to confirm the Soil Mix conforms to the approved material.
   2. All testing shall be performed by the same soil lab that performed the original Soil Mix testing.
   3. Testing results shall be within 10% plus or minus of the values measured in the approved Soil Mix.
   4. Any Soil Mix that fails to meet the above criteria, if requested by the SMITHSONIAN COTR, shall be removed and new soil installed.

G. Soil compaction testing: following installation or modification of soil, test soil compaction as follows:

   1. Soil density shall be measured using a nuclear densometer (Troxler nuclear soil density gauge or equivalent) if required by the SMITHSONIAN COTR. Soil density shall be reported as a measured percentage derived from the dry density divided by the maximum dry density (See ***Section 1.10.F.2***).
      a. Soil density testing using a nuclear densometer must be completed by a certified operator.
      b. One soil density measurement shall be completed after the second 12” lift of soil. This will be used to calibrate acceptable soil density and establish the approved cone pentrometer readings.
      c. Soil density results must be within the range specified in Part 3 of this Section.
   2. Soil compaction for detection of compacted layers shall be tested using a static cone penetrometer using method ASTM D3441 - 16 Standard Test Method for Mechanical Cone Penetration Testing of Soils. This test shall not be used on wet soils.
      a. Maintain at the site, at all times, a soil cone penetrometer with pressure dial and a soil moisture meter to check soil compaction and soil moisture.
      b. Penetrometer shall be AgraTronix Soil Compaction Meter distributed by Forestry Suppliers, www.forestry-suppliers.com or approved equal.
      c. Prior to testing the soil with the penetrometer check the penetrometer readings in the mockup soils. Penetrometer readings are impacted by soil moisture and excessively wet or dry soils

will read significantly lower or higher than soils at optimum moisture.
1.) Refer to ***Section 1.16.A*** for requirements concerning soil moisture levels.

3. Soil penetrometer readings shall be completed at 150mm (12-inch) intervals for the full depth of the soil profile. These shall be recorded for review by the SMITHSONIAN COTR.
4. The penetrometer readings shall be within 20% plus or minus of the readings in the approved mockup when at similar moisture levels.

H. Soil infiltration testing shall be completed for each Soil Mix or area installed. Soil infiltration testing shall be conducted using ASTM D3385 - 18: Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer (Falling head method).
   a. A 150mm (6") inner ring / 300mm (12") outer ring Double Ring Infiltrometer shall be used.
      1.) Turf-Tec IN7-W Infiltration Rings, 12″ OD/6″ ID by 4″ Tall distributed by Forestry Suppliers, www.forestry-suppliers.com or approved equal.
      2.) Maintain the Double-Ring Inflitrometer at the site at all times.
   b. One infiltration test per planting area shall be sufficient.

1.15 SITE CONDITIONS

A. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify the SMITHSONIAN COTR, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.

1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the SMITHSONIAN COTR in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the SMITHSONIAN COTR of such conditions, they shall remain responsible for plant material under the warrantee clause of the specifications.
2. This specification requires that all planting soil and irrigation (if applicable) work be completed and accepted prior to the installation of any plants.

B. Subgrade (subsoil) drainage:

1. Perform infiltration and density tests on subsoil:
   a. Infiltration rate for subgrade, Min. 0.25" per hour
      1.) See ***Section 1.14.H*** for testing procedure.
   b. Compaction rate for subgrade, static cone penetrometer method:
      1.) 0 -150mm (0-6") depth: Range 120 to 180 pounds per square in (psi)
      2.) 150mm - 300mm (6"-12") depth: Range 160 to 220 psi.
      3.) See ***Section 1.14.G.2*** for testing procedure.
2. Submit test results as part of the Submittals in ***Section 1.10*** above.

1.16 DELIVERY, STORAGE, AND HANDLING

A. Weather: Do not mix, deliver, place or grade soils when frozen or with moisture greater than 70 percent of moisture level for optimum soil compaction as determined from Standard Proctor tests. Doing so is cause for the SMITHSONIAN COTR to reject the soil outright.

1. In addition to obtaining soil moisture levels from a nuclear soil density gauge, moisture can be determined by feel in the following manner:

   a. With a handful of soil, form a ball by compressing the soil together.
      1.) Above Field Capacity: If the ball glistens or is plastic (can form a ribbon or be molded), it

is too wet.
2.) Nearing Field Capacity: If the ball breaks fractures into large pieces but not individual peds, it is too moist for handling.
3.) Acceptable Condition: If the ball breaks into individual soil peds with little hand pressure, it is then suitable for handling and spreading.
4.) At or Below Wilt Point: If the soil is unable to form a ball with hand pressure, it is unsuitable for handling and spreading.

B. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Cover stockpiles with plastic sheeting or fabric at the end of each workday.

C. Planting Soils shall be stockpiled, loaded, unloaded and transported using methods that protect the size percentage range and distribution of soil peds within the soil.

1. Soil Mixes shall not be allowed to remain in stockpiles for longer than six (6) weeks, either at the soil source or the project site. If the soil will be stockpiled for longer than six (6) weeks, it must be planted to a cover crop or covered with mulch to protect it from sun/heat, rain, and wind erosion. ***The intent of this requirement is to harvest soil from the source only as it is needed and have it directly delivered to the project site, and then installed very soon after delivery. This minimizes soil handling and resulting soil degradation and saves storage space and maintenance. Careful planning and close coordination between the contractor and soil provider is essential.***

2. Use of soil shooters, soil blowers, augers, and conveyors with drops greater than 1-meter (3 feet) or other soil conveyance devices that break up soil peds shall be prohibited. Craned soil in large bulk bags are permitted provided that the process to place the soil into the bags and empty them at the site respects the need to protect soil peds.

D. All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations. All products shall be freshly manufactured and dated for the year in which the products are to be used.

E. Bulk material: Coordinate delivery and storage with the SMITHSONIAN COTR and confine materials to neat piles in areas acceptable to the SMITHSONIAN COTR.

1.17 EXCAVATING AND GRADING AROUND UTILITIES

A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

B. Determine location of underground utilities including irrigation and electrical systems and perform work in a manner that will avoid damage. Hand excavate as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.

1. Prior to Work commencement review and clearly mark in field horizontal and vertical locations of existing public underground utilities and structures with respective utility companies.

2. Prior to Work commencement review and clearly mark in field horizontal and vertical locations of existing private underground utilities and structures with the SMITHSONIAN COTR or the qualified party responsible for completing this work.

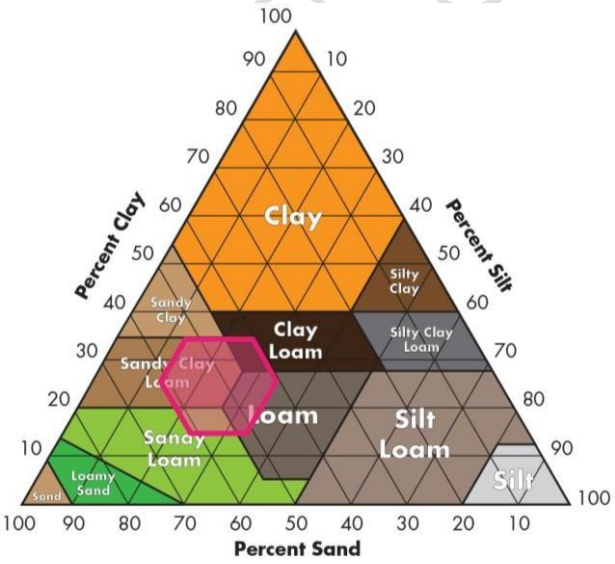
PART 2 – PRODUCTS

2.1 **BASE SOIL**

A. Base Soil definition: Fertile, friable soil containing 15% or less of a total volume of the combination of subsoil, refuse, roots larger than 25mm (1-inch) diameter, clumps of heavy, sticky or stiff clay, stones larger than 75mm (3 inches) in diameter, noxious seeds, sticks, brush, litter, or any substances deleterious to plant growth. The percent (%) of the above objects shall be controlled by source selection, *not by screening the soil*. Base Soil shall be suitable for the germination of seeds and the support of vegetative growth. Base Soil shall not contain weed seeds in quantities that cause noticeable weed growth and hazardous weed species in the planting beds. *This can be controlled by selection of the soil source site and soil management/cover crops*. The contractor shall remove all weeds as they emerge.

B. Base Soil shall be a defined as a ***Clay Loam, Loam, Sandy Loam, or Sandy Clay Loam*** having between 17 to 37 percent clay, between 15 to 35 percent silt, and between 40 to 62 percent sand; that will be similar to or match the surrounding topsoil layer. For example, if the topsoil layer is loam soil, the imported soil must also be loam soil with similar organic matter content. Soils imported for subsoil layers, if necessary, must be similar to or match the surrounding subsoil. Soil with greater than 35 percent silt will be rejected.

1. If required, Base soil may be tested for wet aggregate stability, with results showing more than 60 percent stable soil aggregates greater than 0.20 mm
2. Soil structure should have an identifiably strong aggregation of particles in the form of peds, or small clumps, commonly seen in soils characterized as granular or subangular blocky.



3. Chemical properties: Base Soil shall have the following soil chemical properties:

Item	Units	Range
Organic Matter Content	%	2.5 - 6
Total Nitrogen	mg kg^{-1}	>200
Ammonium-nitrogen	mg kg^{-1}	>10
Nitrate-nitrogen	mg kg^{-1}	>5
Available Phosphorus	mg kg^{-1}	>50

Item	Units	Range
pH	Std Units	5.5 – 7.3
Cation Exchange Capacity (CEC)	meq/ 100 gm soil	>17
Soluble Salts/ Electrical Conductivity (EC)	dS.m- 1	<1
Potassium	mg kg^{-1}	>90
Calcium	mg kg^{-1}	>800
Magnesium	mg kg^{-1}	>200
Sodium	mg kg^{-1}	<180
Sulphate-S	mg kg^{-1}	>20
Lead	mg kg^{-1}	<50
Manganese	mg kg^{-1}	<200
zinc	mg kg^{-1}	<150
boron	mg kg^{-1}	<3
Exch. Aluminum	mg kg^{-1}	< 200

C. Base Soil may be a harvested soil from fields or development sites. The organic content and particle size distribution shall be the result of natural soil formation. Manufactured soils where Coarse Sand, composted organic material or chemical additives has been added to the soil to meet the requirements of this specification section shall not be acceptable. Retained soil peds shall be the same color on the inside as is visible on the outside.

D. Base Soil shall NOT have been screened. Soil may retain soil peds or clods larger than 2 inches in diameter throughout the stockpile after harvesting as determined by visual inspection by the SMITHSONIAN COTR.

E. Base Soil Moisture: Protect the Base Soil from rain as required. Soil moisture shall be sufficient when it retains moisture, enabling a friable structure when squeezed, but not in such a wet condition as to leave mud on the hand (see field moisture determination procedure above). Cover the piles after harvesting and uncover during mid-summer/fall drought periods to dry out the soil if project schedule permits.

F. Submit sample from the Base Soil source location per requirements outlined in ***Section 1.10.G.*** The sample shall be a mixture of the random samples taken around the source stockpile or field. The soil sample shall be delivered with soil peds intact that represent the size and quantity of expected peds in the final delivered soil.

2.2 COARSE SAND

A. Coarse Sand for amending the Base Soil (if required) shall be uniformly graded coarse sand consisting of clean, inert, rounded to sub-angular grains of quartz or other durable rock free from loam or clay, surface coatings, mica, and other deleterious materials. There shall be no coarse fragments over 1.0 cm in size or visible organic matter present. Particle size distribution for material passing a Number 4 Sieve shall be:

U.S. Sieve Size	% Passing Minimum	% Passing Maximum
4	90	100
10	75	95
18	48	75

35	20	45
60	0	20
140	0	5
270	0	3
0.002 mm	0	1

1. The pH shall not exceed 7.8 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy Methods of Soil Analysis, Part 2, 1986.

B. Submit testing sample per requirements outlined in ***Section 1.10.E***.

2.3 COMPOST

A. Compost shall be a stable, humus-like material produced from the aerobic decomposition and curing of organic vegetative residues derived from feedstock consisting of woody stems, leaves, grass cuttings, and livestock manure (up to 10 percent of the compost mix by volume). No food products are acceptable as part of the compost feedstock. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices with no visible free water or dust, with no unpleasant odor. Compost shall contain no more than 1 percent foreign materials by weight, and be capable of passing through a one-half inch screen. Compost shall not have become anaerobic during the processing and storage process.

B. Compost shall be commercially prepared Compost and meet US Compost Council STA/TMECC criteria or as modified in this section for "Compost as a Landscape Backfill Mix Component".

http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf

C. Chemical Properties - Compost shall conform to the following values:

Item	**Units**	**Range**
Organic Matter	Percent	>35%
Total Nitrogen	ppm	>1500
Carbon:Nitrogen Ratio	No units	Between 10:1 to 20:1
Extractable Nitrate	ppm	20-200
Total Phosphorus	ppm	5-2000
Available Phosphorus	ppm	5-200
pH	Std Units	5.5 - 8.0
Salt concentration	dS.m- 1	<6
Moisture	% wt	30-55

1. One hundred percent of the material shall pass a 1/2-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight.

2. The Compost shall be screened to ½-inch maximum particle size and shall contain no more that 3 percent material finer than 1.0mm (No. 18 sieve) as determined by sieve analysis.
   a. Additional tests defined in Part I as Chemical Properties shall be performed and the results shall be utilized to evaluate amendments to the Soil Mixes that may be required.

3. Maturity:
   a. C02 test: Compost respiration shall be no more than 6 mg C02-ClgBVS day.
   b. Solvita test: The compost must achieve a maturity index of 6 or more.

4. Biological Values:
   a. Active bacteria and fungi are not to be higher than 10 percent of total bacteria and fungi respectfully.
   b. Total bacteria to be a minimum of 1500 ng/g
   c. Total fungi to be a minimum of 400 ng/g
   d. Protozoa to be 100,000 (amoeba and flagellates with no more 3000 ciliates)
5. Pathogens/Metals/Vector Attraction reduction shall meet 40 CFR Part 503 rule, Table 3, page 9392, Vol. 58 No. 32.

D. Submit testing and sample per requirements outlined in ***Section 1.10.E***.

2.4 LIGHTWEIGHT AGGREGATE

A. Shall be a 5/8" lightweight expanded shale or clay, produced by the rotary kiln process and meeting the requirements of ASTM E2278-M18. Lightweight expanded shale shall have a proven record of durability and be non-corrosive, with the following properties:

1. Soundness Loss: Max 30% with 4 cycles of Magnesium sulfate, in accordance with AASHTO T104
2. Abrasion Resistance: Max 40% in accordance with ASTM C131.
3. Chloride Content: Max. 100 ppm in accordance with AASHTO T 291.

2.5 NO. 8 PEA GRAVEL

A. Shall be clean, dried and free of organic/deleterious materials, conforming to ASTM C-33 specifications for 3/8" aggregate.

2.6 NO. 57 STONE

1. Shall be clean, coarse, open-graded, self-compacting aggregate blend of size 5, 6, & 7 stone.
   a. NO. 57 Stone shall conform to the following particle size:

U.S. Sieve Size	% Passing Minimum	% Passing Maximum
1.5 inch	100	100
1 inch	95	100
0.5 inch	25	60
#4	0	10
#8	0	8
18	0	0
270	0	0
0.002 mm	0	0

2.7 SOIL MIXES

A. All Soil Mixes shall be blended and prepared with the components (Base Soil, Compost, Coarse Sand, and **Lightweight Aggregate**) in the ratios summarized below. Preparation of Soil Mixes shall follow the requirement of Part 3 – Execution. Specific blending details are outlined per Soil Mix below.

SOIL MIX	Base Material	Second Component	Third	Ratio by Volume

			Component	
Planting Soil	Base Soil	Compost *(if req'd)*		5 pts base soil to 1 pt compost *(if req'd)*
Lawn Soil	Base Soil	Compost *(if req'd)*		4 pts base soil to 1 part compost
High-Use Lawn Soil	Base Soil *(Clay Loam or Sandy Clay Loam)*	Coarse Sand	Compost	2 pts base soil to 3 pts coarse sand to 1 pt compost
	Base Soil *(Loam or Sandy Loam)*	Compost	Coarse Sand *(if req'd)*	4 pts base soil to 1 pts compost *(add 1 pt coarse sand if req'd)*
Biofiltration Soil	Base Soil *(Clay Loam or Sandy Clay Loam)*	Coarse Sand	Compost	2 pts base soil to 4 pts coarse sand to 1 pt compost
	Base Soil *(Loam or Sandy Loam)*	Compost	Coarse Sand *(if req'd)*	3 pts base soil to 2 pts compost *(add 1 pt coarse sand if req'd)*
Lightweight Extensive Soil	Base Soil	Lightweight Aggregate	Compost	4 pts base soil to 4 pts lightweight aggregate to 1 pt compost

B. Estimated Soil Mix Densities for determining structural bearing capacity in applications over-structure are provided below. Estimated densities assume approximately 50 percent porosity and 2.5 percent organic matter in Planting Soil; 47 percent pore space for Lawn Soils, and 35 percent porosity and no organic matter in Coarse Sand.

SOIL MIX OR COMPONENTS	Dry Density	Saturated Density
Planting Soil	82 to 87 lbs/cu ft	110 to 114 lbs/cu ft
Lawn Soils	85 to 90 lbs/cu ft	113 to 118 lbs/cu ft
Biofiltration Soil	106 to 110 lbs/cu ft	125 to132 lbs/cu ft
Lightweight Extensive Soil	69 to 75 lbs/cu ft	92 to 101 lbs/cu ft
Coarse Sand	109 to 115 lbs/cu ft	127 to 132 lbs/cu ft

2.8 PLANTING SOIL

A. Planting Soil shall consist of Base Soil harvested from the soil source site. If the Base Soil has organic matter greater than 3.0 percent, and the soil is dark brown with strong aggregate structure (with discernable peds indicating granular or subangular blocky composition), no blending of amendments shall be done and the soil shall be used without further processing unless large rocks, sticks, or other debris greater than 75mm (3 inches) are present. Large items may be manually removed from the soil (preferred) or, if necessary, screened through a screen with 50mm – 75mm (2- to 3-inch) openings (only if large objects are greater than 10 percent of the harvested soil material). Soils must be examined and approved of by the SMITHSONIAN COTR.

1. If the soil organic matter content is less than 3.0 percent, the Planting Soil shall be blended with compost in a ratio of 10 parts Base Soil to 1 part Compost for each percentage point less than 3 percent. The Planting Soil shall be blended to be a uniform, homogenous mixture of the soil components. Additives to achieve specified criteria are not acceptable.
2. Mix Compost into the soil with a loader bucket to loosely incorporate it into the Base Soil as follows.
   a. Soil moisture shall not be greater than 17 percent by weight of the Base Soil mass. Wetter soil will remain cohesive and not blend with compost well.
   b. Spread the Base Soil out as a layer approximately 380mm - 500mm (15-20 inches) deep.
   c. Place the Compost over the soil in a layer 75mm – 100mm (3- to 4-inches) thick.
   d. Using the loader bucket, push and lift the soil and compost into a pile, back-drag the pile only once and lift the soil/compost blend in the bucket and allow it to roll [gently] out of the bucket back into the pile.
3. DO NOT OVER MIX! Do not mix with a soil blending machine. Do not screen the soil. This specification assumes that the various other operations of loading and delivery and final spreading of the soil at the site will further mix the two components to an acceptable amount.
4. Base Soil moisture: Prior to mixing Planting Soil (*if required*), protect the Base Soil required for this mix from rain so that the soil moisture remains above wilt point and below field capacity. Soil moisture shall be between 8 to 17 percent by weight of the soil mass when blending with amendments or when handling. Soil with greater than approximately 15 percent moisture may lose critical soil structure if handled too much. Soil with less than 8 percent moisture by weight may be too brittle and soil peds may shatter into structureless soil particles that will become cemented or compacted when re-wetted.
   a. Cover the piles after harvesting and uncover during summer/fall drought periods to dry out the soil required and if project schedule permits.
   b. See additional requirements for soil moisture as defined in ***Section 1.16.A***.
5. Planting Soil moisture: After mixing Planting Soil, protect from rain so that the soil moisture is sufficient to be friable and crumble when squeezed and not leave mud on the hand. Cover the piles after mixing and uncover during mid-summer/fall drought periods to dry out the soil if soil moisture requires and project schedule permits.
   a. See additional requirements for soil moisture as defined in ***Section 1.16.A***.
6. Submit Planting Soil sample per requirements outlined in ***Section 1.10.G.*** The sample should represent the size and distribution of the soil peds in the soil. Sample shall be marked with the proportion of Base soil to Compost. Submit testing data per requirements outlined in ***Section 1.10.F.***
   a. Planting Soil chemical qualities shall be tested and include:

Item	**Units**	**Range**
Total Organic Matter	Percent	3.0 – 5.0%
Total Nitrogen	mg kg^{-1}	>750
Ammonium-nitrogen	mg kg^{-1}	>20
Nitrate-nitrogen	mg kg^{-1}	>25
Available Phosphorus	mg kg^{-1}	>50
Item	**Units**	**Range**

pH	Std Units	5.5 – 7.3
Cation Exchange Capacity (CEC	meq/ 100 gm soil	>17
Soluble Salts/ Electrical Conductivity (EC)	$dS.m^{-1}$	<1.0
Potassium	$mg\ kg^{-1}$	>90
Calcium	$mg\ kg^{-1}$	>700
Magnesium	$mg\ kg^{-1}$	>200
Sodium	$mg\ kg^{-1}$	<100
Sulphate-S	$mg\ kg^{-1}$	>20
Lead	$mg\ kg^{-1}$	<50
Manganese	$mg\ kg^{-1}$	<200
Exchangeable aluminum	$mg\ kg^{-1}$	<180
zinc	$mg\ kg^{-1}$	<50
boron	$mg\ kg^{-1}$	<3
Exch. Aluminum	$mg\ kg^{-1}$	<200

2.9 LAWN SOIL

A. Lawn Soil shall consist of Base Soil harvested from the soil source site that will be blended with Compost in a ratio of 4 parts Base Soil to 1 part Compost. If the Base Soil has organic matter greater than 3.0 percent, and the soil is dark brown with strong aggregate structure, no blending of is necessary and the soil shall be used without further processing unless large rocks, sticks, or other debris greater than 4 inches are present. The soil components shall be blended to a homogenous, uniform mix free of large clay clods, rocks or sticks greater than 50mm (2 inches) in any dimension, or debris that could affect plant growth and development.

   If the combined fine (no. 140 screen) and very fine (no. 270 screen) sand fraction of the soil particle size is greater than 30 percent of the total soil texture, then Coarse Sand shall be added to the soil blend with a final ratio of 3 parts Base Soil to 1 part Compost to 1 part Coarse Sand. Additives to achieve specified criteria are not acceptable.

   1. The soil components may first be blended using a loader bucket to loosely incorporate the Compost (and Coarse Sand, if required) into the Base Soil as follows.
      a. Spread the Base Soil out as a layer approximately 380mm - 500mm (15-20 inches) deep.
      b. Place the Compost over the soil in a layer 100mm (4 inches) thick.
      c. If coarse sand is required to be added to the blended soil, the Base Soil shall be placed in a layer approximately 380mm (15 inches) thick, upon which a 100mm (4-inch) layer of Compost and a 100mm (4-inch) layer of Coarse Sand will be placed over the Base Soil.
      d. Using the loader bucket, push and lift the soil and compost into a pile, back-drag the pile only once and lift the soil/compost blend in the bucket and allow it to roll [gently] out of the bucket back into the pile.
   2. Blending shall be completed by use of a rotating mixer or a 50mm (2-inch) screen to more evenly mix the soil components.

B. Submit Lawn Soil sample per requirements outlined in ***Section 1.10.G***. Submit testing data per requirements outlined in ***Section 1.10.F***. Soil chemical qualities shall be tested and include:

Item	**Units**	**Range**

Total Organic Matter	Percent	>3.0%
Total Nitrogen	mg kg^{-1}	>700
Ammonium-nitrogen	mg kg^{-1}	>20
Nitrate-nitrogen	mg kg^{-1}	>25
Available Phosphorus	mg kg^{-1}	>50
pH	Std Units	6.5 – 7.8
Cation Exchange Capacity (CEC	meq/ 100 gm soil	>14
Soluble Salts/ Electrical Conductivity (EC)	$dS.m^{-1}$	<1.0
Potassium	mg kg^{-1}	>90
Calcium	mg kg^{-1}	>500
Magnesium	mg kg^{-1}	>200
Sodium	mg kg^{-1}	<100
Sulphate-S	mg kg^{-1}	>20
Lead	mg kg^{-1}	<50
Manganese	mg kg^{-1}	<200
Exchangeable aluminum	mg kg^{-1}	<180
Zinc	mg kg^{-1}	<50
Boron	mg kg^{-1}	<3
Exch. Aluminum	mg kg^{-1}	<200

1. Soil moisture shall be as defined in Section ***1.16.A***.
2. Protect prepared soils from rain during storage to prevent soils from becoming saturated during storage. Cover the piles after mixing and uncover during mid-summer/fall drought periods to dry out the soil if soil moisture requires and project schedule permits.

2.10 HIGH-USE LAWN SOIL

A. High-Use Lawn Soil shall consist of Base Soil harvested from the soil source site that will be blended in a ratio per Soil Mix Table in ***Section 2.7.A***. If the Base Soil has organic matter greater than 3.0 percent, and the soil is dark brown with strong aggregate structure, no blending of is necessary and the soil shall be used without further processing unless large rocks, sticks, or other debris greater than 4 inches are present. The soil components shall be blended to a homogenous, uniform mix free of large clay clods, rocks or sticks greater than 50mm (2 inches) in any dimension, or debris that could affect plant growth and development.

1. The soil components may first be blended using a loader bucket to loosely incorporate the Coarse Sand and Compost into the Base Soil as follows.
   a. Spread the Base Soil out as a layer approximately 380mm - 500mm (15-20 inches) deep.
   b. Place the Compost over the soil in a layer 100mm (4 inches) thick.
   c. Add the Coarse Sand over the soil in a layer 100mm (4-inch) thick.
   d. Using the loader bucket, push and lift the soil and compost into a pile, back-drag the pile only once and lift the soil/compost blend in the bucket and allow it to roll [gently] out of the bucket back into the pile.
2. Blending shall be completed by use of a rotating mixer or a 50mm (2-inch) screen to more evenly

mix the soil components.

B. Submit High-Use Lawn Soil sample per requirements outlined in ***Section 1.10.G***. Submit testing data per requirements outlined in ***Section 1.10.F***. Soil chemical qualities shall be tested and include:

Item	Units	Range
Total Organic Matter	Percent	>3.0%
Total Nitrogen	mg kg^{-1}	>700
Ammonium-nitrogen	mg kg^{-1}	>20
Nitrate-nitrogen	mg kg^{-1}	>25
Available Phosphorus	mg kg^{-1}	>50
pH	Std Units	6.5 – 7.8
Cation Exchange Capacity (CEC	meq/ 100 gm soil	>14
Soluble Salts/ Electrical Conductivity (EC)	$dS.m^{-1}$	<1.0
Potassium	mg kg^{-1}	>90
Calcium	mg kg^{-1}	>500
Magnesium	mg kg^{-1}	>200
Sodium	mg kg^{-1}	<100
Sulphate-S	mg kg^{-1}	>20
Lead	mg kg^{-1}	<50
Manganese	mg kg^{-1}	<200
Exchangeable aluminum	mg kg^{-1}	<180
Zinc	mg kg^{-1}	<50
Boron	mg kg^{-1}	<3
Exch. Aluminum	mg kg^{-1}	<200

1. Soil moisture shall be as defined in Section ***1.16.A***.
2. Protect prepared soils from rain during storage to prevent soils from becoming saturated during storage. Cover the piles after mixing and uncover during mid-summer/fall drought periods to dry out the soil if soil moisture requires and project schedule permits.

2.11 BIOFILTRATION SOIL

A. The Biofiltration Soil shall consist of the Base Soil blended in a ratio per Soil Mix Table in ***Section 2.7.A***, blended to a uniform, homogenous mix of soil components. The soil blend shall be free of large clay clods, rocks or sticks greater than 38mm (1.5 inches), or foreign debris.

1. Submit Biofiltration Soil sample per requirements outlined in ***Section 1.10.G***. Submit testing data per requirements outlined in ***Section 1.10.F***. Soil chemical qualities shall be tested and include:

Item	Units	Range
Total Organic Matter	Percent	2.0 – 6.0
Total Nitrogen	mg kg^{-1}	>450

Item	Units	Range
Ammonium-nitrogen	mg kg^{-1}	>20
Nitrate-nitrogen	mg kg^{-1}	>25
Available Phosphorus	mg kg^{-1}	>50
pH	Std Units	6.0 – 7.8
Cation Exchange Capacity (CEC	meq/ 100 gm soil	>12
Soluble Salts/ Electrical Conductivity (EC)	$dS.m^{-1}$	<1.0
Potassium	mg kg^{-1}	>90
Calcium	mg kg^{-1}	>800
Magnesium	mg kg^{-1}	>200
Sodium	mg kg^{-1}	<100
Sulphate-S	mg kg^{-1}	>20
Lead	mg kg^{-1}	<50
Manganese	mg kg^{-1}	<200
Exchangeable aluminum	mg kg^{-1}	<180
Zinc	mg kg^{-1}	<50
Boron	mg kg^{-1}	<3
Exch. Aluminum	mg kg^{-1}	<200

B. Biofiltration drainage layers shall consist of the following:

1. No. 8 Pea Gravel as described in ***Part 2.5*** of this Section
2. No. 57 Stone as described in ***Part 2.6*** of this Section

C. The Biofiltration Soil shall comply with DOEE Filter Media Criteria for Bioretention.

2.12 LIGHTWEIGHT EXTENSIVE SOIL

A. Lightweight Extensive Soil shall be a blend of 50 percent Base Soil to 50 percent Lightweight Aggregate (1:1 blend ratio) to provide a uniform, homogenous blend of the soil components. The blended Soil/EC mix shall then be blended with compost in a ratio of 5 parts Soil/EC mix to 1 part compost. Blending using a rotating or tumbling drum or screen is recommended. The soil shall be tested for particle size distribution after blending to assure the proper ratio of expanded clay particles and soil particle sizes.

B. Submit Lightweight Extensive Soil sample per requirements outlined in ***Section 1.10.G***. Submit testing data per requirements outlined in ***Section 1.10.F***. Soil chemical qualities shall be tested and include:

Item	Units	Range
Total Organic Matter	Percent	>2.0%
Total Nitrogen	mg kg^{-1}	>500
Ammonium-nitrogen	mg kg^{-1}	>20
Item	**Units**	**Range**

Total Organic Matter	Percent	>2.0%
Total Nitrogen	mg kg^{-1}	>500
Ammonium-nitrogen	mg kg^{-1}	>20
Nitrate-nitrogen	mg kg^{-1}	>25
Available Phosphorus	mg kg^{-1}	>50
pH	Std Units	6.5 – 7.8
Cation Exchange Capacity (CEC	meq/ 100 gm soil	>10
Soluble Salts/ Electrical Conductivity (EC)	$dS.m^{-1}$	<1.0
Potassium	mg kg^{-1}	>90
Calcium	mg kg^{-1}	>800
Magnesium	mg kg^{-1}	>200
Sodium	mg kg^{-1}	<100
Sulphate-S	mg kg^{-1}	>20
Lead	mg kg^{-1}	<50
Manganese	mg kg^{-1}	<200
Exchangeable aluminum	mg kg^{-1}	<180
Zinc	mg kg^{-1}	<50
Boron	mg kg^{-1}	<3

1. See additional requirements for soil moisture as defined in Section ***1.16.A***.

PART 3 – EXECUTION

3.1 COORDINATION WITH PROJECT WORK

A. The Contractor shall coordinate with all other work that may impact the completion of the work.

B. Prior to the start of work, submit and obtain approval of the Planting Soils Installation Plan and prepare a detailed schedule of the work for coordination with other trades.

C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the SMITHSONIAN COTR of any conflicts encountered.

3.2 PRE-EXAMINATION, VERIFICATION AND ACCEPTANCE

A. A Pre-installation Examination with the SMITHSONIAN COTR is required for the work of this section. Schedule the examination at least five days before the installation process begins.

1. As the work proceeds, the Contractor shall schedule a pre-installation examination with the SMITHSONIAN COTR for each area of planting soil installation.

2. Reference ***Section 1.12*** for further requirements governing pre-installation examinations.

B. Upon receipt of delivery of the Soil Mixes, the Contractor shall visually inspect the soil for moisture content, non-aggregated soil particles, clumping, debris, deleterious or foreign materials, or any other physical conditions that could affect the quality of the soils and the Contractor's installation operations.

1. The Contractor shall immediately notify the SMITHSONIAN COTR of any soil deliveries that exhibit any of the physical conditions noted above.

2. The Contractor shall not accept or use soil that exhibits any of the physical conditions noted above.

C. The Contractor shall be responsible for verification that all of the planting areas receiving Soil Mixes have been prepared in conformance with the Contract Documents.

1. Verify that utilities have been installed and accepted.
2. Verify that irrigation mainlines have been installed.
3. Verify that there is a sufficient means for on-site watering of installed plants.
4. Verify that the rough grading has been accepted by the SMITHSONIAN COTR.

D. Examine subgrade for deficiencies including:

1. Construction debris present within the area to receive Soil Mixes.
2. Puddling of water, muddy soil conditions, or expressing of water from the subgrade or adjacent areas.
3. The subgrade is not at the correct depths for installing the planting soil.
4. Incomplete utility, irrigation and /or subsurface drainage installation.
5. Insufficient compaction of subgrade. Refer back to ***Section 1.15.B*** or the geotechnical subgrade requirements (*if applicable*) outlined in Specification **Section 00 0000 -- Earthwork**.

E. Submit all noted deficiencies that will impact the proper installation or execution of the Work to the SMITHSONIAN COTR in writing prior to beginning soil installation operations. The Contractor assumes responsibility for all subgrade work and conditions upon beginning soil installation operations.

3.3 GRADE AND ELEVATION CONTROL

A. Provide grade and elevation control during installation of the Soil Mixes. Utilize grade stakes, surveying equipment, and other means and methods to assure that grades and contours conform to the grades indicated on the plans.

1. Establish lines and levels, locate and lay out by instrumentation and similar appropriate means for planting area finish grades.
2. Provide as many grade stakes and string lines as required to achieve smooth finish grades acceptable to the SMITHSONIAN COTR with positive surface drainage.
3. High Points and Low Points: Provide grade stakes at high points and low points including top of berms, catch basin rims and area drain rims.

3.4 SUBGRADE PREPARATION FOR ON-GRADE CONDITIONS

A. Protection of Existing Conditions:

1. Refer to Specification **Section 01 5639 – Site Protection** for requirements governing this work.
2. Submit written notification of conditions damaged during construction to the SMITHSONIAN COTR immediately.

B. Excavate to the proposed subgrade where applicable. Maintain all required angles of repose of the adjacent materials as shown on the drawings or as required by this specification. Do not over excavate compacted subgrades of adjacent pavement or structures. Maintain a supporting 1:1 side slope of compacted subgrade material along the edges of all paving and structures where the bottom of the paving or structure is above the bottom elevation of the excavated planting area.

C. Remove all construction debris and material including any construction materials from the subgrade.

D. Confirm that the subgrade is at the proper elevation and compacted if required. Subgrade elevations shall slope approximately parallel to the finished grade and/or toward the subsurface drain lines as shown in the Drawings.

E. Subgrade shall be scarified (roughened) to a depth of 75 – 150mm (3-6 inches) prior to placement of subsoil and Soil Mixes to create an uneven, broken surface in which the subgrade can be mixed with the first lift of Soil Mix placed. Scarification can be accomplished using a mini-disc, reverse tiller, or other suitable device as approved by the SMITHSONIAN COTR.

F. Perform infiltration and density tests on subsoil as described in ***Section 1.15.B***.

G. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use 12.5mm (1/2-inch) plywood as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.

1. At the end of each working day, clean up any soil or dirt spilled on any paved surface.
2. Any damage to the paving or site features or work shall be repaired at the Contractor's expense.

3.5 PREPARATION FOR OVER-STRUCTURE CONDITIONS

A. Protection of Existing Conditions:

1. Refer to Specification **Section 01 5639 – Site Protection** for requirements governing this work.
2. Submit written notification of conditions damaged during construction to the SMITHSONIAN COTR immediately.

B. In areas of work over structure, confirm that all waterproofing and drainage layers are complete. Remove any debris from the surface of the drainage layer.

3.6 SOIL MOISTURE

A. Volumetric soil moisture level, in the Soil Mixes and the root balls of all plants, prior to, during and after soil installation and planting shall be above permanent wilt point and below field capacity. Reference ***Section 1.16.A.1*** for determining acceptable soil moisture levels for delivering, handling, placing, and grading activities. Failure to adhere to these requirements is cause for the SMITHSONIAN COTR to reject the soil outright.

3.7 SOIL INSTALLATION

A. **General**

1. Phase work such that equipment to deliver or grade soil and install Soil Mixes does not have to operate over previously installed soil work including lower lifts. Work in rows of lifts the width of the extension of the bucket on the loader. Install all lifts of the entire assembly in one row before proceeding to the next. Work out from the furthest part of each bed from the soil delivery point to the edge of each bed area.
2. The contractor shall continuously check the compaction of the soil installation with a cone penetrometer (at 150mm (12-inch) intervals), as the work progresses, to assure that penetration resistance conforms to the values of the mock up. Final compaction readings with the cone penetrometer should be taken for each planting area at the completion of soil installation (see ***Section 3.9***).
3. Installing soil using soil or mulch blowers or soil slingers shall not be permitted for planting soil due to the over mixing and soil ped breakdown cause by this type of equipment. Use of soil "Gaylord" bags craned into the site is permitted

4. Where travel over installed soil is unavoidable, limit paths of traffic to reduce the impact of compaction in planting soil.
   a. Wheel-driven vehicles are expressly forbidden to be allowed on installed soils. Only low-ground pressure (less than 6 psi), wide track 400mm to 600mm (18-24 inches) equipment may be allowed on installed soils and only along pre-approved corridors or lanes.
   b. All grading and soil delivery equipment shall have buckets equipped with 100 mm (6-inch) long teeth to scarify any soil that becomes compacted.
   c. Protect the surface of the soil in any areas that will receive repeated passes with motorized equipment with 19mm (3/4-inch) plywood matting.
      1.) 3/4" plywood shall only be used when the duration of use does not exceed three days. This is considered for temporary use only.
      2.) No part of any plywood matting shall be moved, altered, or changed in any way until access across, adjacent to, or through installed soil zones is no longer necessary or until the temporary use period has concluded.
   d. Till the surface of the soil with a mini-disc or reverse tiller to a depth of 150mm to 200mm (6-8 inches) when the plywood is removed.
   e. Each time equipment passes over the installed soil it shall reverse out of the area along the same path with the teeth of the bucket dropped to scarify the soil. In the event that the planting soil becomes over compacted, thereby failing to comply with ***Section 3.9***, the soil shall be removed in 12" lifts and the compaction retested until specified compaction levels are observed before proceeding with new soil installation.
5. Prior to installing Planting Soils, the SMITHSONIAN COTR shall approve the condition of the subgrade and the previous scarification.
   a. Immediately install the Soil Mix. Protect the loosened area from traffic. DO NOT allow the loosened subgrade to become compacted.
6. Compaction of soils to specified soil densities shall be accomplished using rollers, foot pressure, or manual tools.
   a. Vibratory, plate and jumping jack compactors, or impact methods (using a backhoe bucket or similar to impact or "hammer" the soil) are strictly prohibited.
7. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing planting soil.
8. Where possible place trees on soil pedestals such that the elevation of the tree root flare will be at the planned finished soil elevation. Tree pedestals will be compacted to 90- to 95% of the soil's maximum dry density, using the Standard Proctor method, to resist settling of the soil from the weight of the tree.

B. **Planting Soil Installation**

1. After inspecting the base grade of the soil, the Planting Soil shall be installed in lifts not to exceed 300mm (12-inch) to the required depths as shown in the Drawings.
   a. Compact each lift gently and evenly to approximately 80 to 84 percent of the soil's maximum dry density using the Standard Proctor method
   b. After each lift has been successfully compacted, scarify the surface of the lift to a depth of 38mm (1.5 inches) and place the next soil lift. Repeat the placement of soil lifts for each soil layer until the Planting Soil grade elevation has been achieved.
   c. Measure soil compaction using a nuclear soil density gauge to attain the required soil density approved in the soil mock up.
2. Where trees will be planted / installed, pack each lift of Planting Soil around the base and rootball of the tree using manual tools (shovels, rakes) to assure that no voids are present around the rootball and that soil is firmly in place.

a. Place the Planting soil in 300 mm (12-inch) lifts.
   1.) Compact each lift gently and evenly to approximately 80 to 84 percent of the soil's maximum dry density using the Standard Proctor method.
   2.) Scarify each lift to a depth of approximately 25mm (1 inch) prior to placement of each successive lift.
b. After the final Planting Soil lift has been installed, grade the surface of the Planting Soil smooth and even. Scarify the final soil lift to create a firm, friable planting surface.

C. **Planting Soil Installation in Soil Cells**

1. Refer to Section 32 94 51 – Soil Cells

*(**Note to Specifier:** Specifications can be downloaded directly from Deeproot.com)*

D. **Planting Soil Installation in Raised Planters**

*(**Note to Specifier:** Section only required if raised planters used. Remove reference if not used)*

1. Planter Soils are expected to be installed in areas with limited space and access. Planter soils shall consist of a Planting Soil layer and a Compost till layer (surface).
2. Install the Planting Soil in lifts not to exceed 300mm (12-inch) to the required depths as shown on the Plans. Compact each lift using foot pressure or equivalent to gently and evenly compact soil to approximately 82 to 84 percent of optimum Standard Proctor soil density. After each lift has been successfully compacted, scarify the surface of the lift to a depth of 38mm (1.5 inches) and place the next soil lift. Repeat the placement of soil lifts for each soil layer until the Planting Soil grade elevation has been achieved. Measure soil compaction using the cone penetrometer as required to attain the soil density approved in the soil mock up.
   a. Prior to placement of successive lifts, determine soil density using the cone penetrometer. Resistance to penetrometer push shall be 110 to 170 psi.
   b. Pack each lift of Planting Soil firmly up to edges or walls of planter boxes using manual tools (shovels, rakes) to assure that no voids are present and that soil is firmly in place.
   c. After placement of all Planting Soil, the soil density shall be measure for the whole depth of the Planting Soil layer to check for uniform density and that clay or compaction pans are not present.
3. The Planting Soil shall be finished with a firm, friable planting surface.

E. **Lawn Soil Installation**

1. The Lawn Soil profile shall include the Planting Soil layer and the Lawn Soil.
2. Install the Planting Soil in lifts not to exceed 300mm (12-inch) to the required depths as shown in the Drawings. Compact each lift gently and evenly compact soil to approximately 82 to 84 percent of the soil's maximum dry density using the Standard Proctor method. After each lift has been successfully compacted, scarify the surface of the lift to a depth of 38mm (1.5 inches) and place the next soil lift. Repeat the placement of soil lifts for each soil layer until the Planting Soil grade elevation has been achieved. Measure soil compaction using the cone penetrometer as required to attain the required soil density approved in the soil mock up.
   a. Prior to placement of successive materials or lifts, determine soil density using the cone penetrometer. Resistance to penetrometer push shall be 110 to 170 psi.
   b. Where trees will be planted / installed, pack each lift of Planting Soil around the base and rootball of the tree using manual tools (shovels, rakes) to assure that no voids are present around the rootball and that soil is firmly in place.
3. Install the Lawn Soil in lifts not to exceed 300mm (12-inch) to the required depths as shown on the Plans. Compact each lift gently and evenly compact soil to approximately 82 to 84 percent of the soil's maximum dry density using the Standard Proctor method. After each lift has been

successfully compacted, scarify the surface of the lift to a depth of 38mm (1.5 inches) and place the next soil lift. Repeat the placement of soil lifts for each soil layer until the final grade of the soil profile has been achieved, as required to attain the required compaction approved in the soil mock up.

a. Prior to placement of successive materials or lifts, determine soil density using the cone penetrometer. Resistance to penetrometer push shall be 110 to 170 psi.
b. After placement of all Lawn Soil, the soil density shall be measure for the whole depth of the Lawn Soil layer to check for uniform density and that clay or compaction pans are not present.
c. The Lawn Soil shall be finished with a firm, friable planting surface.

F. **High-Use Lawn Soil Installation**

1. The High Use Lawn Soil profile shall include the Planting Soil layer, a Coarse Sand drainage layer and a Lawn Soil layer.
2. Install the Planting Soil in lifts not to exceed 300mm (12-inch) to the required depths as shown on the Plans. Compact each lift gently and evenly compact soil to approximately 82 to 84 percent of the soil's maximum dry density using the Standard Proctor method. After each lift has been successfully compacted, scarify the surface of the lift to a depth of 38mm (1.5 inches) and place the next soil lift. Repeat the placement of soil lifts for each soil layer until the Planting Soil grade elevation has been achieved. Measure soil compaction using a nuclear soil density gauge to assure the required soil density approved in the soil mock up.
3. Install the 150mm (6-inch) Coarse Sand drainage layer over the Planting Soil, taking care to minimize damage, including excess compaction, to the Planting Soil layer.
   a. The Coarse Sand drainage layer shall be installed evenly and raked smooth to a firm, smooth surface.
   b. The Coarse Sand drainage layer shall not be compacted.
4. Install the High-Use Lawn Soil in lifts not to exceed 200mm (8-inch) to the required depths as shown on the Plans. Compact each lift gently and evenly compact soil to approximately 82 to 84 percent of the soil's maximum dry density using the Standard Proctor method. After each lift has been successfully compacted, scarify the surface of the lift to a depth of 38mm (1.5 inches) and place the next soil lift. Repeat the placement of soil lifts for each soil layer until the final grade of the soil profile has been achieved, as required to attain the required compaction approved in the soil mock up.
   a. Prior to placement of successive materials or lifts, determine soil density using the cone penetrometer. Resistance to penetrometer push shall be 110 to 170 psi.
   b. After placement of all High-Use Lawn Soil, the soil density shall be measure for the whole depth of the Lawn Soil layer to check for uniform density and that clay or compaction pans are not present.
   c. The Lawn Soil layer shall be graded smooth and even and compacted using a roller, or previously approved means. Any uneven surface areas shall be graded smooth.
   d. The Lawn Soil shall be finished with a firm, friable planting surface.

G. **Biofiltration Soil Installation**

1. Biofiltration Soil profiles shall be installed as shown in the plans to comply with DOEE requirements.
2. Prior to installation of the Biofiltration soil profile, check that all subgrade preparation has been completed and accepted. The base of each biofiltration areas shall be scarified to a depth of 50mm (2-inches) and graded smooth with a rough, porous surface.
3. A rock drainage layer consisting of clean No. 57 stone (1" to 1.5" stone) shall be placed to the

depth shown in the Drawings above the base grade concurrent with the installation of the bioretention drainage system. The stone drainage layer will be raked or graded smooth.

4. A layer of 3/8" No. 8 pea gravel shall be installed above the stone drainage layer. The pea gravel layer shall be placed as an even layer raked smooth.
5. The Biofiltration Soil shall be installed to the depths according to the plan details. For installation, the soil shall be installed in 200mm – 300mm (8- to 12-inch) lifts. Each lift shall be graded smooth and scarified prior to the placement of the next subsequent lift. Biofiltration Soil lifts shall not be compacted, but each lift must be raked to assure that soil voids have been eliminated.
6. After placement of the Biofiltration Soil, the full profile shall be wetted to allow for natural settling and compaction. This process shall be conducted a minimum of two times. The final grade elevation of the Biofiltration Soil shall be measured. Any resulting settling or voids shall be filled with added Biofiltration Soil to the final grade.
7. The final Biofiltration Soil shall be graded smooth and a firm, friable planting bed shall be prepared.

H. **Lightweight Extensive Soil Installation**

1. The structural base upon which the soil will be installed, including waterproofing and the drainage system, shall be provided by others.
2. After completion of the structural surface, waterproofing, and drainage layers, the installation of the protection layer, root barrier and separation geotextile should follow.
3. Next, the Lightweight Planting Soil shall be installed as shown in the Drawings.
   a. The Lightweight Planting Soil shall be installed to the depth shown in the drawings in a single lift and raked and graded smooth. Compaction of this lift is not necessary.

3.8 INSTALLATION OF COMPOST TILL LAYER

Note to specifier: *The following paragraph is critical to establishing an organic-rich O horizon in installed Planting Soil. This added layer of Compost must be shown on the soil details in the Drawings*

A. After Planting Soils are installed and just prior to the installation of shrub or groundcover plantings, spread 50mm (2 inches) of Compost over the beds and roto till into the top 100mm (4 inches) of the Planting Soil. This step will raise grades slightly, refer to ***Section 3.10.A***.

1. Planting Soils here refer to ***Sections 3.7B*** (Planting Soil), ***3.7D*** (Planting Soil in Raised Planters), and ***3.7G*** (Biofiltration Soil).

3.9 POST SOIL INSTALLATION TESTING

A. Soil density, soil compaction, and soil infiltration testing shall be completed as soil is installed and at completion of soil installation to assure that soils comply with specified requirements as established in this Section.

1. Soil density shall be measured using a nuclear soil density gauge as described in ***Part 1.14.G*** of this section.
   a. Soil density measurements shall be completed for each planting area smaller than 100 square meters, or one test for each 100 square meters of a larger planting area.
   b. Soil density shall be between 80 to 84 percent of the soil's maximum dry density using the Standard Proctor method in all areas. If soil density exceeds this range, additional soil density tests shall be conducted offset by 5 feet in each direction from the point of exceedance to

determine extent of excessive soil density. The SMITHSONIAN COTR shall be consulted for corrective actions.

c. Soils with high compost or organic matter concentrations may not achieve the specified soil density range. Advise the SMITHSONIAN COTR if soil density measurements and the location of soil density measurements not meeting the specified range.

2. Compaction testing, including surface as well as subsurface compaction layers, shall be tested using a cone penetrometer as described in ***Part 1.14G*** of this Section.
   a. Compaction testing shall be done for each 25 square meters of planting area at a minimum.
   b. Compaction measured as resistance to penetration of the cone penetrometer in pounds per square inch (psi) shall not exceed 140 psi in the surface 150mm (6 inches), 180 psi in the 150 – 300 mm (6- to 12-inch) depth interval, or 200 psi at depths greater than 300 mm in the soil profile.
      1.) If compaction testing detected compacted layers exceeding the allowances described above, soil shall be removed to the depth of compaction, and compacted soils shall be loosened with hand tools to break compacted layers and achieve appropriate soil density.

3. Infiltration testing shall be conducted as described in ***Section 1.14H***. Infiltration testing shall be completed using the Double-Ring Infiltrometer.
   a. Infiltration testing shall be done for each planting area of 100 square meters or less. Infiltration testing shall be done at a rate of one test per 100 square meters for panting areas greater than 100 square meters.
   b. Infiltration rates for Planting Soil and Lawn Soil shall be greater than 15 mm per hour (0.6 inches/hour). If infiltration rates are not greater than 15 mm/hr, consult with the SMITHSONIAN COTR to determine corrective actions.
   c. Infiltration rates for High-Use Lawn and Biofiltration Soils shall be greater than 25 mm per hour (1.0 inches/hour). If infiltration rates are not greater than 25 mm/hr, consult with the SMITHSONIAN COTR to determine corrective actions.

3.10 FINISH GRADING

A. The finish grades of all planted areas shown in the Drawings are the elevations after settlement and shrinkage of the Compost Till Layer and planting soil. This settlement is anticipated to be within a few months after installation as the Compost breaks down. A minimum settlement of approximately 25mm (1-inch) of the soil depth is expected. The Contractor shall install the planting soil at a higher level to anticipate this reduction of planting soil volume (approximately 25mm (1-inch)).

   1. Grade the edges of shrub areas and ground cover areas soil surfaces to an elevation 50mm (2 inches) below the finished surface of adjacent paving and curbs, after initial soil settlement, unless indicated otherwise.

   2. The grades in bed areas shown in the Drawings is the soil line before mulch is added and after soil settlement. The grades in lawn areas shown in the Drawings in the thatch line of the sod after initial soil settlement, unless indicated otherwise.

B. Utilize hand tools to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.

C. Inspect and survey finished soil grades for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds consistent with soil grade designs unless indicated otherwise. Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations as shown in the Drawings. Notify the SMITHSONIAN COTR in the event that conditions make it impossible to achieve positive drainage.

   1. Grade soil surface smooth to be free of high and low areas which will inhibit surface drainage.

2. Provide smooth, rounded transitions between slopes of different gradients and direction.

3.11 TOLERANCES

A. Grade soil surface to within 0.10-foot of grades indicated in the Drawings, except bring soil surface grades along headers, paving, curbs, and other structures to within 0.01-foot of grades indicated in the Drawings.

B. Transition soil surface grades along paving, curbs and other structures to areas of less strict tolerance over a 5-foot distance.

C. Fill all depressions and remove any rises or mounds in the overall plane of the slope. The tolerance for dips and bumps in shrub and ground cover planting areas shall be a 50mm (2-inch) deviation from the plane in 3-meters (10 feet). The tolerance for dips and bumps in lawn areas shall be a 25mm (1-inch) deviation from the plane in 3-meters (10 feet).

3.12 PROTECTION AND REPAIRS

A. The Contractor shall take every precaution to ensure the integrity of the underdrainage, aeration and irrigation systems during and after soil placement. Any damage caused by the Contractor shall be repaired at no additional expense to the Owner.

B. The Contractor shall be responsible to ensure that no soil disturbance will occur from construction traffic or other construction activities after placement of planting soil is complete. Disturbance shall be repaired by the Contractor at no additional expense to the Owner.

1. The Contractor shall place barricades to prevent compaction of planting soil from vehicles, equipment, or pedestrian traffic.

2. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

C. Protect newly graded areas from traffic and erosion. Keep free of trash, debris or construction materials from other work.

D. Repair and re-establish grades where completed or partially competed surfaces become eroded, rutted or compacted. Scarify, or, if directed by the SMITHSONIAN COTR, remove and replace soil to a depth as directed. Reshape and re-compact to the required density while soil is at a moisture content between permanent wilting point and field capacity.

E. Where settling greater than 50mm (2-inches) occurs, before final acceptance or during the warranty period, remove finish surfacing, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the SMITHSONIAN COTR.

1. Repaired or restored areas shall follow the same procedures as specified for installation of new Soil Mixes.

F. Any soil that becomes compacted to a density greater than 85 proctor density and/or the density in the approved mockup shall be dug up and reinstalled. This requirement includes compaction caused by other sub-contractors after the Soil Mix (Planting Soil) is installed and approved.

G. Surface tilling shall not be considered adequate to reduce over compaction at levels 150mm (6 inches) or greater below finished grade. See ***Section 3.7.A.4*** for remediating over-compaction.

3.13 FINAL ACCEPTANCE / SOIL SETTLEMENT

A. Upon written notice from the Contractor, the SMITHSONIAN COTR shall review the work and make a determination if the work is substantially complete.

B. The date of substantial completion of the planting soil shall be the date when the SMITHSONIAN COTR accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

C. Aesthetic Acceptance of Grades:

1. Upon completion of finish grading Work, schedule with the SMITHSONIAN COTR a review to obtain aesthetic acceptance.
2. Provide three (3) days advance written notification.
3. Do not commence planting or sodding Work until receiving aesthetic acceptance.

D. At the end of the plant warrantee and maintenance period, (see **Specification Section 00 0000 -- Planting**) the SMITHSONIAN COTR shall observe the soil installation work and establish that all provisions of the contract are complete, and the work is satisfactory.

1. Restore any soil settlement and or erosion areas to the grades shown in the Drawings. When restoring soil grades remove plants and mulch and add soil before restoring the planting. Do not add soil over the root balls of plants or on top of mulch.

E. Failure to pass acceptance: If the work fails to pass final acceptance, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the SMITHSONIAN COTR.

3.14 EXCESS MATERIALS

A. Excess Planting Soil: Remove the excess planting soil mixture and materials from the project area at no additional cost to the Owner.

END OF SECTION 32 91 00

Spec Checklist

Smithsonian Gardens

Spec Checklist Template

Section 32 9100

PART 1

	Product	Using?	Notes
1.1.B.1	**Base Soil**	Y	Indicate scope of work by denoting soil components used in the project and removing those that are not
	Coarse Sand	Y	
	Compost	Y	
	Lightweight Aggregate	N	
	No. 8 Pea Gravel	N	
	No. 57 Stone	N	
1.1.B.2	**Planting Soil**	Y	Indicate scope of work by denoting soil mixes used in the project and removing those that are not
	Lawn Soil	Y	
	High-Use Lawn Soil	N	
	Biofiltration Soil	N	
	Lightweight Extensive Soil	N	

1.13	Pre-Construction Meeting	Reviewed?	Meeting Date	SG Follow-up Review Date	Contractor Confirmation & Date	Notes
1.9	**Long Lead Item**	Y	-	-	-	The spec should be reviewed in its entirety during the landscape pre-construction meeting. The list indicates the most important review items. Denote whether the spec section was reveiwed, and the date if reviewed separate from the date of the Pre-Con meeting. Log the contractor confirmation date and note any agreed upon changes or variations from the original spec requirements.
1.10.B	**Planting Soils Installation Plan**	Y	-	-	-	
1.10D	**Submittals Timeframe**	Y	-	-	-	
1.10E	**Soil Components Product Data and Samples**	Y	-	-	-	
1.10F	**Soil Mix Testing Procedures**	Y	-	-	-	
1.10G	**Soil Mix Samples**	Y	-	-	-	
1.11	**Soil Installation Mockup**	N	-	-	-	
1.14.B	**Base Soil Source**	Y	-	-	-	
1.14.E	**Base Soil Souce Inspection**	Y	-	-	-	
1.15.B	**Subgrade Infiltration Testing**	Y	-	-	-	
1.16	**Delivery, Storage, Handling**	Y	-	-	-	
2.7.A	**Soil Mixes**	Y	-	-	-	

DELETE ANY SOIL COMPONENT OR SOIL TYPE BELOW THAT IS NOT BEING USED IN THE PROJECT

	Submittal	Date Due	Date Received	Testing	Approved Range	Received Range	Status	Date Approved	Notes
1.10.B	**Planting Soils Installation Plan**	12 wks	-	-	-	-	*received*	-	
1.10.C	**Base Soil Source**	12 wks	-	-	-	-	*received*	-	Note supplier and contact info here
1.14.E	*Place date of Base Soil inspection here >>>>>>>*		-				*approved*		
1.10.E 2.3.A	**Compost Product Data and Sample**	12 wks	-	Organic Matter	>35%	-	*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Size (passing)	1/2 screen or less			-	
			-	Total Nitrogen	>1500 ppm	-		-	
			-	Carbon:Nitrogen Ratio	10:1 to 20:1	-		-	
			-	Extractable Nitrate	20-200 ppm	-		-	
			-	Total Phosphorous	5 - 2000 ppm	-		-	
			-	Available Phosphorous	5 - 200 ppm	-		-	
			-	pH	5.5 - 8.0	-		-	
			-	Salt concentration	<6 dS.m- 1	-		-	
			-	Moisture	30-55 %wt	-		-	
			-	CO2 test (max.)	6 mg CO2-ClgBVS / day	-		-	
			-	Solvita test	6 or more	-		-	
			-	Active bacteria (max.)	10%	-		-	
			-	Total bacteria (min.)	1500 ng/g	-		-	
			-	Total fungi (min.)	400 ng/g	-		-	
			-	R. th	2.3.C.5			-	
1.10.E 2.2.A	**Coarse Sand Product Data and Sample**	12 wks	-	pH	< 7.8	-	*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Sieve #4	min. 90 - max. 100	-		-	
			-	Sieve #10	min. 75 - max. 95	-		-	
			-	Sieve #18	min. 48 - max. 75	-		-	
			-	Sieve #35	min. 20 - max. 45	-		-	
			-	Sieve #60	min. 0 - max. 20	-		-	
			-	Sieve #140	min. 0 - max. 5	-		-	
			-	Sieve #270	min. 0 - max. 0	-		-	
			-	Sieve .002mm	min. 0 - max. 1	-		-	
1.10.E 2.4.A	**Lightweight Aggregate Product Data and Sample**	12 wks	-	Size	5/8" expanded shale or clay	-	*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Soundness loss	<30% per AASHTO T104	-		-	
			-	Abrasion resistence	<40% per ASTM C131	-		-	
			-	Chloride content	<100ppm AASHTO T291	-		-	
1.10.E	**No.8 Pea Gravel Product Data and Sample**	12 wks	-	Size	3/8" clean, dried per ASTM C33	-	*outstanding*	-	All samples to be submitted along with required testing & product data
1.10.E	**No.57 Stone Product Data and Sample**	12 wks	-	Physical	Clean, double-washed, open graded	-	*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Sieve 1.5 inch	min. 100 - max. 100	-		-	
			-	Sieve 1 inch	min. 95 - max. 100	-		-	
			-	Sieve 1/2 inch	min. 25 - max. 60	-		-	
			-	Sieve #4	min. 0 - max. 10	-		-	
			-	Sieve #8	min. 0 - max. 8	-		-	
			-	Sieve #18	min. 0 - max. 0	-		-	
			-	Sieve #270	min. 0 - max. 0	-		-	
			-	Sieve .002mm	min. 0 - max. 0	-		-	

	Submittal	Date Due	Date Received	Testing	Approved Range	Received Range	Status	Date Approved	Notes
1.10.F 2.1.A	**Base Soil Testing and Sample**	12 wks	-	USDA soil texture (Clay Loam, Loam, Sandy Loam, Sandy Clay Loam)	17-37% Clay 15-35% Silt 40-62% Sand	-	*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Wet Agg. Stability	60% > 0.20mm	-		-	
			-	Organic Matter	2.5 - 6%	-		-	
			-	Total Nitrogen	>200 mg kg-1	-		-	
			-	Ammonium-Nitrogen	>10 mg kg-1	-		-	
			-	Nitrate-Nitrogen	>5 mg kg-1	-		-	
			-	Available Phosphorous	>50 mg kg-1	-		-	
			-	pH	5.5 - 7.3	-		-	
			-	CEC	>17 meq / 100 gm soil	-		-	
			-	Soluble Salts/ EC	<1 dS.m-1	-		-	
			-	Potassium	>90 mg kg-1	-		-	
			-	Calcium	>800 mg kg-1	-		-	
			-	Magnesium	>200 mg kg-1	-		-	
			-	Sodium	<180 mg kg-1	-		-	
			-	Sulphate-S	>20 mg kg-1	-		-	
			-	Lead	<50 mg kg-1	-		-	
			-	Manganese	<200 mg kg-1	-		-	
			-	Zinc	<50 mg kg-1	-		-	
			-	Boron	<3 mg kg-1	-			
			-	Exch. Aluminum	<200 mg kg-1	-			
1.10.F 2.8.A	**Planting Soil Testing and Sample**	2 wks after approval of Base Soil / soil components	-	Mix Ratio by Volume	**5 pts Base Soil to 1 pt Compost (if req'd) see 2.7.A**	-	*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Organic Matter	3.0 - 5%	-		-	
			-	Total Nitrogen	>750 mg kg-1	-		-	
			-	Ammonium-Nitrogen	>20 mg kg-1	-		-	
			-	Nitrate-Nitrogen	>25 mg kg-1	-		-	
			-	Available Phosphorous	>50 mg kg-1	-		-	
			-	pH	5.5 - 7.3	-		-	
			-	CEC	>17 meq / 100 gm soil	-		-	
			-	Soluble Salts/ EC	<1 dS.m-1	-		-	
			-	Potassium	>90 mg kg-1	-		-	
			-	Calcium	>700 mg kg-1	-		-	
			-	Magnesium	>200 mg kg-1	-		-	
			-	Sodium	<100 mg kg-1	-		-	
			-	Sulphate-S	>20 mg kg-1	-		-	
			-	Lead	<50 mg kg-1	-		-	
			-	Manganese	<200 mg kg-1	-		-	
			-	Zinc	<50 mg kg-1	-		-	
			-	Boron	<3 mg kg-1	-		-	
			-	Exch. Aluminum	<180 mg kg-1	-		-	
1.10.F 2.9.A	**Lawn Soil Testing and Sample**	2 wks after approval of Base Soil / soil components	-	Mix Ratio by Volume	**4 pts Base Soil to 1 pt Compost see 2.7.A**	-	*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Organic Matter	>3.0	-		-	
			-	Total Nitrogen	>700 mg kg-1	-		-	
			-	Ammonium-Nitrogen	>20 mg kg-1	-		-	
			-	Nitrate-Nitrogen	>25 mg kg-1	-		-	
			-	Available Phosphorous	>50 mg kg-1	-		-	
			-	pH	6.5 - 7.8	-		-	
			-	CEC	>14 meq / 100 gm soil	-		-	
			-	Soluble Salts/ EC	<1 dS.m-1	-		-	
			-	Potassium	>90 mg kg-1	-		-	
			-	Calcium	>500 mg kg-1	-		-	
			-	Magnesium	>200 mg kg-1	-		-	
			-	Sodium	<100 mg kg-1	-		-	
			-	Sulphate-S	>20 mg kg-1	-		-	
			-	Lead	<50 mg kg-1	-		-	
			-	Manganese	<200 mg kg-1	-		-	
			-	Zinc	<50 mg kg-1	-		-	
			-	Boron	<3 mg kg-1	-		-	
			-	Exch. Aluminum	<180 mg kg-1	-		-	
1.10.F 2.10.A	**High-Use Lawn Soil Testing and Sample**	2 wks after approval of Base Soil / soil components	-	Mix Ratio by Volume	**Dependant on Base Soil Texture see 2.7.A**	-	*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Organic Matter	>3.0	-		-	
			-	Total Nitrogen	>700 mg kg-1	-		-	
			-	Ammonium-Nitrogen	>20 mg kg-1	-		-	
			-	Nitrate-Nitrogen	>25 mg kg-1	-		-	
			-	Available Phosphorous	>50 mg kg-1	-		-	
			-	pH	6.5 - 7.8	-		-	
			-	CEC	>14 meq / 100 gm soil	-		-	
			-	Soluble Salts/ EC	<1 dS.m-1	-		-	
			-	Potassium	>90 mg kg-1	-		-	
			-	Calcium	>500 mg kg-1	-		-	
			-	Magnesium	>200 mg kg-1	-		-	
			-	Sodium	<100 mg kg-1	-		-	
			-	Sulphate-S	>20 mg kg-1	-		-	
			-	Lead	<50 mg kg-1	-		-	
			-	Manganese	<200 mg kg-1	-		-	
			-	Zinc	<50 mg kg-1	-		-	
			-	Boron	<3 mg kg-1	-		-	
			-	Exch. Aluminum	<180 mg kg-1	-		-	

1.10.F 2.11.A	**Biofiltration Soil Testing and Sample**	2 wks after approval of Base Soil / soil components	-	Mix Ratio by Volume	**Dependant on Base Soil Texture see 2.7.A**	-	*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Organic Matter	2.0 - 6.0	-		-	
			-	Total Nitrogen	>450 mg kg-1	-		-	
			-	Ammonium-Nitrogen	>20 mg kg-1	-		-	
			-	Nitrate-Nitrogen	>25 mg kg-1	-		-	
			-	Available Phosphorous	>50 mg kg-1	-		-	
			-	pH	6.0 - 7.8	-		-	
			-	CEC	>12 meq / 100 gm soil	-		-	
			-	Soluble Salts/ EC	<1 dS.m-1	-		-	
			-	Potassium	>90 mg kg-1	-		-	
			-	Calcium	>800 mg kg-1	-		-	
			-	Magnesium	>200 mg kg-1	-		-	
			-	Sodium	<100 mg kg-1	-		-	
			-	Sulphate-S	>20 mg kg-1	-		-	
			-	Lead	<50 mg kg-1	-		-	
			-	Manganese	<200 mg kg-1	-		-	
			-	Zinc	<50 mg kg-1	-		-	
			-	Boron	<3 mg kg-1	-		-	
			-	Exch. Aluminum	<180 mg kg-1	-		-	
1.10.F 2.12.A	**Lightweight Extensive Soil Testing and Sample**	2 wks after approval of Base Soil / soil components	-	Mix Ratio by Volume	**4 pts Base Soil to 4 pts Lightweight Agg. to 1 pt Compost see 2.7.A**	-	*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Organic Matter	>2.0%			-	
			-	Total Nitrogen	>500 mg kg-1	-		-	
			-	Ammonium-Nitrogen	>20 mg kg-1	-		-	
			-	Nitrate-Nitrogen	>25 mg kg-1	-		-	
			-	Available Phosphorous	>50 mg kg-1	-		-	
			-	pH	6.5 - 7.8	-		-	
			-	CEC	>10 meq / 100 gm soil	-		-	
			-	Soluble Salts/ EC	<1 dS.m-1	-		-	
			-	Potassium	>90 mg kg-1	-		-	
			-	Calcium	>800 mg kg-1	-		-	
			-	Magnesium	>200 mg kg-1	-		-	
			-	Sodium	<100 mg kg-1	-		-	
			-	Sulphate-S	>20 mg kg-1	-		-	
			-	Lead	<50 mg kg-1	-		-	
			-	Manganese	<200 mg kg-1	-		-	
			-	Zinc	<50 mg kg-1	-		-	
			-	Boron	<3 mg kg-1	-		-	
			-	Exch. Aluminum	<180 mg kg-1	-		-	

	Submittal	Date Due	Date Received	Testing	Approved Range		Status	Date Approved	Notes
DELETE ANY SOIL TYPE SAMPLE BELOW THAT IS NOT BEING USED IN THE PROJECT									
1.10.G	**Samples**	2 wks after approval of Base Soil / soil components	-	Base Soil	2 gallon		*outstanding*	-	All samples to be submitted along with required testing & product data
			-	Planting Soil	2 gallon			-	
			-	Lawn Soil	2 gallon			-	
			-	High-Use Lawn Soil	2 gallon			-	
			-	Biofiltration Soil	2 gallon			-	
			-	Lightweight Ext. Soil	2 gallon			-	
1.10.H 1.15.B	**Subgrade Infiltration and Density**	-	-	Infiltration	Min. 0.25" per hour	-	*received*	-	Testing data must be received a minimum of 7 days before soil installation occurs.
			-	Compaction (0-6")	120 - 180 psi	-		-	
			-	Compaction (6-12")	160 - 220 psi	-		-	

1.11	Soil Installation Mockup	Reviewed?	Mockup Date	SG Follow-up Review Date	Contractor Confirmation & Date	Date Due	Notes
1.15.B	**Subgrade Infiltration Testing**	Y	-	-	-		
1.16	**Delivery, Storage, Handling**	Y	-	-	-		Denote whether the spec section was reviewed.
3.3	**Grade and Elevation Control**	Y	-	-	-		
3.4	**Subgrade Preparation**	Y	-	-	-		Log the contractor confirmation date and note any agreed upon changes or variations from the original spec requirements.
3.6	**Soil Moisture**	Y	-	-	-		
3.7	**Soil Installation**	Y	-	-	-		
3.8	**Installation of Compost Till Layer**	Y	-	-	-		
3.9	**Post Soil Installation Testing**	Y	-	-	-		
1.11.A.6	**Soil Mockup Installation Report**	-	-	-	-	-	*outstanding*	*Within 3-5 days following approved mockup*	Report shall include the final methods of soil installation, including all penetrometer, nuclear densometer, and soil moisture reading catalogued during the mockup.
	Place date of Mockup approval here **>>>>>>>>>**		-						

Details

Smithsonian Gardens

Smithsonian Institution Lawns and Grasses Specification

Disclaimer and Responsibility of the User:

Use of this document: The following specification has been prepared by the Smithsonian Institution and is copyrighted 2021. Permission is granted for use of this material for individual use or use by your organization to prepare specifications. This document, when used as the basis of a specification, has significant legal and financial ramifications on the outcome of a construction project. By adopting this specification, in part or in its entirety, the user accepts all liability related to its use.

How to Use this Template:

1. This specification is designed to be used in conjunction with standard Division 01 specifications, which cover project general conditions and project wide contract elements. THIS IS NOT A STAND-ALONE SPECIFICATION and should not be used as a contract for turf replacement. Important issues of project ownership, liability, insurance, contract language, project controls, Instructions to bidders, change orders and review and approval of the work are normally in the Division 01 specifications.

2. This specification is designed for the **replacement of turf area for large-scale projects.** A large-scale project is defined as one where an entire lawn area is being replaced and where the maintenance for the lawn area would be included in that project.

Section 32 92 00
LAWN AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sodding.

B. Related Sections:

1. Division 31 Section "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
2. Division 31 Section "Earth Moving" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.
3. Division 32 Section "Exterior Plants" for tree and shrub planting, and tree support systems.
4. Division 32 Section 32 9100 “Planting Soil” for soil materials.

1.3 DESCRIPTION

A. Sodding: This work shall consist of soil preparation, addition of soil amendments (as determined by the soil test results), watering, and placing grass sod on prepared areas, as specified in the Contract Documents or as directed by the Smithsonian or Smithsonian’s representative.

1.4 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

E. Planting Soil: Material consisting of standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or, manufactured topsoil; which is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

G. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

H. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

B. Submit certification of identification for the following:
1. Source and name and telephone number of supplier.
2. Certification of each seed mixture for turfgrass sod.

C. Qualification Data: For qualified landscape Installer.

D. Product certificates: For soil amendments and fertilizers, from manufacturer.

E. Soils tests, analysis and recommendations: See requirements in section 32 1900 Planting Soils.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and meadow establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years experience in turf installation in addition to requirements in Division 1 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician – Exterior.
    b. Landscape Industry Certified Lawn Care Technician.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Store packaged materials in a manner that will prevent damage or intrusion of foreign matter. Any material that becomes contaminated will be removed from the job site.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime and soil amendments with appropriate certificates.

1.8 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Sod

    a. Spring Planting: April 01 to June 15
    b. Fall Planting: August 21 to November 01

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within the specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Smithsonian, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.

2. Warranty Periods from Date of Planting Completion:

a. Sodded Turf: 12 months, or completion of a single growing season, whichever is greater.

1.10 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Sodded Turf: From date of installation to Final Acceptance.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

A. Turfgrass Sod: Maryland Certified (labeled), inspected and approved by the Maryland Department of Agriculture, complying with Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted. Sod shall be harvested during periods of active growth and irrigation. Dormant sod will not be acceptable.

B. Turfgrass Species:

1. Sod shall be a 90/10 mix with 90% of the mix consisting of a blend of at least three turf type tall fescues, and at least 10% Bluegrass. Approved varieties shall be selected "Recommended Turfgrass cultivars for Professional Seed Mixtures," University of Maryland Turfgrass Technical Update TT-77 most recent edition. A copy of this publication can be obtained by visiting the Maryland Turfgrass Council website http://www.mdturfcouncil.org or by calling them at 410-836-2876.

a. Thickness of Cut: The thickness of the roots and soil should be ½" (12.7 mm) to ¾" (19.05 mm).
b. Pad Size: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be 5%. Broken pads and torn or uneven ends will not be acceptable.
c. Strength of Sod Sections: Under ideal conditions, standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10% of the section **without the use of netting**. Sod shall be a minimum of one year old.
d. Sod Viability: Sod shall not be harvested or transplanted under drought conditions.

C. Subject to compliance with requirements, acceptable sources include but are not limited to:

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

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

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

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
2. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content less than or equal to 30 percent by weight; 98 percent passing through 1-inch (25.4 mm) sieve; soluble salt content of less than 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

B. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 m^2) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.5 SUBSOILS

A. See requirements for Subsoils in specification 32 9100 Planting Soil.

2.6 PLANTING SOILS

A. See requirements for Lawn Soil in specification 32 9100 Planting Soil.

2.7 PESTICIDES AND HERBICIDES

A. General: Do not use pesticides and herbicides unless authorized by Smithsonian COTR.

PART 3 - EXECUTION

3.1 SOIL TESTING

A. See requirements for Soil Testing in specification 32 9100 Planting Soil

3.2 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. All areas to receive planting soil shall be free of construction debris, refuse, compressible or decayable materials, stones greater than two inches (50.8 mm) and standing water.
3. Do not mix or place soils and soil amendments in frozen, excessively dry, wet, or muddy conditions.
4. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
5. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Smithsonian COTR and replace with new planting soil.

3.3 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.4 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Subsoil areas which are intended to receive topsoil shall be maintained on a true and even grade, in compliance with plans, drawings or other applicable specifications pertaining to the site, with no significant depressions or elevations. Topsoil shall not be deposited or spread over the subsoil until rough grading has been completed and all areas within the subgrade are within 2/10 of 1.0 foot (6/100 of 1 m) from the final subgrade. If the graded area develops weed or other plant growth, the plants shall be eliminated before topsoil is deposited or spread over the subsoil.

C. For Newly Graded Subgrades refer to Smithsonian Gardens Planting Soil Specification 329100.

D. Unchanged Subgrades Inside Tree Critical Root Zones: See Smithsonian Gardens Site Protection Specification 015639.

E. Unchanged Subgrades Outside Tree Critical Root Zones: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

   1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
   2. Loosen surface soil to a depth of at least 6 inches (152.4 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches (101.6 mm) of soil. Till soil to a homogeneous mixture of fine texture.

      a. Apply fertilizer directly to surface soil before loosening.

   3. Remove stones larger than ¾ inch (19.05 mm) in any dimension and sticks, roots, trash, brush, wire, grade stakes and other debris that would interfere with sodding.
   4. Legally dispose of waste material, including grass, vegetation, and turf, off Smithsonian's property.

F. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (12.7 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

G. Planting may be done immediately thereafter, provided the topsoil has remained in a good, friable condition and has not become muddy or hard. If it has become hard, it shall be tilled to a friable condition again before acceptance. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

H. Before planting, obtain Smithsonian's COTR acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.5 SODDING

A. Consult with Smithsonian COTR regarding sodding boundaries. Sod layout shall utilize full panels of sod to create complete coverage of area to be sodded.

B. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Do not install sod on slopes greater than 3:1. Consult with Smithsonian COTR if any slopes exceed 3:1.
2. Anchor sod on slopes exceeding 1:6 with biodegradable staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

D. Saturate sod with fine water spray within two hours of planting. During first two weeks after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38.1 mm) below sod.

3.6 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (101.6 mm).

1. Water turf with fine spray at a minimum rate of 1 inch (25.4 mm) per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow Fescue/Kentucky bluegrass to a height a minimum of 3 inches (76.2 mm).

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/ 92 m^2) to turf area.

3.7 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Smithsonian COTR:
1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

C. Turf Grass Conditions will not be accepted if there is a poor or thin stand; improper application of sod, dead grass or sod, use of sod other than approved in specifications, improper fertilizer application either uneven spreading or insufficient amounts, or failure to re-fertilize during extended acceptance, and the presence of persistent weeds established in turf areas.

3.8 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove nondegradable erosion-control measures after grass establishment period.

3.5 TIME RESTRICTIONS

A. When permanent sodding is specified or directed, and is not allowed because of time restrictions specified above, utilize one or more of following methods to prevent erosion and sedimentation until permanent sodding is allowed.
1. Prepare soil as for permanent sodding.
2. Apply temporary seeding, straw mulch, or shredded hardwood mulch in consultation with the Smithsonian COTR.

3. Provide other erosion control measures acceptable to Engineer.
4. Remove straw or wood chips used as temporary mulch before initiation of permanent sodding application.

END OF SECTION 329200

Smithsonian Gardens

Smithsonian Institution Lawns and Grasses Specification

Disclaimer and Responsibility of the User:

Use of this document: The following specification has been prepared by the Smithsonian Institution and is copyrighted 2021. Permission is granted for use of this material for individual use or use by your organization to prepare specifications. This document, when used as the basis of a specification, has significant legal and financial ramifications on the outcome of a construction project. By adopting this specification, in part or in its entirety, the user accepts all liability related to its use.

How to Use this Template:

1. This specification is designed to be used in conjunction with standard Division 01 specifications, which cover project general conditions and project wide contract elements. THIS IS NOT A STAND-ALONE SPECIFICATION and should not be used as a contract for turf replacement. Important issues of project ownership, liability, insurance, contract language, project controls, Instructions to bidders, change orders and review and approval of the work are normally in the Division 01 specifications.

2. This specification is designed for the **replacement of turf area for small-scale projects.** A small-scale project is defined as one where a portion of an existing turf area is to be repaired that would not require separate maintenance on the repaired turf area apart from the maintenance that is already in place in the larger turf area. Examples of small-scale projects include but are not limited to utility trenching that disturbs a small area of turf or repair of a turf area that was damaged by equipment.

SECTION 32 92 00
LAWN AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sodding.

B. Related Sections:

1. Division 31 Section "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
2. Division 31 Section "Earth Moving" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.
3. Division 32 Section "Exterior Plants" for tree and shrub planting, and tree support systems.
4. Division 32 Section 32 9100 “Planting Soil” for soil materials.

1.3 DESCRIPTION

A. Sodding: This work shall consist of soil preparation, addition of soil amendments (as determined by the soil test results), watering, and placing grass sod on prepared areas, as specified in the Contract Documents or as directed by the Smithsonian or Smithsonian’s representative.

1.4 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

E. Planting Soil: Material consisting of standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or, manufactured topsoil; which is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

G. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

H. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

B. Submit certification of identification for the following:
1. Source and name and telephone number of supplier.
2. Certification of each seed mixture for turfgrass sod.

C. Qualification Data: For qualified landscape Installer.

D. Product certificates: For soil amendments and fertilizers, from manufacturer.

E. Soils tests, analysis and recommendations: See requirements in section 32 1900 Planting Soils.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and meadow establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years experience in turf installation in addition to requirements in Division 1 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician – Exterior.
    b. Landscape Industry Certified Lawn Care Technician.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Store packaged materials in a manner that will prevent damage or intrusion of foreign matter. Any material that becomes contaminated will be removed from the job site.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime and soil amendments with appropriate certificates.

1.8 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Sod

    a. Spring Planting: April 01 to June 15
    b. Fall Planting: August 21 to November 01

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within the specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Smithsonian, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.

2. Warranty Periods from Date of Planting Completion:

a. Sodded Turf: 12 months, or completion of a single growing season, whichever is greater.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

A. Turfgrass Sod: Maryland Certified (labeled), inspected and approved by the Maryland Department of Agriculture, complying with Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted. Sod shall be harvested during periods of active growth and irrigation. Dormant sod will not be acceptable.

B. Turfgrass Species:

1. Sod shall be a 90/10 mix with 90% of the mix consisting of a blend of at least three turf type tall fescues, and at least 10% Bluegrass. Approved varieties shall be selected "Recommended Turfgrass cultivars for Professional Seed Mixtures," University of Maryland Turfgrass Technical Update TT-77 most recent edition. A copy of this publication can be obtained by visiting the Maryland Turfgrass Council website http://www.mdturfcouncil.org or by calling them at 410-836-2876.

a. Thickness of Cut: The thickness of the roots and soil should be ½" (12.7 mm) to ¾" (19.05 mm).
b. Pad Size: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be 5%. Broken pads and torn or uneven ends will not be acceptable.
c. Strength of Sod Sections: Under ideal conditions, standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10% of the section **without the use of netting**. Sod shall be a minimum of one year old.

d. Sod Viability: Sod shall not be harvested or transplanted under drought conditions.

C. Subject to compliance with requirements, acceptable sources include but are not limited to:

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

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

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

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
2. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content less than or equal to 30 percent by weight; 98 percent passing through 1-inch (25.4 mm) sieve; soluble salt content of less than 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

B. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 m^2) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.5 SUBSOILS

A. See requirements for Subsoils in specification 32 9100 Planting Soil.

2.6 PLANTING SOILS

A. See requirements for Lawn Soil in specification 32 9100 Planting Soil.

2.7 PESTICIDES AND HERBICIDES

A. General: Do not use pesticides and herbicides unless authorized by Smithsonian COTR.

PART 3 - EXECUTION

3.1 SOIL TESTING

A. See requirements for Soil Testing in specification 32 9100 Planting Soil

3.2 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. All areas to receive planting soil shall be free of construction debris, refuse, compressible or decayable materials, stones greater than two inches (50.8 mm) and standing water.
3. Do not mix or place soils and soil amendments in frozen, excessively dry, wet, or muddy conditions.
4. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
5. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Smithsonian COTR and replace with new planting soil.

3.3 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
1. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.4 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Subsoil areas which are intended to receive topsoil shall be maintained on a true and even grade, in compliance with plans, drawings or other applicable specifications pertaining to the site, with no significant depressions or elevations. Topsoil shall not be deposited or spread over the subsoil until rough grading has been completed and all areas within the subgrade are within 2/10 of 1.0 foot (6/100 of 1 m) from the final subgrade. If the graded area develops weed or other plant growth, the plants shall be eliminated before topsoil is deposited or spread over the subsoil.

C. For Newly Graded Subgrades refer to Smithsonian Gardens Planting Soil Specification 329100.

D. Unchanged Subgrades Inside Tree Critical Root Zones: See Smithsonian Gardens Site Protection Specification 015639.

E. Unchanged Subgrades Outside Tree Critical Root Zones: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least 6 inches (152.4 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches (101.6 mm) of soil. Till soil to a homogeneous mixture of fine texture.
    a. Apply fertilizer directly to surface soil before loosening.
3. Remove stones larger than ¾ inch (19.05 mm) in any dimension and sticks, roots, trash, brush, wire, grade stakes and other debris that would interfere with sodding.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Smithsonian's property.

F. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (12.7 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

G. Planting may be done immediately thereafter, provided the topsoil has remained in a good, friable condition and has not become muddy or hard. If it has become hard, it shall be tilled to a friable condition again before acceptance. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

H. Before planting, obtain Smithsonian's COTR acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.5 SODDING

A. Consult with Smithsonian COTR regarding sodding boundaries. Sod layout shall utilize full panels of sod to create complete coverage of area to be sodded.

B. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Do not install sod on slopes greater than 3:1. Consult with Smithsonian COTR if any slopes exceed 3:1.
2. Anchor sod on slopes exceeding 1:6 with biodegradable staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

D. Saturate sod with fine water spray within two hours of planting. During first two weeks after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38.1 mm) below sod.

3.6 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Smithsonian COTR:
1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

C. Turf Grass Conditions will not be accepted if there is a poor or thin stand; improper application of sod, dead grass or sod, use of sod other than approved in specifications, improper fertilizer application either uneven spreading or insufficient amounts, or failure to re-fertilize during extended acceptance, and the presence of persistent weeds established in turf areas.

3.7 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove nondegradable erosion-control measures after grass establishment period.

3.5 TIME RESTRICTIONS

A. When permanent sodding is specified or directed, and is not allowed because of time restrictions specified above, utilize one or more of following methods to prevent erosion and sedimentation until permanent sodding is allowed.
   1. Prepare soil as for permanent sodding.
   2. Apply temporary seeding, straw mulch, or shredded hardwood mulch in consultation with the Smithsonian COTR.
   3. Provide other erosion control measures acceptable to Engineer.
   4. Remove straw or wood chips used as temporary mulch before initiation of permanent sodding application.

END OF SECTION 329200

SECTION 33 16 15
WATER STORAGE STEEL TANKS

EDITING NOTE

All bracketed blanks, words, phrases, sentences, and paragraphs in this specification require the editor to either include or delete the bracketed section, or provide required information.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provision of Contract, including General and Special Conditions and Division 1 Specification Section, apply to work of this Section.

1.02 SUMMARY

A. Provide all engineering, design, erection, and testing for new elevated storage tank for fire protection service.

1.03 ALLOWANCES

[List Allowances, if included as part of the contract. Confirm with OSHEM and COTR]

1.04 UNIT PRICES

[List Unit Prices, if included as part of the contract. Confirm with OSHEM and COTR]

1.05 DEFINITIONS

A. COTR: Contracting Officer Technical Representative

B. FM: FM Global (Factory Mutual)

C. FPE: Fire Protection Engineer

D. Furnish: To supply the stated equipment or materials

E. Install: To set in position and connect or adjust for use

F. NFPA: National Fire Protection Association

G. NICET: National Institute for Certification in Engineering Technologies

H. OSHEM: Office of Safety Health and Environmental Management

I. Provide: To furnish and install the stated equipment or materials

J. UL: Underwriters Laboratories

1.06 SYSTEM DESCRIPTION

A. New _____gallon (____liter) dedicated fire protection water storage tank. Tank shall be [fluted column] [pede sphere] [standpipe] design.

1.07 PERFORMANCE REQUIREMENTS

A. Design and Construction Standards

1. National Fire Protection Association (NFPA) 22, Standard for Water Tanks for Private Fire Protection

2. The design, fabrication, and erection of the [elevated tank] [standpipe][reservoir] shall be in accordance with the applicable requirements of AWWA D100 or AWWA D103 except as modified herein. Earthquake design shall be [in accordance with UFC 3-310-04 SEISMIC DESIGN FOR BUILDINGS and Sections 13 48 00 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and13 48 00.00 10 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT] [as indicated]. No additional thickness for corrosion allowance will be required.

3. Design metal temperature shall be [_____] degrees F. The elevated tank shall be designed for a basic wind speed of [_____]mph in accordance with ASCE 7 or designed in accordance with AWWA D100 wind load design, whichever provides the greater pressure. [The elevated tank shall be designed for a snow load of 25 psf [_____]]. The [standpipe][reservoir] shall be designed for a peak wind speed of [_____] and snow load of [_____].

B. Welding

1. Qualification of welding procedures, welders, and welding operators shall be in accordance with Section 8.2 of AWWA D100.

C. Design Requirements

1. The elevated tank shall have a storage capacity of [_____] gallons. The high-water level of tank shall be at elevation [_____] with the top of column foundations at elevation [_____]. The range between high and low water levels shall be approximately [_____] feet. The existing grade at the tank site is

approximately elevation [_____]. The top of straight side sheets, where a cone-shaped roof is furnished, shall not be less than 6 inches above the top of the overflow weir. The tank diameter shall be not less than [_____] feet and the riser diameter not less than [_____] feet.

2. The tank shall [be of the style shown] [have an ellipsoidal bottom, with vertical side sheets and a cone shaped top, or shall be of an elliptical or oval design as approved. In the latter design, the lower section of the roof may be used for water storage].

3. The tower supporting the tank shall be constructed of structural shapes of the open type, or of tubular sections, to permit inspection and painting. The tower shall be thoroughly braced with horizontal struts and diagonal ties. The tower columns may be vertical or inclined as the design may require. Main column splices shall be as few as possible and shall be located as near as practicable to the intersection of the centerline of the struts. Splice plates shall be welded so as to hold the members in line and transmit any tension ors hearing stresses to which the members may be subjected.

4. The connections of the tank, with the columns shall be made to distribute the load properly over the column sections and over the shell of the tank.

5. Around the bottom of the tank a balcony meeting the requirements of Section 4.7.2 of AWWA D100 and conforming to all federal or local laws or regulations shall be provided. Balcony floor plates shall be at least 1/4 inch thick and shall be suitably punched or drilled for drainage.

D. Sizing and Design

1. Sizing and design of elevated tank shall be in accordance with Section 4 of AWWA D100. Submit a certificate signed by a registered professional engineer providing: (1) description of the entire tank and foundation structural design loading conditions, (2) description of structural design methods and codes used in establishing allowable stresses and safety factors, (3) statement that the structural design has been checked by experienced engineers specializing in hydraulic structures to ensure that design calculations for member sizes, dimensions, and fabrication processes are as prescribed by ACI and AWWA standards, and (4) certification that the completed work was inspected in accordance with AWWA D100 or AWWA D103 as applicable.

E. [Standpipe] [Reservoir]

1. The [standpipe] [reservoir] shall have a storage capacity of [_____] gallons. The high-water level of [standpipe] [reservoir] shall be at elevation[_____] with the

top of foundation approximately at elevation [_____]. The range between high and low water levels will be approximately [_____] feet.

2. Existing grade at proposed location is approximately elevation [_____].The [standpipe] [reservoir] shall have such standard shell height and such diameter as will meet the requirements for the selected standard capacity and for the high-water level specified above.

3. The [standpipe] [reservoir] may have [supported cone roof,] [supported toriconical roof,][self-supporting umbrella roof,] [self-supporting dome roof, or][ellipsoidal roof,] [aluminum self-supporting dome roof,] as approved. The [standpipe] [reservoir] shall be of welded or bolted construction.

F. Coatings Certification

1. Coating materials for interior applications and all other materials which will be in normal contact with potable water shall conform to NSF 61. Certification by an independent third-party organization that all interior coatings and materials, that come in contact with potable water, comply with NSF 61 shall be provided.

1.08 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00

B. Shop Drawings

1. Tank Installation: Detail and erection drawings, before proceeding with any fabrication. Complete drawings with details of steel, pipe, and concrete work, and of the assembling of items required for the total installation. Use standard welding symbols as recommended by the American Welding Society. Details of welded joints referenced on the drawings shall be included.

C. Product Data

1. System Description

2. Foundations

3. Design Analysis and Calculations

D. Test Reports

1. Tank Installation

2. Testing of Valves and Piping

3. Each coating manufacturer's technical data, application instructions, Material Safety Data Sheets (MSDS), and certificate for compliance for VOC content.

4. Copies of the following test results:

   a. Manufacturer's mill test reports for plate material.

   b. Mill and shop inspections by a commercial inspection agency.

   c. After acceptance of the structure, the radiographic film and test segments.

   d. At the conclusion of the work, a written report prepared by the Contractor covering the hydrostatic test and certifying that the work was inspected in accordance with Section 11.2.1 of AWWA D100.

5. Certificates

   a. System Description

   b. Foundations

   c. Certification by an independent third-party organization that all interior coating and materials that come in contact with the potable water comply with NSF 61.

   d. A certificate signed by a registered professional engineer, providing the following information:

      1) Description of the structural design loading conditions used for the design of entire tank including the foundation.

      2) Description of the structural design method and codes used in establishing the allowable stresses and safety factors applied in the design.

      3) A statement verifying that the structural design has been checked by experienced engineers specializing in hydraulic structures.

      4) A statement verifying that the detail drawings have been checked by experienced engineers specializing in hydraulic structures to determine that they agree with the design calculations in member sizes, dimensions, and fabricating process as prescribed by applicable ACI and AWWA standards.

1.09 QUALITY ASSURANCE

A. Manufacturers Qualifications: The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

    a. ASCE 7 (2005; Supp 1) Minimum Design Loads for Buildings and Other Structures

2. AMERICAN WATER WORKS ASSOCIATION (AWWA)

    a. AWWA B300 (2004) Hypochlorites

    b. AWWA B301 (2004) Liquid Chlorine

    c. AWWA C104/A21.4 (2003) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

    d. AWWA C105/A21.5 (2005) Polyethylene Encasement for Ductile-Iron Pipe Systems

    e. AWWA C110/A21.10 (2008) Ductile-Iron and Gray-Iron Fittings for Water

    f. AWWA C111/A21.11 (2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

    g. AWWA C115/A21.15 (2005) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

    h. AWWA C150/A21.50 (2002; Errata 2003) Thickness Design of Ductile-Iron Pipe

    i. AWWA C151/A21.51 (2002; Errata 2002) Ductile-Iron Pipe, Centrifugally Cast, for Water

    j. AWWA C500 (2002; R 2003) Metal-Seated Gate Valves for Water Supply Service

    k. AWWA C504 (2006) Standard for Rubber-Seated Butterfly Valves

l. AWWA C508 (2001) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600mm) NPS

m. AWWA C600 (2005) Installation of Ductile-Iron Water Mains and Their Appurtenances

n. AWWA C652 (2002) Disinfection of Water-Storage Facilities

o. AWWA D100 (2005; Errata 2007) Welded Steel Tanks for Water Storage

p. AWWA D103 (1997) Factory-Coated Bolted Steel Tanks for Water Storage

q. ASME B16.3 (2006) Malleable Iron Threaded Fittings, Classes 150 and 300

r. ASME B40.100 (2005) Pressure Gauges and Gauge Attachments

3. ASTM INTERNATIONAL (ASTM)

a. ASTM A 197/A 197M (2000; R 2006) Standard Specification for Cupola Malleable Iron

b. ASTM A 48/A 48M (2003) Standard Specification for Gray Iron Castings

c. ASTM A 53/A 53M (2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

4. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

a. MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check Valves

5. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

a. NFPA 24, Standard for Water Tanks for Private Fire Protection.

6. NSF INTERNATIONAL (NSF) NSF 61 (2007a; Addendum 2007) Drinking Water System Components - Health Effects

7. THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

a. SSPC PS 4.04 (1982; E 2004) Four-Coat White or Colored Vinyl Painting System (For Fresh Water, Chemical, and Corrosive Atmospheres)

b. SSPC PS Guide 17.00 (1982; E 2004) Guide for Selecting Urethane Painting Systems

c. SSPC Paint 104 SSPC Paint 21(1982; E 2004) Paint Specification No. 104White or Tinted Alkyd Paint (1982; E 2004) Paint Specification No. 21White or Colored Silicone Alkyd Paint (Type I, High Gloss and Type II, Medium Gloss)

d. SSPC Paint 25 (1997; E 2004) Paint Specification No.25Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type I and Type II

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in unopened containers with unbroken seals and labels showing designated name, specification number, color, directions for use, manufacturer, and date of manufacture, legible and intact at time of use.

B. Handle and store water storage tank systems, components, and parts to prevent distortions and other damage that could affect their structural, mechanical, or electrical integrity.

C. Replace damaged items that cannot be restored to original condition.

D. Store items subject to deterioration by exposure to elements, in a well-drained location, protected from weather, and accessible for inspection and handling.

1.11 PROJECT CONDITIONS

[List any special project conditions and/or environmental limitations on system installation, such as temperature, humidity, ventilation, etc.

1.12 COORDINATION

A. Coordinate major equipments and piping layouts with other trades to avoid obstructions and excessive changes in direction for piping.

1.13 WARRANTY

A. The Contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the Government.

B. Final acceptance includes, but is not limited to, the receipt and OSHEM approval of, as-built drawings and operation and maintenance manuals.

1.14 SERVICE AGREEMENT

[List requirements, if part of the contract. Confirm with OSHEM and COTR].

1.15 EXTRA MATERIALS

[List special requirements for spare parts, if part of the contract. Confirm with OSHEM and COTR].

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide materials conforming to the following requirements:

1. Steel

2. Shop Fabrication

a. Section 2 of AWWA D100 or Section 2 of AWWA D103.

b. Section 9 of AWWA D100 or Section 7 of AWWA D103.

2.02 PIPE

A. Ductile-Iron Pipe

1. Pipe for fluid conductors, except for overflow pipe, shall be ductile-iron pipe and shall be either of the following:

B. Bell-and-Plain End Pipe

1. AWWA C150/A21.50 and AWWA C151/A21.51, for not less than 150 psi working pressure, unless otherwise shown or specified. Joints shall be push-on or mechanical-joint conforming to AWWA C111/A21.11. Pipe shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

C. Flanged Pipe

1. Flanged pipes shall conform to the applicable portions of AWWA C110/A21.10,AWWA C115/A21.15 and AWWA C151/A21.51, for not less than 150 psi working pressure, unless otherwise shown or specified. Pipe shall have flanged ends in accordance with AWWA C115/A21.15. Pipe shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

D. Specials and Fittings (except for overflow pipe)

1. Ductile-Iron with Bell-and-Plain End

    a. AWWA C110/A21.10 and AWWA C151/A21.51 for not less than 150 psi working pressure, unless otherwise shown or specified. Specials and fittings shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

2. Ductile-Iron with Flanged Ends

    a. AWWA C110/A21.10 and AWWA C151/A21.51 for not less than 150 psi working pressure unless otherwise shown or specified. Fittings shall have flanged ends in accordance with AWWA C110/A21.10. Specials and fittings shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

E. Fittings for Screw-Joint Pipe

1. Malleable-iron, galvanized, 150 psi, ASTM A 197/A 197M, threaded ends, ASME B16.3.

F. Joints Inside Valve Chamber

1. All joints inside the valve chamber shall be flanged.

2.03 VALVES

A. Gate Valves

1. All valves serving water supply and discharge pipes for water storage tanks shall be gate valves or Post Indicator Valves. Gate valves shall be opened by turning counterclockwise. Valves 3 inches and larger shall be iron body, brass mounted, conforming to AWWA C500. Valves smaller than 3 inches shall be all bronze and shall conform to MSS SP-80, Type 1, class 150. Valves 3 inches or larger located in valve chambers shall be equipped with hand-operating wheels and shall be flanged.

B. Check Valves

1. Check valves shall be of the horizontal swing-check type, suitable for the purpose and the operating conditions. The body shall be iron and shall have a removable gate assembly and a cover removable for inspection. The gate, gate seat, shaft, gate studs, and nuts shall be bronze or other suitable alloy. Valves shall conform to AWWA C508.

C. Altitude Valve

1. The supply to the [elevated tank] [standpipe] [reservoir] shall be controlled by a [_____] inch altitude valve, automatic in operation and accurately set to prevent overflow of the [elevated tank] [standpipe][reservoir]. The valve shall have flanged ends and a heavy cast iron body, shall be bronze fitted with renewable cups and seats, and shall be designed without metal-to-metal seats. The valve shall be cushioned when opening and closing to prevent water hammer or shock. Valves shall be provided with a travel indicator.

2.04 PRESSURE GAUGE

1. Pressure gauge of the direct-reading type, equipped with a shutoff cock, shall be provided, in the valve chamber, on the tank side and on the discharge side of the check or altitude valve. Gauges shall have 6 inch dials, shall be stem mounted, and shall conform to ASME B40.100. Accuracy of gauges shall be Grade A or better. Gauges shall be calibrated in psi in not more than 2 psi increments from 0 to 50 psi in excess of the normal operating pressure at the tank.

2.05 ASSEMBLIES

A. Tank Accessories

1. Section 7 of AWWA D100 or Section 5 of AWWA D103 and as specified. Additional requirements for accessories are as follows:

B. Manholes and Pipe Connections

1. Section 7 of AWWA D100 and Section 5 of AWWA D103 represent the minimum requirements. Number, type, location, and size of manholes and pipe connections shall be as shown on the drawings. Inlet pipe connections to extend [_____] inches above tank bottom and shall be provided with deflectors as shown on the drawings. Outlet pipe connections to extend [_____] inches above tank bottom and shall be provided with vortex breakers as shown on the drawings.

C. Overflow

1. The overflow for the tank shall consist of an overflow weir and [stub overflow] [outside drop pipe, adequately supported and] capable of discharging at a rate of [_____] gpm with [_____] inches of head [, without the water level exceeding [_____]]. [The top of the weir shall be [_____] inches below [_____].] [The weir shall be located as indicated.] The [stub overflow shall be steel, ASTM A 53/A 53M or equal, and shall befitted with a screen] [overflow pipe shall be steel,

ASTM A 53/A 53M or equal, and shall terminate 1 to 2 feet above grade and shall be fitted with a flapper valve or screen to prevent ingress of animals and insects].

D. Vent

1. Vent shall be welded to the cover plate of the center manhole on the roof. Vent will be tank manufacturer's standard type mushroom vent with aluminum bird screen. The free area of the vent shall be sized 50 percent in excess of the [_____] gpm pump-in rate and [_____] gpm pump-out rate. Screening for vent shall conform to Section 5.7.2 of AWWA D100 or Section 5.7.2 of AWWA D103which ensures fail-safe operation in the event that screen frosts over and the bottom of the screen shall be sufficiently elevated for snow consideration in the area.

E. Ladders and Safety Devices

1. Ladders and safety devices shall be provided in accordance with Sections7.4 and 7.5 of AWWA D100 or Sections 5.4 and 5.5 of AWWA D103. Location of ladders shall be as shown on the drawings. Sections 7.4 and 7.5 of AWWA D100 and Sections 5.4 and 5.5 of AWWA D103 represent the minimum requirement. In addition, safety cage, rest platforms, roof ladder handrails, and other safety devices shall be provided as required by federal or local laws or regulations.

F. Scaffold Cable Support

1. Provision shall be made for the attachment of a scaffold cable support at the top of the roof on welded tanks.

G. Balconies

1. Provide a balcony a minimum of 2 feet wide with a standard guard railing. Provide a structural steel railing with a top rail 42 inches above balcony platform with an intermediate rail halfway between. Guard rail shall be capable of withstanding a force of 200 pounds applied in any direction. Install a steel toe board with minimum height of 4 inches. Bottom of toe board shall be a maximum 1/4 inch from platform top. Extend guard rail and toe board entire length of balcony except where access openings are required. For balcony floors use diamond plates a minimum of 1/4 inch thick, punched or drilled for drainage. [Equip access openings in guardrail with a gate which closes automatically.] Hatches through balcony floor shall be counterbalanced or otherwise arranged to open from below.

H. Coating for Welded Tanks

1. Provide exterior coating systems conforming to Section 09 97 13.27,"Exterior Coating of Steel Structures," and interior coating systems conforming to Section 09 97 13.16, "Interior Coating of Welded Steel Water Tanks."

I. Coating for Bolted Tanks

1. As supplied by the manufacturer.

J. Valve Chamber

1. Valve chamber shall be sufficiently large to house all control valves and fittings. Pipes, valves, and fittings shall be supported on concrete blocks where necessary. The valve chamber shall be constructed to provide not less than [_____] feet of cover over the pipes. The valves and fittings shall extend from the [standpipe] [reservoir] [riser pipe]connection to a point one length of pipe outside the valve chamber walls on the main or feed line to the [elevated tank] [standpipe] [reservoir]; the drain line will be carried to an outlet as indicated on the drawings. The access manhole shall be not less than 30 inches in diameter.

K. Anchors for [Standpipe] [Reservoirs]

1. The following requirements shall be met:

a. An adequate number of anchors designed to prevent overturning of the [standpipe] [reservoir] when empty shall be installed. If anchor bolts are used, the nominal diameter shall not be less than one inch, plus a corrosion allowance of at least 1/4 inch on the diameter. If anchor straps are used, they shall be pre-tensioned before welding to the tank shell.

b. The anchor bolts shall be a right angle bend, hook, or plate washer, while anchor straps shall have only a plate welded to the bottom. The anchors shall be inserted into the foundation to resist the computed uplift.

c. Attachment of anchors to the shell shall not add significant localized stresses to the shell. The method of attachment shall consider the effects of deflection and rotation of the tank shell. Anchors shall not be attached to the tank bottom. Attachment of the anchor bolts to the shell shall be through stiffened chair-type assemblies or anchor rings of adequate size and height.

2.06 CONCRETE WORK

A. Concrete work shall conform to Section [03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE][03 30 00 CAST-IN-PLACE CONCRETE].

2.07 CHLORINE

A. AWWA B300 for hypochlorites or AWWA B301 for liquid chlorine, mixed with water to give the solutions required in AWWA C652.

PART 3 - EXECUTION

3.01 FOUNDATIONS

A. Foundations for the [standpipe] [reservoir] [tank columns and riser] and for the valve chamber shall be constructed of concrete, reinforced where necessary, and designed in accordance with Section 12 of AWWA D100 or Sections 11 and 8.5 of AWWA D103 for earth with a bearing value of [_____] psf, at elevation [_____], and constructed in conformance with the applicable requirements of Section [03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE][03 30 00 CAST-IN-PLACE CONCRETE], except as shown or specified herein. An AWWA D100 Type 1 or an AWWA D103 Type 1 or Type 2 foundation shall be provided for the [standpipe] [reservoir]. Factor of safety on overturning of [elevated tanks] [standpipe] [reservoir] under design windload shall be 1.33 minimum. When a footing is required, an inverted truncated pyramid of earth with 2 on 1 side slopes above top of footing maybe used in determining overturning stability.

3.02 EXCAVATING, FILLING, AND GRADING

A. Excavating, filling, and grading shall conform to the applicable requirements of Section 31 00 00 EARTHWORK.

3.03 CATHODIC PROTECTION

A. Cathodic protection shall be provided, conforming to Section 26 42 15.00 10 CATHODIC PROTECTION SYSTEM (STEEL WATER TANKS).

3.04 OBSTRUCTION LIGHTING

A. Obstruction lighting shall be provided and installed as shown, and shall conform to Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM or FAA AC 150/5345-43.

3.05 BEACON

A. Beacon shall be provided and installed as shown, and shall conform to Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.06 TANK INSTALLATION

A. Tank installation shall be in accordance with the following requirements:

1. Welding Section 8 of AWWA D100 or Section 6 of AWWA D103.

2. Erection Section 10 of AWWA D100 or Section 8 of AWWA D103.

3.07 INSPECTIONS AND TESTING

A. Tank inspection and testing shall be in accordance with Section 11 of AWWA D100 or Section 9 of AWWA D103. Mill and shop inspections [are not required] [are required and shall be performed by an approved commercial inspection agency].

B. Perform the radiographic inspections of the welded tank shell, the hydrostatic test and the vacuum box leak test of the tank bottom. Final hydrostatic and leak tests shall be performed before painting of welded tanks.

3.08 PIPING INSTALLATION (EXCEPT FOR OVERFLOW PIPING)

A. General Guidelines

1. Where details of fabrication or installation are not shown on the drawings, installation shall conform to Section 1 and 3 of AWWA C600.

B. Testing of Valves and Piping

1. After the [elevated tank] [standpipe] [reservoir] has been erected and the valves and piping installed, and before field painting is begun, the valves and piping shall be hydrostatically tested in accordance with Section 4 of AWWA C600. Replace with sound material any defective material disclosed by the pressure test; the test shall be repeated until the test results are satisfactory.

C. Polyethylene Encasement of Underground Ductile-Iron Piping Polyethylene encasement of underground ductile-iron piping shall be provided in addition to asphaltic coating in accordance with AWWA C105/A21.5.

D. Plugging Ends: Pipe ends left for future connections shall be capped or plugged as directed.

3.09 PAINTING AND COATING OF TANK

A. Each coating manufacturer's technical data, application instructions, Material Safety Data Sheets (MSDS), and certificate for compliance for VOC content shall be submitted to the COTR. Application, curing time, mixing and thinning of the coating materials shall be in strict accordance with the manufacturers instructions. The use of

thinners shall not alter the required minimum dry thickness or adversely affect the VOC content.

B. Exterior Surfaces (Welded Tanks)

1. [A prime coat, minimum of 2.0 mil thick followed by two coats of alkyd enamel, each a minimum of 1.5 mil thick shall be applied. The prime coat shall be rust inhibitive red iron oxide, zinc oxide, oil and alkyd primer without lead or chromate pigments, in accordance with SSPC Paint 25. The finish coats shall be [white alkyd enamel in accordance with Type I of SSPC Paint 104] [[_____] gloss alkyd enamel in accordance with SSPC Paint 21] [alternating panels (checkerboard) of white alkyd enamel in accordance with Type I of SSPC Paint 104 and international orange gloss alkyd enamel in accordance with SSPC Paint 21 color 12197].]

2. [[A gray vinyl prime coat a minimum of 1.5 mil thick followed by two coats of [white] [light gray] vinyl paint, each a minimum of 1.5 mil thick shall be applied. SSPC PS 4.04] [A two-component catalyzed epoxy prime and intermediate coat, The primer and paint shall be VR-3 in accordance with each a minimum of 3.0 mil thick, followed by a two-component catalyzed aliphatic polyurethane finish coat, a minimum of 1.5 mil thick, conforming to Type V of SSPC PS Guide 17.00 shall be applied. The prime coat shall be a green primer, Formula 150 in accordance with MIL-DTL-24441. The intermediate coat shall be white Formula 152 in accordance with MIL-DTL-24441 and may be tinted with pigment color. The finish coat shall be [white] [_____] [alternating panels (checkerboard) of international orange and white]].]

C. Interior Surfaces (Welded Tanks)

1. [A prime coat at least 3.0 mil thick and a [white] [_____] final coat at least 5.0 mil thick shall be applied. Each coat shall be a two-component catalyzed epoxy in accordance with MIL-PRF-23236. The primer shall contrast with the color of the finish coat.] [Four coats, each at least 1.5 mil thick, of VR-3 vinyl resin paint in accordance with SSPC PS 4.04 shall be applied. The second, third, and fourth coats shall be of contrasting colors.]

D. Bolted Tanks

1. The tanks shall have a coating applied to both the interior and exterior surfaces in accordance with Section 10 of AWWA D103. Color shall be [as indicated on the drawings] [as approved] [_____].

3.10 DISINFECTION

A. The [elevated tank] [standpipe] [reservoir] and connecting lines thereto shall be disinfected with chlorine before being placed in operation.

B. Tank

1. The [elevated tank] [standpipe] [reservoir] shall be disinfected in accordance with [AWWA C652] [_____]. After the chlorination procedure Is completed and before the storage facility is placed in service, the COTR will collect samples of water in properly sterilized containers for bacteriological testing from the full facility in accordance with Section 7 of AWWA C652. The tank will not be accepted until satisfactory bacteriological results have been obtained.[After coating system has been inspected, approved, and cured, rinse tank with potable water. Disinfect tank and connecting lines in accordance with AWWA C652,[Method 1] [Method 2] [or] [Method 3].]

C. Piping

1. The valves and piping shall be disinfected in accordance with Section 33 11 00 WATER DISTRIBUTION.

3.11 INSPECTION AND REPAIR

A. Prior to tank repair job, perform a detailed inspection of the structure and submit report by a certified inspector.

END OF SECTION 331615